The 35th Annual Congress of the American Romanian Academy of Arts and Sciences (ARA)

"Science and Art in the Informatics Era"

Universitatea "Politehnica" Timişoara, Romania
July 6-11, 2011

PROCEEDINGS

Scientific Editors

Ioana IONEL

Traian FLEŞER

Ion VETREŞ

PRESSES INTERNATIONALES
POLYTECHNIQUE

Montréal, Québec, 2011

American Romanian Academy
of Arts and Sciences

Universitatea "Politehnica"
Timişoara, Romania

Presses internationales
Polytechnique
École Polytechnique de Montréal
Montréal, Québec

ISBN 978-1-935924-01-2

ISBN 978-2-553-01596-0

The 35th Annual Congress of the American Romanian Academy of Arts and Sciences (ARA)
"Science and Art in the Informatics' Era"
Timişoara, Romania, July 6-10, 2011

Scientific Editors: Ioana IONEL, Traian FLEŞER, Ion VETREŞ

First Paperback Edition 2011

Cover Page: reproduction by Marian Gh. Simion after the original desing by Nathalie Jodoin

American Romanian Academy of Arts and Sciences
PUBLICATIONS
For information on publications, distribution and points of sale, visit: www.roacad.org

Boston: American Romanian Academy of Arts and Sciences | c/o Prof. Marian Gh. Simion,
21 Oak Ridge Drive, Ayer, MA 01432, U.S.A. | www.roacad.org
Braşov: Universitatea Transilvania din Braşov | c/o Prof. Stela Drăgulin,
Facultatea de Muzică, Str. Andrei Şaguna nr.2, Braşov, Romania | www.unitbv.ro/muzica
Chişinău: Academy of Economic Studies of Moldova | c/o Prof. Dumitru Todoroi,
Bănulescu-Bodoni St. 59-61, Chişinău MD 2005, Republic of Moldova | www.ase.md
Lausanne: École Polytechnique Fédérale de Lausanne | c/o Prof. Tudor Ratiu,
Department of Mathematics, Station 8 CH-1015 Lausanne, Switzerland | www.epfl.ch
Montréal: École Polytechnique de Montréal | c/o Prof. Ion Paraschivoiu,
P. O. Box 6079, Station Centre-Ville Montréal, QC, H3C 3A7, Canada | www.meca.polymtl.ca
Timişoara: Facultatea de Mecanică, Departament Maşini Mecanice, Utilaje şi Transporturi |
c/o Prof. Ioana Ionel, Bulevardul Mihai Viteazu 1, 300222, Timişoara, România | www.mec.upt.ro

For information on distribution and points of sale, see our Web site:
www.polymtl.ca/pub

E-mail of Polytechnic International Press
pip@polymtl.ca

All rights reserved.
© École Polytechnique de Montréal, 2011

This book may note be duplicated in any way without the express written consent of the publisher.

Legal deposit:
Bibliotèque nationale de Québec
National Library of Canada

ISBN: 978-2-553-01596-0
Printed in Romania

CUPRNS

FOREWARD viii

LAW, POLITICS / DREPT, POLITICĂ

Critical Infrastructure Security – The Way Ahead
Marius HANGANU 3

A Marketing Approach To The Concept Of E-Government
Constantin SASU, Luciana SASU 8

The Connection Of Nonetary Policies With The Evolution Of Integration And Globalization
Alexandru OLTEANU, Mădălina Antoaneta RADOI 12

PHILOSOPHY, THEOLOGY / FILOZOFIE, TEOLOGIE

Paradise Or Annihilation – Paradis sau Neant
Dinu LEONTE 19

Subconcious In Conscience Pyramid
Diana MICUŞA, Nicoleta TODOROI 23

LINGUISTICS, LITERATURE, MUSIC, FINE ARTS / LINGVISTICĂ, LITERATURĂ, MUZICĂ, ARTE FRUMOASE

A Modern Approach Of Shakespeare
Viorica BANCIU, Valentin MORGOVAN 33

The Discourse Of News
Angela JIREGHIE 37

ECONOMY, ENVIRONMENT / ECONOMIE, MEDIU

The Financing From Public Resource Of The Wage Necessary For The Clerical Personnel
Ionel BOSTAN 43

The Coherent Evaluation Of The Assets And Passives From The Balance Of The Insurance Companies
Ionel BOSTAN 47

Examples Of Determining The Volume Of Production By Function And Vice Versa
Rodica BERZAN 51

The Balance Of Payments – A Factor Of Sustainable Economic Development
Camelia MILEA, Alina Georgeta AILINCĂ, Adina CRISTE, Iulia LUPU 55

A Possible Tax Model For Environmental
Gabriela Cornelia PICIU, Carmen Lenuța TRICĂ 59

Globalization And The Environment
Gabriela Cornelia PICIU, Carmen Lenuța TRICĂ 63

Exploring The Tourism Image Of Romania
Constantin SASU, Luciana SASU 67

Policies And Strategies At The EU and National Level Regarding Improvement Of Working Conditions In Knowledge-Based Society
Cristina LEOVARIDIS 71

Controversies In Using Derivatives In The Context Of The Financial Crisis
Alexandru OLTEANU, Mădălina Antoaneta RĂDOI 75

Fiscal Security – An Efficient Method For Ensuring Budget Incomes
Diana CRICLIVAIA, Inesa BRUMĂ 79

Influence Of Economic Crisis On Financial Performance Of Commercial Banks In Moldova
Larisa MISTREAN, Denis MISTREAN 84

Calibration Of Convective Heat Transfer Models For Combustion Analysis In Spark Ignition Engines
Adina GHEORGHIAN, Adrian IRIMESCU 88

Aerosol Layers Investigation By Lidar Systems, Satellite Images And Trajectory Models
Ion VETRES, Ioana IONEL, Malan BASSIM 92

Hunting Park In The Banat Of Timisoara County Under Cynegetic Biodiversity, Zoo-Technical and Economic Aspects
Marcel MATIUTI, Carmen – Luminița MATIUTI 96

Remote Sensing Measurement Techique For SO_2 Emissions
Cătălin NISULESCU, Ioana IONEL, Delia CALINOIU 102

BIOLOGY, MEDICINE / BIOLOGIE MEDICINĂ

Nanorobotics In Medicine
Ilie POPA, Magdalena Adina CIOBANU 117

Biomechanical And Clinical Considerations of Openbite Treatment In Adults
Camelia SZUHANEK 121

Biomechanical Analysis of Two Orthodontic Closing Spaces Methods
Anghel CERNESCU, Camelia SZUHANEK, Nicolae FAUR, Traian FLEŞER 125

The Necessity Of Gene Banks In Order To Protect The Breeds Created On Romanian Territory
Marcel MATIUTI, Carmen – Luminița MATIUTI 129

Clinical particularities In Pulmonary Thromboembolism
Rodica AVRAM, Mihai BALINT, Iulian AVRAM 133

The Clinical Value Of Nonlinera Dynamics Parameters As Tool For ECG Signal Processing
Victor Dan MOGA, Tudor CIOCÂRLIE, Mariana MOGA 137

Prognostic Improvement With Antidepressive Therapy In Patients With Myocardial Infarction
Mariana TUDORAN, Cristina TUDORAN, Cătălina GIURGI..... 142

ENGINEERING, APPLIED MATHEMATICS, COMPUTER SCIENCE / INGINERIE, MATEMATICĂ APLICATĂ, INFORMATICĂ

Analogy Between the Wing Shapes Of Gliding Birds And Of Global Optimized Flying Configurations
Adriana NĂSTASE..... 147

Impact Assessment Of The Dent – Gouge Combination Like Flows On Operating Safety Of The Natural Gas Transmission Pipeline
Gheorghe ZECHERU, Alin DINITA..... 151

Supersonic Reacting Flow Around A Wedge Considering Variable Specific Heats With Temperature
Corneliu BERBENTE, Sorin BERBENTE..... 159

Characteristics Of Joining Aluminium Matrix Composites
Traian FLEŞER, Marius POP - CALIMANU..... 163

Analysis Of The Flow For Optimizing The Coandă Ejector Performance
Alexandru DUMITRACHE, Florin FRUNZULICA, Octavian PREOTU, Horia DUMITRESCU 167

Active And Passive Control Methods On The Aerodynamic Surfaces
Florin FRUNZULICĂ, Alexandru DUMITRACHE, Octavian PREOTU, Horia DUMITRESCU 171

Thermodynamic And Structural Properties Calculations Of Polychlorinated Biphenyls
Giorgiana C. MÎNDRILĂ, Cristina MANDRAVEL..... 175

The Influence Of UV Radiations On Some Dyes Textiles
Liliana ROŞU, Dan ROŞU, Cristian GAVAT..... 179

Predicting And Confirming The Lifetime Of The Polyurethanes
Liliana ROŞU, Dan ROŞU, Ştefan OPREA 184

Computer Graphics In Information, Knowledge And Conscience Societies
Sergiu PERETETCU, Dumitru TODOROI 188

Considerations On Security Management And Management Security In IP Communications Networks
Daniel GHEORGHICĂ, Victor CROITORU 196

Mechanical Characteristic Of Aesthetic Nitinol Archwires
Camelia SZUHANEK, Traian FLEŞER..... 200

Mechanical Properties Of Ceramic Orthodontic Brackets
Camelia SZUHANEK, Traian FLEŞER 204

Experimental Investigation Of The Fretting Phenomenon-Dependence Of Number Cycles
Ştefan GHIMIŞI 209

SCR System Applied On Off Road Vehicle To Reduce NO_x
Ramon-Mihai BALOGH, Ioana IONEL, Dan Simion STEPAN, Nicolae LONTIS 213

PHYSICS, CHEMISTRY / FIZICĂ, CHIMIE

Study Of Nonlinear Elastic Deformation Of Quantum-Crystals
Thi Hoa NGUYEN, Valeriu DAMIAN 219

New Optical Materials Based On Chalcogenide Glasses
M. S. IOVU, V. G. BENEA, I. A. COJOCARU, E. P. COLOMEICO, V. E. TAZLAVAN, M. A. IOVU.....223

Analytical Comparison Between Vapor Compression And Cryogenic Freezing
Valeriu DAMIAN, Cristian IOSIFESCU, Thi Hoa NGUYEN..... 227

Microstructural Analysis Of Magnetron Sputtered PT Catalyst On Carbon Cloth For Proton Exchange Membrane Fuel Cells
Denis NEGREA, Cătălin DUCU, Sorin MOGA, Viorel MALINOVSCHI, Daniela EBRASU, Dorel DOROBANŢU, Marius ENĂCHESCU 231

Deposition Of The Porous Titania Films By Plasma Electrolytic Oxidation Of Titanium Suitable For Biomedical Application
Maria Magdalena DICU, Cătălin DUCU, Sorin MOGA, Denis NEGREA, Dorel DOROBANŢU, Marius ENĂCHESCU..... 238

Characterization Of Diatomite Modified By Structural-Chemical Method
Veacheslav ZELENTSOV, Tatiana DATSKO, Elena DVORNIKOVA 241

ARTS AND EDUCATION / ARTE ŞI EDUCAŢIE

Learning And The Digital Revolution
Isabelle SABĂU, Carmen SABĂU..... 247

Ştefan Luchian – Poetry Of Color
Carmen SABĂU, Isabelle SABĂU..... 251
The Role Of Motivational Factor In Stimulating The Productive Potential Of Human Resource
Cornelia NEAGU 255

ICT Sector Assessment And Competence In The Field, Reflecting On The Occupational Structure In Various Countries
Cornelia NEAGU, Maria BĂDILEANU, Andrei DOSPINESCU..... 260

Conscience Society. Stage Development
Dumitru TODOROI 264

Spirit Education In Conscience Society
Zinaida TODOROI, Dumitru MICUSA 269

Applications Of Differential Subordinationds And SuperordinationsAnd Sandwich Theorems
Anamaria G. MACOVEI 274

Subclasses Of Univalent Functions Defined By Convolution
Anamaria G. MACOVEI 278

Adaptable Softwarw – Modular Extensible Monadic Evaluator And Typechecker Based On Pseudoconstructors
Dan POPA 282

Consciene Pyramid
Diana MICUŞA, Nicoleta TODOROI 287

Aspects Of Family Involvment In Educational Process
Valentin Cosmin BLÂNDUL 294

Non-Existence Of Finite Approximation Relative To Model-Completeness In The Provability-Intuitionistic Logic
Olga IZBASH 298

On Functional Completeness In The Gr. Moisil Dual Intuitionistic Logic
Mefodie T. RAȚIU 301

Sonata In Domenico Scarlatti's Creation
Stela DRĂGULIN, Veronica DEMENESCU 304

Schenkerian Aspects In Piano Performance
Stela DRĂGULIN 308

Biomass Behavior During Anaerobic Fermentation – Experimental Approach
Adrian Eugen CIOABLĂ, Ioana IONEL, Ion VETREŞ, Gabriela Alina DUMITREL 313

Conceptual And Elementary Framework Of The Organizational Conflict
Stela SEARS 317

Biodegradable Polymers Used In The Packaging Industry: A Review
Alexandru SMARANDA, Dumitru ȚUCU 321

INDEX OF AUTHORS 327

FORWARD

ADDRESSED AT THE OPENING CEREMONY

SALUTATION FROM THE UNIVERSITY „POLITEHNICA" OF TIMISOARA

Excellency, honoured and distinguished guests and dear colleagues,

In my position as rector of the main organiser I address warm greetings to all participants and sponsors of the scientific reunion of the special program of the international reunion of the American Romanian Academy, that completes in Timisoara, in my university, its 35-th congress. Welcome to ARA35 – Science & Art in the informatics' era, 6-10 July 2011, Timisoara – ROMANIA!

My appreciations and warm thanks from the deepness of my hart for the effort joining us and contributing to the scientific outstanding level of the congress!

As Robert Eskridge indicated in "Exploration and the Cosmos: The Consilience of Science and Art", there has long been a connection between art and science, one that can be traced back to the Egyptian pyramids. History proves that the two disciplines cannot exist without each other, enduring in constantly changing and evolving relationships.

Science and art naturally overlap. Both are a means of investigation. Both involve ideas, theories, and hypotheses that are tested in places where mind and hand come together: the laboratory and studio. Artists, like scientists, study materials, people, culture, history, religion, mythology and learn to transform information into something else. In ancient Greece, the word for art was *techne*, from which *technique* and *technology* are derived, terms that are aptly applied to both scientific and artistic practices.

Romanians or friends of Romania, from all over the world, representing many countries (Canada, USA, Germany, Rep. Moldavia, Netherland, Great Britain and Vietnam), not mentioning Romania, answered and offered their support to sustain by own contribution the scientific ranking of this reunion. Thus over 90 scientific papers, covering diverse domains such as Science, Fine Arts, Literature, Education, Philosophy, Medicine, Theology, and Economy will be delivered, as key note and invited speech, invited speech or regular session frame. They review the state of art of the development, the contributions and results to the development but also the clear outfit, that the creativity of Romanians from all over the world is outstanding! In this millennium for sure new tendencies will refresh our life and industrial development! Environmental protection and sustainable development are main targets, as only by a clean environment, considering also the political and social aspects; the humanity may assure the covering of present energy resource shortage, tremendous population increase, and food and medical care for the entire population, as well higher life standards and civilization.

The congress is open to free audience from the civil society, as well!

Welcome to join the creative and innovative spirit of the ARA!

As the reunion is organised shortly after UPT (POLITEHNICA University Timisoara) celebrated 90 years of existence of the, please allow me to give you a short introduction into the history, for more details please access our web site www.upt.ro and specialised promoting materials.

Do not hesitate to become a closer friend and supporter!

The establishment of the "Polytechnic School", in November 1920, was primarily felt as a stringent need linked to the necessity of providing qualified staff to the industrial platform of the city, which was renowned, at the middle of the 19th century, as one of the most developed cities in Romania and, equally important, as one of the most important cities in the south-east of Europe. The willingness to establish a technical higher education institution existed even under the domination of the Austrian-Hungarian Monarchy, in the 1900s, when most engineers came from the Universities of Budapest and Vienna. The initiatives to establish the new "Polytechnic School" were reactivated by the Romanian authorities after the 1918 (nineteen hundred eighteen) Great Union, which brought the recovery of the Romanian territory.

Among the first UPT supporters was eng. Stan Vidrighin, the city mayor of Timişoara by that time, who, in the Local Council's meeting of 27.02.1920, (twenty seventh February nineteen hundred twenty) read the report addressed to the Ministry of Education and Religion, arguing in favor of establishing the "Polytechnic School" in Timisoara. This report specified the city hall's obligations and commitment in promoting this noble idea by ensuring the provisional headquarters of the newly-created institution and by donating land from the public property for the construction of UPT building. In March 1920, the Ministry of Public Works from Bucharest got involved in this action. Supported by Emanoil Ungureanu and eng. Stan Vidrighin, Traian Lalescu managed to convince Dimitrie Greceanu, the then Minister of Public Works, of the necessity of establishing a polytechnic school in Timişoara.

The 11th (eleventh) of November 1920 (nineteen hundred twenty), stipulated by the Decree Law no. 44 822 issued and signed by King Ferdinand I, D. A. Greceanu, Minister of Public Works, and C. Argetoianu, Finance Minister, stands as the official birthday of the newly-established technical Romanian higher education institution - the Polytechnic School of Timişoara.

Presently the university is one of the best major technical establishment in East Europe, offering through its 10 (ten) faculties for more than 14,500 (fourteen thousand) students bachelor (in "Bologna" paradigm), master and PhD programs. At the moment, the university is ongoing a refresh period for implementing a novel management & strategic plan of development. Thus a consortium with the Medical University has been signed, for developing a stronger and larger teaching and research organism, in the western part of Romania. We invite you to feel free and visit our faculties and step into our spirit, history and future! Hear its hart beets, smell its perfume, sing together the note of hope and peace!

An important number of research centers, respectively teams of researchers constituted ad-hoc, on different themes, successfully put in practice the scientific research strategy of the university, within the framework of numerous grants and contracts won by competition. The results of the research are materialized in papers, patents and products, all bringing for the University prestige, as well as important funds.

"Politehnica" University of Timisoara possesses an educational and research infrastructure - both buildings and equipments- comparable with the one of the most prestigious European universities. One of the main priorities for the "Politehnica" University of Timisoara was the international affirmation and collaboration. At the present, the university has cooperation agreements with more than 100 universities from all over Europe, but also from USA, Canada and Japan. The students of the "Politehnica" University of Timisoara beneficiate of a modern social campus, comprising very nice cafeteria and 16 hostels, totalizing 5500 modern and retrofitted accommodation places (with internet connection and cable television, new refrigerators and furniture, etc.). The university developed for its students and employees, an excellent sport base, comprising: a sport hall, an indoor swimming pool, a running track, then tennis fields, basket fields, handball fields and mini-football and football fields. The

interpersonal climate in the university is one of good-understanding and mutual respect, at the same time agreeable and propitious to performance.

In the name of my university I address warm thank to the president of ARA for his support and initiatives, during the past years and also for the honour of selecting Timisoara as host city and us as host organisers, thus trusting our managerial and scientific level and capabilities of organization!

Also the name of Consiliul Judetean Timis (Timis County Council) and Primaria Municipiului Timisora (City Hall Timisoara) and other dear sponsors and supporters should be mentioned, thank you for supporting the generous idea of sustaining by all means the development of local skills and self integrity!

Not at least I have deep gratitude and appreciations towards my colleagues and friends that supported the organisation by hard and action, day and night, in the last period!

We wish success to the scientific reunion! Have a fruitful and pleasant event, in favour of transnational and interdisciplinary cooperation in science and art, in this era of informatics, that creates bridges between generations, and Romanian artists and scientists from different countries and specialties, over the time!

Nicolae ROBU

Timisoara, 24.06.2011

LAW, POLITICS

DREPT, POLITICĂ

CRITICAL INFRASTRUCTURE SECURITY – THE WAY AHEAD

Marius HANGANU
"Carol I" National Defence University , 68-72, Panduri, Bucharest, mhanganu49@yahoo.com

Abstract. Critical infrastructures have always been a most sensitive area, because of their special role in any system or process structure, stability and function. Vulnerability comes from the inability to assure adequate protection, and usually, it is directly proportional to the role played by infrastructure. Therefore, irrespective of how well they are protected, critical infrastructures will always have a high degree of vulnerability, since, usually, they are the first targeted when a system or a process is aimed to be destabilised or destroyed.

Keywords: security, critical infrastructure, economy, defence

1. INTRODUCTION

Identifying, optimizing, and securing critical infrastructures represent an unquestionable priority both for systems and process managers as well as for their opponents, namely for those seeking to attack, destabilise and destroy the concerned systems and processes. Critical infrastructures are not and do not become critical only under attack or because of that, but also for other reasons, some of it difficult to be detected and analyzed. Usually, moreover after 09.11 2001, terrorist attacks on World Trade Centre and the Pentagon, infrastructures are considered to be or to be able to become critical in relation with terrorist attacks or other types of threats, especially asymmetric.

This is only an aspect or an identification criterion of critical infrastructures. However, there are also others concerning both systems and processes stability and functionality, as well as their relations with the outside environment. Therefore, from our point of view, analyzing critical infrastructure issues must be done according to all dimensions and implications of stability and systems and processes functionality, as well as the causal series that may generate or influence their dynamics.

2. THE MAIN CRITICAL INFRASTRUCTURES

Infrastructures always sustain complex physical systems, usually, within human society, with social functions and roles. Commonly, infrastructures develop according to vital necessities of normal functioning and of system stability.

After grouping these physical infrastructures on categories of physical systems positioned in maritime and fluvial areas, one can identify physical infrastructures that can be considered critical as follows:

a. Critical infrastructures of the economic sector:

- utility networks: electric energy distribution (380 volts or high voltage), distribution networks of industrial water, gas, refuelling (including lubricants), and other strictly necessary substances supplying networks;
- computer physical network – the computers and/or the network with related links, cables, protocols, software, regardless of network topology, database and so on;
- network storage of raw materials, finished products and special materials usage (strategic, inflammable, radioactive materials, chemical substances, biological agents and other types of high-risk materials);
- communication networks, especially their physical infrastructures (relays, cables, supports, stations, switches and so on);
- road and rail networks used by business agents, car parks, equipment and facilities parks used in the production process;
- communication network (command and control);
- producing infrastructure of energy, as follows:

o energy-heat central from Chiscani/Braila;

o wind centrals (two) built nearby Baia/Tulcea, in 2004-2005;

- infrastructures of strategic road networks, regardless their categorization – European, national or of county interest: road maintenance bases, maintenance and moreover clearance road machinery;

b. Critical infrastructures of air transport:

- Mihail Kogălniceanu airport/Constanta county, for air traffic of European and international importance, with all its related infrastructures: the airport itself (the runway and its lighting and beacons), energy, water, and gas supplying systems; fuel storage networks; aircraft hangars and parks, including infrastructure and current

control checking apparatus aircraft, control towers and air traffic control facilities: Radar stations, traffic control stations, computer networks; other infrastructure systems that depend on flight safety and security;

- Mihail Kogălniceanu airport/Tulcea, of national importance, with the afferent infrastructure mentioned before.

c. Critical rail infrastructures: railways from Dobrogea as well as railways positioned near the left bank of Danube; bridges, viaducts and other embankment works, on the rail or adjacent, stops / stations; electrical rail network, both the power and security, command and control; communications networks;

d. Critical shipping infrastructures: Black Sea Ports: Sulina, Midia, Constanta and Mangalia; harbor infrastructures with role in providing utilities: water, electricity; harbor infrastructures for cargo operation: cranes, inner rail and roads system; operating hydrocarbons and dangerous materials (flammable) terminal and their inner transportation network; lighthouse facilities: Sulina and St. Gheorghe, Portița, Cap Midia, Constanta, Cap Tuzla; radio navigation stations; radar stations and communications systems, vessel traffic routing systems, lighting system in the Romanian responsibility area for the Black Sea; coastal protection dam systems; security and safety navigation on sea systems infrastructures; rescue systems (ships, divers, devices, etc.); shipyards for construction and repairing maritime and/or fluvial ships from Constanta and Mangalia;

e. Critical infrastructure of towns from Dobrogea, excluding those bordering the river: transport networks and water inlet: wells, pumping stations and other infrastructure systems of water purification; electricity and gas transmission networks, especially junctions, checkpoints and distribution, substations serving Dobrogea municipalities; public transport networks (trolley buses and trams); telephone networks; relays, stations and centrals; national or local warning relays and radio and TV stations, public lighting, heat supply, hospitals and other emergency medicine and care infrastructure; laboratories and hematology centres, operating, recovery rooms and other parts of the surveillance and monitoring emergencies infrastructures; preventing and extinguishing fire protection systems infrastructures; civil protection system infrastructures, especially systems and networks for action and response to disasters, nuclear , industrial, chemical and technological accidents; networks and warehouses, etc..

f. Critical infrastructure of public order system, of informational and state safety system from Constanta, Tulcea, Galati, Braila, Ialomita and Calarasi counties:

- infrastructures of the police and gendarmerie, including of the community and rural police;

- infrastructures of Emergency **Situations** Committee; critical infrastructures of citizen, property and institution protection system;

- infrastructures of forces and formations of early intervention and reaction;

- infrastructures of intelligence and of other institutions depending on data protection;

g. Critical infrastructure of the health system and citizen, family and community protection:

- county hospitals and emergency networks;
- medical analysis laboratories, hematology centres;
- medicines storage;
- infrastructures of medical research centres and of the Faculty of Medicine from Constanta, etc.

Critical infrastructure specific to fluvial, lagoon, and Danube Delta

In addition to the physical maritime infrastructure, one can identify specific elements for fluvial, lagoon and delta areas that can be considered as critical infrastructure, even if their listing is not (nor should it be appropriate to have) an exhaustive character:

a. Critical infrastructures of economic operators and economic sector of (industry and the related sectors of economy):

- networks utilities in areas with high risk of flooding (especially those in the Danube Delta): electricity distribution, natural gas distribution, fuel supply network;
- computer physical networks from Delta using wireless technology (relays, switches);
- intermediate storage of food and medicine network (especially those in the Danube Delta);
- storage and food preservation technology warehouses using freezing (especially the fishery production storage), particularly in areas with high potential for natural disasters (flooding and chronic pandemic areas stemming from the specific migration of Delta);
- access routes network to ports;
- access channels (the network of channels) used in delta and lagoon areas serving economic operators;
- lakes and water surface system used in the production of fishery in delta and lagoon areas process;

b. Critical infrastructures of fluvial transport:

- fluvial ports on Danube, especially ports with high economic activity, such as: Calarasi, Cernavoda, Braila, Galati, Tulcea
- port infrastructures with insurance utilities role: water, electricity;
- port infrastructures operating goods: inner ports cranes, rail and road system;
- lighting installation and fluvial traffic regulating installed in conformity to Danube Navigation Regulations and / or COLREG;
- radio-navigation stations, radar stations and communications systems, river traffic control systems;
- security systems and navigation safety on river infrastructures;
- bank protection levees systems, water courses improve systems;
- systems and water courses maintenance infrastructure in conformity to the Convention concerning the navigation regime in Belgrade, including infrastructure

and floating dredge with role in ensuring the safety of navigation on the river;

- measuring water flow rates systems for different sectors of Danube, in order to warn in time in case of flood;

- adjusting water rate, channel of communication and excess water flow arrangements;

- locks and gates systems (both on Danube - Black Sea Channel and for the lagoon and deltaic areas);

- ships ensuring the airworthiness river (ice breakers)

- environmental control systems, water and air quality evaluation systems of the river and delta area, with immediate warning and analysis role, particularly in the following context:

- insecurity evidence in the functioning of the Bulgarian nuclear power plant from Kozloduy;

- accepted radiation norms in relation to the functioning of Atomo Center - Power Plant in Cernavoda;

- oil (and / or lubricants), chemicals pollution;

- rescue intervention systems in the remote delta areas (sanitary vessels, intervention helicopters) – with essential role in case of natural disasters (floods, pandemics, chronic) or periodic ice blocking waterways (helicopters);

- naval shipyards profiled on:

• ship construction (marine and fluvial) from Galati, Braila and Tulcea;

• maritime and/or fluvial ship repairing;

- infrastructures specific to fluvial crossings (ship, ferry, pontoon systems) from Braila, Galati, Tulcea;

- passenger and cargo river transport networks, particularly in delta area;

c. Critical infrastructure in the Danube Delta localities:

- drinking water transport and inlet networks; wells, stations and other infrastructures of water purification systems;

- electricity transmission networks, with personal heating centrals for isolated localities (St. George);

- fluvial public transport networks (the linking line of Tulcea to its suburban area Tudor Vladimirescu);

- telephone, relays, relay stations and centrals, national or local alert radio and TV stations;

- public lighting;

- the emergency hospital and other medical and health care infrastructures in Tulcea and Sulina;

- fire prevention and extinction systems, civil protection systems, especially for action and response to calamities, disasters, nuclear, industrial, chemical and technological accidents, networks and warehouses infrastructures, and so on.

Critical infrastructures of Navy responsibility for both maritime and fluvial areas

a. Critical infrastructures from Dobrogea region (county, area, etc.):

• bridges over watercourses and/or railways;

• road and rail intersection nodes;

- hydrocarbons and other dangerous materials storage tanks (LPG, chemicals, etc.);

- linkage station to natural gas pipeline crossing Dobrogea (coupling station from Isaccea), and the portion that crosses the national territory (including underwater pipeline on the Danube bottom of in Isaccea)

- linkage station to the high voltage line (750 kV network) crossing Dobrogea (Isaccea linkage station), and the segment that crosses the national territory (including the cable positioned above the Danube near Isaccea)

- communication networks from Dobrogea territories: wired networks, relays/relay points, telephone centrals, post offices, satellite transceivers stations, transport equipment, optical fibre routes, relays, signal modulators;

b. Inland critical infrastructures:

- Cernavoda Nuclear Power Central;

The following bridges with their infrastructure:

• CERNAVODA - FETESTI road and rail bridge;

• VADU OII - GIURGENI road bridge;

• critical infrastructure elements with a vital role for the Navy responsibility area;

• Danube - Black Sea Canal;

• Romanian platforms and infrastructures for oil extraction from the west of Black Sea;

• Galati Steel Combine;

• Petromidia refinery processing the oil from Navodari.

Other documents regulating the critical infrastructures protection at ministerial level are emergency ordinances and orders.

3. NATIONAL RESPONSIBILITIES FOR CRITICAL INFRASTRUCTURES DEFENCE

According to Government Ordinance no. 47/1944, Central Commissions specialized on types of disasters were created, in the subordination of the Governmental Commission of Defence against Disasters, organized within the competent ministries, as follows:

a. Central Commission for defence against floods, dangerous meteorological phenomena and hydraulic construction accidents, -Ministry of Waters, Forests and Environmental Protection;

b. Central Commission for Prevention and Protection against earthquakes and landslides - Ministry of Public Works and Territory Planning;

c. Central Commission for nuclear accidents and cosmic objects falls - Ministry of Defence;

d. Central Commission for large explosions, on surface and underground chemical accidents and very serious damages to pipelines - Ministry of Industry and Commerce;

e. Central Committee for very serious accidents on communication level - Ministry of Transport;

f. Central Commission for emergency medical assistance in case of disasters and epidemics - Ministry of Health;

g.Central Commission for epizooties and radioactive, chemical or biological contamination of plant and animal products supervising - Ministry of Agriculture and Food;

h.Central Commission for mass fires - Ministry of Interior;

i. Central Commission for Telecommunications - Ministry of Communications.

Aligning critical infrastructures protection at national level to European programs can be achieved in three manners:

a. harmonization of laws;

b.aligning dependencies and interdependencies of critical infrastructures in Romania to EU;

c. full and responsible involvement of decision-makers and experts, public or private, in elaborating and implementing EU policies and strategies in critical infrastructure protection.

National vital (critical) infrastructure protection enlists, in one way or another, in the European Programme for Critical Infrastructure Protection in at least three ways:

a. adapting the law, action and emergency situations response system to European requirements, in the process of preparing the integration and the integration process;

b.dependencies and interdependencies of Romanian vital infrastructure to the European;

c. participation to the development and implementation of policies and strategies combating terrorism, illegal trafficking, organized crime and asymmetric threats.

Romanian vital infrastructures are almost entirely critical infrastructures from at least a few main reasons:

a. they result from the infrastructure of a giant economy, inflexible and hardly adaptable to market economy, whose traces have not been yet cleared, nor improved;

b.Romanian economy and society as a whole is in a state of chaos, specific to long and repeated periods of transition, in which everything or almost everything is vital, critical and vulnerable;

c. actions without discernment on the environment, massive forest cut, chaotic land cultivation, the disaster in agriculture, lack of a coherent and effective agricultural, ecological and environmental protection policy create and proliferate serious threats for all infrastructures and especially for critical infrastructures.

d.it is expected that Romania's participation to the antiterrorist coalition and to other crisis and conflict management and peacekeeping missions to generate a new kind of threat on citizens and on vital infrastructures of economy, society, information and living conditions.

Of course, dangers and threats are more numerous. They are subject to legislative initiatives, they are included in the national security strategy and other important documents, but are far from being fully monitored, managed, controlled and removed.

4. The future of critical infrastructure protection

There are fears that the frequency and severity of critical infrastructure incidents will increase in the future. Although efforts are under way, there is no unified national capability to protect the interrelated aspects of the country's infrastructure. One reason for this is that a good understanding of the inter-relationships does not exist. There is also no consensus on how the elements of the infrastructure mesh together, or how each element functions and affects the others. Securing national infrastructure depends on understanding the relationships among its elements. Critical infrastructure protection requires the development of a national capability to identify and monitor the critical elements and to determine when and if the elements are under attack or are the victim of destructive natural occurrences. CIP is important because it is the link between risk management and infrastructure assurance. It provides the capability needed to eliminate potential vulnerabilities in the critical infrastructure. CIP practitioners determine vulnerabilities and analyze alternatives in order to prepare for incidents. They focus on improving the capability to detect and warn of impending attacks on, and system failures within, the critical elements of the national infrastructure.

A modern, efficient, networked infrastructure necessarily creates interdependencies between infrastructure sectors. Well managed energy, water and transport networks depend on ICT for control and monitoring of their condition, which entails dependency on energy. The ICT and energy infrastructure are becoming increasingly interdependent, since the smart grid needs ICT for control, and will soon not function without it. Commerce is also entirely dependent on ICT for financial transactions. The food supply will be impacted by climate change largely because of dependence on water in agriculture and food production.

Over the past few years, the attention of policymakers and industry players towards the protection of critical infrastructure has grown remarkably. In the era of networks, citizens and businesses have become increasingly dependent on a large set of infrastructures encompassing energy networks, the banking sector, telecommunications, the Internet etc. In the US, a national programme to protect critical infrastructure was launched in 1998, under the Clinton administration, and was confirmed and updated under the Bush administration in 2003. At EU level, the European Council of June 2004 called on the European Commission to prepare an overall strategy to protect critical infrastructure (CI). The Commission adopted on 20 October 2004 a Communication on Critical Infrastructure Protection (CIP) in the Fight against Terrorism which put forward suggestions on what would enhance European prevention, preparedness and response to terrorist attacks involving Critical Infrastructures.

In Romania, The Government Emergency Ordinance no. 98/2010 on the identification, designation

and protection of critical infrastructure was issued, and therefore, one can say some steps were taken towards CIP. Of course, these steps were made only at the urge of the EU and the benchmarks given by the document are far from satisfactory.

References:

1. Cordeman, Anthony H., *Cyber-Threats, Information Warfare, and Critical Infrastructure Protection: Defending the U.S. Homeland*. Praeger Publishers, 2001.
2. Neguţ, Silviu; Neacşu, Marius Cristian; Viorel, Mionel, European Union's Dependency on Russian Energy. Geopolitical considerations, în „The Romanian Economic Journal", nr. 25 bis, 2007.
3. Verton, Dan. *Black Ice: The Invisible Threat of Cyber-Terrorism*. McGraw-Hill/Osborne, 2003.
4. Yourdon, Edward. *Byte Wars: The Impact of September 11 on Information Technology*. Prentice Hall, Upper Saddle River, NJ, 2002.
5. Government Emergency Ordinance no. 98/2010 on the identification, designation and protection of critical infrastructure
6. DoD (department of Defense, USA) – "Critical infrastructure Protection" NDIA Information Briefing, 2007.

A MARKETING APPROACH TO THE CONCEPT OF E-GOVERNMENT

Constantin SASU, Luciana SASU
Al.I.Cuza University, Bd. Carol I, nr. 11, Iaşi, Romania,Technical University Iasi, Bd Independentei No.17, Romania, e-mail:c.sasu_49@yahoo.com, lil-lussiana@yahoo.com

Abstract: This paper aims to identify the profile of the user of online service/public applications at the Iaşi city level (the second largest city in Romania) and highlights determinant quality factors in the customer decision to re-engage the online public services/applications. The study involved a non-probability quota sampling, based on personal in-home survey. Research was conducted on a sample of 200 respondents from the 26 areas of the city. Within each area, we used a convenience sampling. Number of questionnaires completed in each area is proportional to the number of residents aged over 18 years. The research provides useful information for better understanding the reality of e-government in Romania in order to adjust on-line services according to user preferences.

1. Introduction

In the context of information society it has developed the concept of electronic government (e-government). Basis for the development of this concept was the need felt in the public government to provide citizens and organizational and social entities with quality services in order to create time and place utility, and added value for all stakeholders. Arguments supporting this process of computerization of public services, in an initial phase generated by the unprecedented acceleration of modern information and communication technologies, consist in efficient public services, gaining citizens confidence and overall society democratization.

Introduced in the 90s, the term "e-government" was not clearly defined nor well understood by practitioners of public administration. Like other management concepts (TQM, strategic management, participatory management), the term e-government stem from the private sector which has delivered the terms „e-business and e-commerce". Electronic Government is the interaction between Government, Parliament and other public institutions and citizens through electronic means. Information on the draft law under discussion and issue opinions by citizens, paying taxes by taxpayers, filling complaints and petitions online, are effective means provided by the State to exercise the fundamental rights of citizens [1].

E-Government is the use by the Government of the computer applications and other information technologies based on the Internet, combined with processes that implement these technologies to improve access and delivery of information to Government and of services to the public, or by other agencies and government entities. This brings improvements in the working way of the Government and has resulted in increased effectiveness, efficiency and service quality. Digital Governance refers to using web infrastructure to provide online services [2].

The base of development of e-governance concept was the need felt in public administration to provide citizens and organizational and social entities with quality service, to provide utilities of time and place, creating added value for all stakeholders. Arguments supporting this process of computerization of public services, in an initial phase generated by the unprecedented acceleration of modern information and communication technologies, consisting in efficient public services, gaining citizens confidence and democratization of the society as a whole.

2. Methodology

Research problem is to identify ways to increase the use of applications / online public services by citizens (who are the users, when used, why not use, what is the user perception of these services and applications).

Research goal is to obtain information necessary to substantiate the marketing strategies of online public services and applications in Iasi city.

The *primary objectives* of the research are:

• Objective 1: Identify the user profile of online service / public applications at the city level;

• Objective 2: Identify determinant quality factors in customer decision to re-engage the services/applications online public.

Research hypotheses are:

H1: Frequency of use of online government applications (e-information and e-participation) depends on the following factors: respondent's sex, age, educational level, income level, number of hours spent daily on the Internet.

H2: The number of online public services accessed in the past 12 months depends on the following factors: respondent's sex, age, educational level, income level, number of hours spent daily on the Internet, trust in the Internet.

Population investigated. Population consists of persons residing in the city of Iasi aged over 18 years.

Primary *research method* was survey on neprobability quota sampling, based on questionnaires distributed at home. Research was conducted on a sample of 200 respondents from the 26 areas of the city. Within each area we used a convenience sampling.

Number of questionnaires completed in each area is proportional to the number of residents aged over 18 years.

Quotas used in the sample makes it representative in terms of gender and age for people over 18 years in Iasi:

3. Results

Objective 1: Identify the user profile of online service / public applications at the city level. User of online service / public applications is the person who turned in the last 12 months at least one of them. Preponderance of males among online public service/ applications users is higher than the share of total population. Compared to total population, age distribution of users of online public services differ by greater share of people of 18-54 years and people share less than 54 years. Online public service / applications users differ of population structure by higher share of persons with university and high school. Demographic structure of users of on-line public services / applications not significantly different from that of the population after the variable "income level. People who have used the last 12 months of online public services or applications daily spend one more hour on the Internet. People who have used the last 12 months of online public services or applications have greater confidence in the Internet.

Objective 2: Identify the determinant factors of customer decision to re-engage the services / applications online public. To this end we use regression analysis. Independent factors which we will enter the analysis are: given the average score for the factor "quality information" (question 8, items i, j, k), given the average score for the factor "site design" (question 8, items e , f, g, h), average score given to the factor "customer service" (question 8, items: a, b, c, d, m, n, a, p) and privacy (question 8, item l). According to secondary education, they are the most important factors in determining the quality of electronic services. Average score for each factor was calculated by introducing a new variable in the "Transform" procedure "Compute." Dependent variable factor is related to Question 11 "If you have to call again on government services or to obtain various information, on a scale of 1-4 (4 - very likely) please indicate how likely it is to use Internet / e-mail to that effect."

4. Verification of research hypotheses

H1: Frequency of use of online government applications (e-information and e-participation) depends on the following factors: respondent's sex, age, educational level, income level, number of hours spent daily on the Internet.

Respondent sex. The government contact women by e-mail more frequently than men. The difference is not statistically significant,

Age. People aged under 44 years turning more frequently to this application and the share of people aged over 54 years who have never contacted the public through the Internet (98.3%) is higher than the average sample (74%). It is noted antagonism between active people aged under 44 years and those aged over 54 years. Persons aged 45-54 years generally have values close to the sample average. Frequency of contact officers, politicians e-mail does not depend on the respondent's age, almost all respondents have not used this application in the last 12 months. Download Frequency of official forms required to obtain a public service does not depend on the respondent's age, most respondents have not used this application in the last 12 months. Reference frequency (uploading is) on the Internet of a completed form / document required by government does not depend on the respondent's age, most respondents have not used this application in the last 12 months. It stands 25-34 years age group which appeals to these applications more frequently than the sample average and over 54 years age group who are at the opposite pole. Frequency of participation in online market research organized by local public bodies, regional or national respondent does not depend on age, most respondents were not involved in such applications in the last 12 months. Frequency of participation in online debates / forums on topics of general interest held by public bodies at local, regional or national respondent does not depend on age, most respondents were not involved in such applications in the last 12 months.

Level of education. People with university degree calls daily from this application at a rate of 8.14% to 3.5% as the average sample. Of the total 11.63% of those with university calls at least once a week in this application, to 5.5% as the average sample. At the opposite end are those with secondary and post-secondary studies who have not accessed the application in the last 12 months at a rate of 88.89% and 96.3% to 74% as the average sample. It notes the difference between those with university education, on the one hand and those with secondary and post-secondary education, on the other hand. Early versions have higher weights "every day", "at least once a week but not every day" and "at least once a month but not every week." Download Frequency (download) official forms required to obtain a public service does not depend on the level of education. Reference frequency on the Internet of a completed form does not depend on the level of education. Frequency of contact officers, politicians e-mail does not depend on the level of education. Frequency of public consultation

documents (decisions, budgets, regulations) on a site of national and local administration level of education depends on the value as a sig materiality. for hi square test. It is noted that people with university education more frequently resort to this application. Frequency of participation in online market research organized by local public bodies, regional or national level does not depend on education. Frequency of participation in online debates / forums on topics of general interest held by public bodies at local, regional or national level does not vary according to studies.

Income. There is no statistically significant differences.

Number of hours spent daily on the Internet. We note that there are significant differences in the number of hours spent daily between those who have never contacted government via e-mail and those who have done this at least once in the last 12 months. We note that there are significant differences in the number of hours spent daily between those who have not ever sought information from government websites and those who have done this at least once in the last 12 months. We also note that there are significant differences in the number of hours spent daily between those who have never have found public documents (decisions, budgets, regulations) on a site of local or national government and those who have done this at least once in last 12 months. Basically we have the same situation as if the frequency of obtaining information from government websites, government and various public agencies and the frequency of contacting government by e-mail (to ask questions to a request) . Download Frequency documents on government websites do not differ significantly depending on the number of hours spent daily on the Internet. Frequency of uploading documents on public administration sites do not differ significantly depending on the number of hours spent daily on the Internet. Frequency of participation in discussions / forums on topics of general interest held by public bodies at local, regional and national no significant difference in the number of hours spent daily on the Internet. Frequency of public contact people via the Internet is no significant difference in the number of hours spent daily on the Internet.

The hypothesis is checked for variables: respondent gender, educational level, age and number of hours spent daily on the Internet for the following applications:

• Contacting government e-mail (to ask questions to a request);

• obtaining information on government websites, government and various government agencies (Environment Agency, local departments for statistics);

• Public consultation documents (decisions, budgets, regulations) on a site of local or national government; and not checked for applications:

• downloading (downloading) the official forms required to obtain a public service (eg to obtain a certificate);

• send (upload area) a completed form online;

• contacting officials, politicians via email;

• participation in online market research organized by local public bodies, regional or national

• participation in online debates / forums on topics of general interest held by public bodies at local, regional or national.

Income criterion does not discriminate in terms of frequency of online public access applications.

H2: The number of online public services accessed in the past 12 months depends on the following factors: respondent's sex, age, educational level, income level, number of hours spent daily on the Internet, trust in Internet

Respondent sex. There is a significant difference between the number of public services used by men and women used. The difference is due to significantly higher number of men moving to the online service "declaration of income.

Monthly income. People who have used a different number of public services online last year did not differ by variable monthly income.

Age of respondents. Number of online public services used by respondents differ significantly depending on their age. There are significant differences in terms of online public services used by persons aged 18-24 years and 25-34 years, on the one hand and with over 45 years, on the other hand. Differences is because people aged 18 to 24 years access to a greater extent of consultation services of public libraries and the catalog entry to an institution of higher education, people aged 25-34 years call largely in services, buy / registration of a car.

Educational level. People with high school and university used in last 12 months a significantly higher number of public services to those with secondary and post-secondary studies.

Number of hours spent daily on the Internet. There is a strong and positive correlation between the number of hours spent daily on the Internet and public access service number last year.

Trust in the Internet. There is a strong and positive correlation between trust in public service and Internet access number last year.

Overall, the hypothesis is confirmed, except for variable monthly income.

5. Conclusions

In the research conducted at the Iaşi city level following conclusions are drawn.

1. Users of online public services have the following demographic structure:

• the share of men among users of services / applications on-line public is higher than the share of total population (51.37% vs. 48.5%);

• age distribution of users of online public services differ by greater share of people of 18-54 years and people share less than 54 years;

• greater share of people with university and college;

• people who have used the last 12 months of online public services or applications every day spend more

hours on the Internet, 2.35 hours to 1.57 hours overall sample average;

• people who have used the last 12 months of online public services or applications have greater confidence in the Internet.

Note that the demographic structure of users of services / applications on-line public not significantly different from the population after the variable "income level".

2. Independent factors were introduced into the analysis: the average score given to the factor "quality information" given. the average score for the factor "site design" (average score given to the factor "customer service and confidentiality. They explained 73% of the variance variable" likelihood " to recall to the public via the Internet. "proportion explained by this model is statistically.

3. Among the public applications, the e-participation were the least accessed: participation in online debates / forums on topics of general interest held by public bodies at local, regional or national participation in online market research organized by local public bodies, regional or national. Among of e-information applications, most often accessed was "Getting information from government websites, government and various government agencies (Environment Agency, local departments for statistics).

Table 2 Frequency of online public access applications

	Ne-ver	At least once in the last 12 months
Contacting government via e-mail	74	26
Obtaining information from government websites	40.5	59.5
Downloading the official forms	94.5	5.5
Send (upload area) on the Internet to a form /	93	7
Contacting officials, politicians by email	97.5	2.5
Consulting public documents	27	73
Participation in online market research	96.5	3.5
Participation in online discussions	95.5	4.5

4. The percentage of appeals to public services online is very low. Online service that appealed to most of Iasi's "Catalogue of consulting public libraries (31% of total population) and the declaration of income (23.5% of total population).

5. The main reasons why people do not use services / applications online public are:

• not possess the skills necessary to obtain services / information required by the Internet - 23.29%

6. Overall, "customer service" was rated with an average of 3.01, "design / quality of web

ages" - 3.8 "quality of information provided - with 3.59 and" confidential information provided by client - 3.17.

7. Networking with government via the Internet, compared with expectations taken ranged from "well below expectations", to "the above expectations" well below expectations - 4.79%, below expectations - 40.41% or better no worse - 36.305, above expectations - 16.44%, well above expectations - 2.05%.

8. Of all respondents, over 75% consider that their needs were addressed as a result of networking via the Internet with the public. Almost 25% think otherwise. Distribution of answers is: yes, all - 4.79%, partly yes - 70.55%, partly not - 11.64%, not far - 13.01%.

9. Of those who interacted with government online, 80% say that is likely to repeat this behavior, only 20% say the opposite. Distribution of responses is: very unlikely - 3.42% less likely - 16.44%, probably - 53.42%, very likely - 26.71%.

10. Of all respondents, 51.37% prefer the Internet, face to face communication is an important competitor with 32.19% of citizens preferences; phone is repoferat of 14.38% and 2.05% letters and fax.

11. The most important benefits perceived by those who used the services / applications on-line public are: "save time", "flexibility" and "ease of service delivery"

By identifying the profile of online service / public applications user at the Iaşi city level and highlighting determinant factors in customer decision to re-engage the online public services / applications, research undertaken provides Romanian government with useful information for better knowledge on e-reality government in Romania to adjust on-line services to user preferences.

10. References

1.Lin, C.S., Wu, S. (2002), Exploring the impact of online service quality on portal site usage, Proceedings of the 35th Hawaii International Conference on System Science, 2002.

2. Moon, M. J. (2002), The evolution of E-government among municipalities: Rhetoric or reality?" Public Administration Review 62(4): 424-433.

3. Melitski, J. - E-Government as an Instrument of Fiscal Accountability and Responsiveness, **HTTP://ARP.SAGEPUB.COM/CGI/CONTENT/ABSTRACT/36/3/301**, 2004.

4. Ştefan, I.G. – (2007), Evaluarea calităţii site-urilor web ale primăriilor oraşelor. Cercetări practice şi teoretice în managementul urban, Anul 2, Numarul 2.

5. Yang, Z., Jun, M., & Peterson, R.T. (2004). Measuring costumer perceived online service quality: Scale development and managerial implications. International Journal of Operations & Production Management, 24(11/12), 1149-1174.

THE CONNECTIONS OF MONETARY POLICIES WITH THE EVOLUTION OF INTEGRATION AND GLOBALIZATION

Alexandru OLTEANU, Mădălina Antoaneta RADOI

Abstract. The last decades have marked a tumultuous acceleration of historical and political processes and this produced significant changes in the geopolitical sphere, which continues to influence the economy, the financial markets and international relations, with effects on the construction of a new global balance.

The unprecedented development of financial relations and monetary policies has contributed to their internationalization, to the homogenization of the financial markets and of some regulations regarding their efficiency.

Keywords. Bilateralism, regionalism, globalization, financial and monetary volatilization, general and financial-monetary integration, efficiency of monetary policies, etc.

1.Introduction

The economic and financial-monetary relations have long preceded the appearance of the first states. Especially commercial links are very old and at first they were completely independent of state social formations. Therefore, bilateralism as a relation between two economic operators is the concept with the longest history, daily needs requiring the exchange of products.

Despite these trends, autarchy dominated economic life from its beginnings to the great geographical discoveries and the Industrial Revolution. Economic "coagulation" continued and widened gradually until today, reaching various forms, interconnected levels that were unbelievable some time ago, representing a balancing factor at regional and international level. Current developments confirm the old forecasts referring to the indissoluble relationship between the economic and financial-monetary factor and international stability.

2. Literature review

2.1. Integration, globalization

One of the problems developed by economists and monetarists in the last decades is that of economic and financial-monetary integration involving the interests of states, classes, nations.

Etymologically “to integrate” means to include, to incorporate into a whole. The French economist Jean Weiller tries to broaden the definition of integration. For him, "integration is not simply an addition, but in a given space, it means increasing the possibilities for coordination of plans of decision centers, in order to form a single economic system. To study integration means to rise above the market and to focus the attention on decisions, expectations and intentions". This definition takes into account the West-European integration and the “centers of decision "are the authorities and the bodies of different national states.

For economists like Viner, Seitovschi, Haberler, integration would be simply the bringing into contact of the economies by removing all barriers that stand in the way of their exchanges. This integration would be nothing else but the creation of a vast free market, formed as a result of the unification of two or more economies. In this case, as André Marshall considers, we can not talk about integration, but about a juxtaposition of economies which keep their own character and become more or less independent, each of them undergoing consequences that appear in their neighbors’ countries. The real integration, as André Marshall says, is the one designed in the structural and voluntarist meaning of the word. "It combines various elements of an economic assembly so that it looks like a space of solidarity."

François Perroux defines the concept of integration based on the Western European integration. "The integration act unites the elements to form a whole or enhances the cohesion of an existing whole. To integrate Europe will be, supposing that the elements of Europe are the nations, to gather them in a whole entity, that deserves by means of its cohesion, to be called European, or to increase the cohesion of an existing whole, that will be legitimate to be called Europe".

In the economic field, Perroux considers that integration aims to replace the national balances established in each European nation, between each European nation and other nations in Europe and beyond, with a new balance of an assembly formed by the European

nations, which is considered more favorable and stable for its own benefit. André Marchall, starting from the definition of Western European integration based on solidarity, considers this could be of four kinds, namely:

a) Economic, which, except from the coordination of national policies or the application of a common policy, can be the result of the many and complex economic ties woven over the borders between member nations producers: industrialists, bankers, merchants.

b) Social, i.e. it appears what Myrdal called "equal opportunity" that involves, contrary to economic integration, the intervention of national and European public powers. If economic integration can be private in nature, social integration cannot be conceived otherwise than institutional.

c) Political, when in Western Europe the management unity is achieved and the conditions for creation and operation of a supranational authority are met, the integrated whole will be structured as each nation is structured.

d) Territorial, this is real integration because it is economic, monetary, social and political, all at the same time.

Unfortunately, we find that André Marchall, as other economists also do, omits one of the fundamental integrations which determines the four types, the **financial-monetary one**.

In this way, we consider that Perroux's considerations, namely that there are three forms of integration, are more comprehensive:

a) market integration

b) integration through investments

c) integration by means of institutions

These forms are, ultimately, different steps in the integration process.

Market integration is the simplest form of integration, which aims to create a common market - economic and financial-monetary - by removing the Customs barriers and ensuring the free movement of goods and money in the area. The financial and monetary integration has an important role in forming the common market, and its element of crucial importance is the free convertibility and movement of national currencies.

The unification of Western Europe, from an economic point of view, resulted in a vast market, which allows the existence of an economy on a higher level, similar to the American or Asian ones.

However, under the shelter of a formula like "the vast territorial unity", "the optimal size", they motivate and protect the greedy expansionist policy of large capitalist countries and imperialist monopolies against small countries, which, under the disguise of integration, seek to plunder the latter's natural wealth and subdue them economically and politically.

Another argument frequently invoked by economists to justify European integration is the development of productive forces, the very rapid contemporary technical progress.

Andre Marchal argues that in its structural sense, integration is impossible to occur unless the following conditions are met:

1. Geographic proximity - Statistics show that neighboring countries have a greater commercial exchange and that despite the progress of the means of transport, distance is an obstacle. He said that "here there is one of the irrefutable superiority of EMU on free trade area which groups seven countries geographically spread: Austria, Denmark, Norway, Portugal, United Kingdom, Sweden, Switzerland."

2. Similar development levels and the homogeneity of the structures."This means, Andre Marchal says, that territorial integrity must unite not complementary economies, but similar economies, with a view to restructure them in a broader framework - which undoubtedly arises numerous problems and obstacles, but which proves to be advantageous. While, on the other way round, the union of complementary economies, which do not arise any problem, seems to be of no utility, because it simply embodies the status quo. "

3. Psychological conditions: the will to become united in order to form a balanced economic complex.

Listing these conditions that would make the economic integration sound and politically acceptable, Andre Marchal shows that it can not be extended to too many countries. That is why no one can speak of global integration, but only of a regional one.

An extremely important observation and at the same time a correct one is made by Myrdal in connection with the worsening regional disparities in terms of integration, because of the mechanism of "circular and cumulative causation". The complete liberalization of trade following the completion of customs unity, labor force, capital, generates a double cumulative process of enrichment of the rich areas and impoverishment the poor regions.

We must understand that European integration does not take place in an international "vacuum". European Union countries are open economies with close links with the world. Therefore, the development of the European Union will be seriously affected also by economic, monetary and political events outside the Community.

On the other hand, the EU is a major player on the world stage, an actor whose actions have a significant impact on the global economic system. All these challenges and evolutions are ultimately the key to progress and to the perpetuation of competition.

2.2. **The impact of the Monetary Union (MU) on the globalization of capital markets The Capital Liberalization Directive** adopted in June 1988 is the document that governs the European Economic Community's full liberalization of capital movements. EU Treaty agreed between Member States shall prohibit any restriction on capital movements and payments

between Member States and shall, in principle, ensure the strength of the European integration, without which the single market cannot be fully supported and carried out.

The full harmonization of the capital market is also hampered by the national characteristics of money markets, resulting mainly from the level of inflation.

The expansion of world trade, seconded by the capital flows, the unprecedented progress of science and technology, the transition of the communist economic system to a market economy have generated the acceleration of the regional and global integration process, which basically represents increased business opportunities for the banks, financial institutions, firms and financial investors.

A brief overview of these events relate to the expansion of the eurocurrency market, the birth and strengthening of the European Union, the growing importance of multinational companies, plus the financial crises, the oil shocks, the debt crisis, the collapse of communism in Russia and in Eastern Europe. At the beginning of the third millennium, globalization has become a fact. In these circumstances governments, international financial institutions, businessmen/businesswomen will have to face challenges, the so called "new rules of the game."

Globalization involves both a series of positive, innovative and dynamic aspects, but also many negative, disturbing and marginalized aspects. In terms of the positive effects, the relations between states and individuals are deeper than ever. World exports in the year 2009 are over 22% of GDP, compared to 17% in 1970. Direct investments abroad in 2009 were over 11 times higher than the level of the 70s. This process of global integration is the result of **changes in the political view,** namely: to promote economic efficiency by:

1. the liberalization of domestic capital markets, financial services and the three factors of production;
2. State disengagement regarding many economic activities

although at the origin of the process there are recent innovations in communications technology, integration is still partial: *borders remain a closed path, especially for low-skilled labor force.*

However, these trends mask some differences: **big progress, but also huge drawbacks, shortcomings and inequalities between countries and regions, poverty is everywhere today**. In industrialized countries, poverty is still obscured by statistics and one in eight is affected either by long-term unemployment or a life expectancy below 60 years, or an income below the national poverty line and a brief training level without the possibility of overcoming the situation.

In some countries, human poverty indicator shows large disparities by regions, for example, in the case of India where the poverty level is twice higher in Bihar state, in comparison to Kerala region. At the same time, the inequalities between men and women are still striking. In many developed countries, women are almost totally excluded from political life. Women occupy more than 30% of parliamentary seats in only five countries in the world and in other 31 countries, their presence in the Parliament is below 3%.

If financial markets or the markets of crime collapse, in the case of AIDS transmission and of the greenhouse effect, the risk of propagation of disturbances is huge. Planetary hazards, such as the global financial crisis started in 2007, are growing beyond the national and international capacity of intervention or response.

The main feature of the economic and financial environment is **the alternation of the phases of expansion with those of recession and the financial and monetary volatility**.

The financial crisis in America, Europe and Asia has destabilized the lives of millions of people, reduced the prospects of economic growth in the world. The analysis of the crisis allows the release of some important conclusions as regards the financial market:

a) **First of all, the instability is the characteristic of globalized financial markets**. A key element in triggering the Asian crisis, for example, was the instant and massive injection of capital for a short term, followed by an equally abrupt withdrawal.
b) **The second important conclusion** that is released from the crisis is **the increased caution with which the governments should open access to capital for the short term**, highly speculative, especially when the regulatory institutions of the financial market are infantile.

How are we going to live with this node of divergence? Will globalization defeat with her good intentions of equilibrium in a kingdom dominated by the Faustian spirit and intelligence or terrorism? It remains to be noticed what will be the answer to these questions.

Who will benefit most from the change? This is not the case of European exchange offices. The sector of IT and business consulting companies will take full advantage of the integration and stability of the currency, as a consequence of a strong demand for the adaptation of information systems. Finally, the whole economy will benefit as a result of integration and currency stability, which is the fundamental goal of the project.

Capital markets have prepared themselves. The state bonds issued after 1999 have been issued in Euro and those in circulation have been converted. As regards the future of the financial centers, the opinions are divided and we cannot make reliable estimates yet. **If Britain will enter the monetary union, London would be able to dominate the capital market.** Smaller financial centers, for example, Brussels and Milan will restrict its

activities. **Otherwise there is a risk that the offshore market in the UK to divert a portion of its profits volume of financial activities generated by the euro area**. Competition among financial centers and institutions will increase, and the result will be the production of alliances on continental markets.

London has an advantage over the competition in terms of financial liberalization, and this allows it to exploit the natural tendency of concentration which is found in the finance industry.

Making use of the "opting out" clause, the UK yet avoids the rigorous monetary policy and the discipline imposed by the ECB, London still retaining its status of offshore center. At the same time, London's advantage is reduced, increasingly, in favor of Paris that offers superior security guarantees for financial transactions.

In terms of derived products from the capital market, the Single currency triggers a uniformity of the futures contracts. At the same time, the listing of securities in euro allows a better comparison and creates new opportunities for arbitrage.

Potential efficiency and success in the financial sector depend, ultimately, on the ability of MU to achieve full financial integration of member countries, to create a more uniform system of practices on financial markets and achieve the fullest possible transparency in the system of quotation and evaluation.

The efficiency and the scope for monetary policy and the statute of the central bank are inseparable.

The impact of external constraints should not be generalized: no country can completely abandon the wave of adjustments, operating continuously. It follows therefore that **a certain degree of independence** must be considered and maintained at all times, **which does not mean isolation** from the process of internationalization. Economic independence is now discretion and security, allowing us to retreat from the game when "cards are bad" and it also means maintaining the autonomy of decision. Independence is connected to the national interest and to the quality of the most precious capital, the human capital. A country that does not make any efforts in this direction, in terms of **nutrition, health, education, comfort and civilization** in general, everything that is related to the **quality of life** today, is likely to disappear sooner or later, from the geopolitical landscape. Today, when we know too well how many forces are raging, many inequalities overwhelm us, and it is clear that this goal is not simple at all.

Two foreign policies are essentially required today:

- **the competition policy;**
- **the cooperation policy.**

The Competition policy is the cornerstone of the margin of maneuver. If we fail to provide a satisfactory level of competitiveness, we expect a dependent position, of a colony or satellite.

Although it was said from the beginning that once the currency are allowed to float freely, they will solve all the problems and the adjustments will be made by themselves, they arrived shortly afterwards to the flotation controlled by central banks, but still this was not effective. Then the coordination of monetary policies appeared, and at present we can also talk about the coordination of economic policies, within the EU and G7.

2.3. The debut of EURO – in between success and skepticism

"**E Day**", i.e. the euro day, on 1 January 2002, when over 300 million people in Europe began to have one thing in common: the same currency.

Conversion is the second part of a long process, conceived in two stages. *The first step*, the introduction of electronic euro was made in January 1999, when imports and exports in and from the EU were calculated using the single currency. After 1 January 2002, consumers in 16 European countries and tourists visiting these countries stopped using the Franc, the Mark and the national Lira and began to pay for food, train tickets or consumer goods with the new banknotes of the single currency.

Moving to a single currency was not simply a matter of monetary logistics. The immediate or long-term consequences, good or bad, are enormous.

Skepticism and mistrust, this could be the position taken by the Western analysts as regards the shift to the single currency, after 1 January 2002.

- *Skepticism*, because almost 40% of the 300 million citizens of the EU

member states do not realize that they do not have their national currencies anymore in their pockets. The same thing can be said also about small and medium enterprises. The managers of these companies have not tried too hard to understand the phenomenon of transition to the single currency. For them the critical moment came when they had to start paying salaries in euro.

- *Lack of confidence* comes today from gloomy forecasts regarding the

economic growth, inflation and high growth of public debt ratio in GDP in the 16 Member States. A few months before "E Day" it was increasingly clear that Europe had problems. At the beginning of 2010, ECB forecasts an inflation rate of 3-4%.

In order to gain confidence in the single currency, it is important not to cause any syncope after switching from the national currencies to the euro, not to lead to delays in payments, and not be the case of temporary currency crises and to reduce the volatility of the exchange rate.

Of course, you can make a series of possible scenarios, based on the current regulations and the confidence in the single currency.

The European unification is more than an alliance or an association under the tutelage of a super-national authority. It is possible for it to exist only by self-limiting the proud movement of the national entities and by means of the conscious delegation of powers that belonged to the national entities.

3. Conclusions

The monetary policies are proved to be a catalyst for general economic and financial stability – regional and global. The euro zone should regain its status of reliable and stabilizing factor in international financial-monetary relations.

REFERENCES

1. Angheta M., Orlean A.: La violence de la monnaie PUF, Paris, 1984
2. C. Basno, N. Dardac:Integrarea monetar-bancară europeană, Ed. Economică, 1999
3. Hans Peter Martin Capcana globalizării, Ed. Economică, 1996
4. Hayek Fr.Mayer Thomas: Money, Banking and the Economy, EDP, 1993
5. Duessenberry,J.S., Robert Z. Aliber, Z, R., Macchielli, Jean-Louis: Multinationales et mondialisation, Edition du Seouil, Paris, 1998
6.Marsbett J.: Megatendințe, Ed Politică, Bucureşti 1989
7. Olteanu, A.: Management bancar, Ed. Dareco, Bucureşti, 2003
8. Stoleru L.: L'ambition internationale, Edition du Seouil, Paris, 1987
9.Zainea E.: Globalizarea – şansă sau blestem, vol. I: Condiționările creşterii economice, 2000
10.Zaman G.:Macrotendințe în economia mondială TE, 26/1997
11.Waqet Isabelle: Crises et les politiques economiques, Presse Universitaire de France, 1998
12. * * * The Economist, decembrie 1999
13. * * * Tratatul de la Maastricht
14. Web pages: www.europa.int, www.euro.eu, www.ecb.int, www.ue.eu.int

PHILOSOPHY, THEOLOGY

FILOZOFIE, TEOLOGIE

PARADISE OR ANNIHILATION ~ PARADIS SAU NEANT

Dinu LEONTE
ESS Global, Hayward, California U.S.A, e-mail: dinu@essglobal.us

Abstract: This essay comes after the controversial warning, regarding the eschatology topic about the Judgment Day which begins with the return of Jesus Christ to rupture His Church. Most of these poems have been written after the milestone of the ARA 32nd Congress in Boston, USA, when this main topic was just initiated [2]. The ARA 33rd Congress in Sibiu offered an award for my contribution. Following the same format, few poems from my book "Amorfe si Cristaline" [1] have been added. Within the last chapter of [1], I wrote Romanian lyrics for some international hits, or English lyrics well suited for some of timeless Romanian evergreens.
To the transdisciplinarity, whose emblematic figure is Acad. Prof Dr. Basarab Nicolescu [3], I dedicated here a poem. Some limericks have been added also. But as always, beyond any shadow of a doubt, these poems express my gratitude to God, to whom alone should be given all praise and glory for our little accomplishments in this life.

1. INTRODUCTION

Given the great importance of the main topic in the Christian poetry that I bring to your attention, I would prefer to jump in it with boldness and humility alike. Most of these poems are inedited. They are going to be published in a new revised and extended edition of [1]. In the next paragraphs, fix-form poems and philosophical poems will follow.

2. CHRISTIAN POETRY

According to the Word of God, the Bible, there is by far the most important thing for each one of us to not disregard the awesome warning about the inherent End of Time, which means eternal paradise or annihilation.

CUVÂNTUL

Ioan 1:14

Cuvântul carne S-a făcut
Şi printre noi a locuit
Dar a rămas pecetluit
Pentru acei ce n-au crezut..

`Naintea lumii ce-a zidit
A existat de la-nceput -
Cuvântul carne S-a făcut
Şi printre noi a locuit.

Dar a rămas necunoscut
La toți cei care n-au dorit
Să aibe-un suflet rennoit
În locul inimii de lut;
Cuvântul – carne S-a făcut!

11 October 2010 Las Vegas, Nevada

I CANNOT KEEP ON SINNING!

Because God's seed abides in me
I cannot keep on sinning
And since I have been born of God
His love for me is winning.

The day I have been born again
My clean new heart has meaning;
Because God's seed abides in me
I cannot keep on sinning!

And yet, my body lusts for sin
Ignoring my heart's cleaning.
But I have Jesus' mercy now,
So I can't keep on sinning…

8 February 2009, Hayward

GRAȚIA DIVINĂ

N-ai ce zice, n-ai ce face
Sunt puțini să spună multe
Despre vremuri şi soroace
Şi nu-s mulți ca să-i asculte.

Cu destinul scris pe față
Omul naşte ca să-noate

Într-un suflet fără viață
În oceanul de păcate,

Până când de el se-ndură
Să-l salveze de pieire
Fiul Vecinic din Scriptură
Prin credință și iubire...
Numai Grația Divină
Este singura în stare
Ca să-i șteargă-ntreaga vină
Prin a Sa răscumpărare!

19 Martie 2010, Albany, CA

BORN-AGAIN

God did it all for your sake!
He sent His Son not in vain –
Heaven and hell are at stake
When you become born-again!

14 Oct 2010, Las Vegas, NV

3. FIX-FORM POETRY

There are many species within the fix-form poetry, some of them more usual such as the sonnets, and the rondels, other ones less usual such as the pantums, the gazels, etc. Because of the space constraints, I selected here a pantum and a rondel.

PANTUMUL RUINELOR

Suspinele văii te cheamă în cânturi
Când lunca se umple de umbrele serii
Şi-un bucium din dealuri te-mbie să vânturi
Puzderii de gânduri sub stele puzderii…

Când lunca se umple de umbrele serii,
Un clocot de clopot din neguri se-adună.
Puzderii de gânduri sub stele puzderii
Pe fruntea ta rece în clarul de lună.

Un clocot de clopot din neguri se-adună…
Şi pieptul tău bate în repezi tic-tacuri.
Pe fruntea ta rece în clarul de lună
Se tulbură valea din somnul de veacuri.

Şi pieptul tău bate în repezi tic-tacuri.
Acolo pe deal se sculară străbunii.
Se tulbură valea din somnul de veacuri,
Dar toate sunt mute sub razele lunii.

Acolo pe deal se scularǎ strǎbunii?
A fost doar părere. Sunt numai ruine.
Dar toate sunt mute sub razele lunii,
Nu sunt decât simplă uitare de sine.

A fost doar părere. Sunt numai ruine…
Puzderii de gânduri sub stele puzderii
Nu sunt decât simplă uitare de sine
Când lunca se umple de umbrele serii…

5 *Mai 1959, Suceava*

DE VINĂ-S GROPIȚELE TALE
Rondel

De vină-s gropițele tale
Nu-i nimeni să ți le priceapă
Că-n ele-ar putea să încapă
Duzini de palate regale!...

Privindu-le, nimeni nu scapă
Şi moare în cântec de jale.
De vină-s gropițele tale
Nu-i nimeni să ți le priceapă…

Şi eu, întâlnindu-te-n cale
Calc azi tot din groapă în groapă.
Colind străzi în noapte, agale
Cu genele pline de apă…

De vină-s gropițele tale.

30-Mai-1960, Bucureşti

4. PHILOSOPHICAL POETRY

TRANSDISCIPLINARITY is a new way of thinking that can be summarized as requiring a focus that is inquiry-driven rather than discipline-driven [4]. Its framework has the origin in the philosophy of Stefan Lupasco [5], and has been developed through a school of thought within CIRET [6] by Acad. Prof. Dr. Basarab Nicolescu in Paris and all over the world. The author is well-known as an accomplished theoretical physicist at the Centre National de la Recherche Scientifique (CNRS). It is important to distinguish carefully the transdisciplinarity approach from others which seem quite similar – such as the pluridisciplinary or the interdisciplinary approach – but which are actually, in both their means and their ends, radically different [7].
Comprehensive works in books and articles about the transdisciplinarity can be found from the site [8], namely the transdisciplinary evolution of the University.

TRANSDISCIPLINARITATE
Lui Basarab Nicolescu

Macro, micro-universul
Işi explică sieşi mersul
După legi mai generale
Multidimensionale.
Filozoful să se-ndrepte
Pe-un Real cu multe trepte

Care-s rupte între ele
Într-o groază de nivele…

Fals şi adevăr se-arată
Într-o singură găleată,
Unde pentru orişicine
Terțiul e inclus, vezi bine!

Logici noi, în parafrază
Frontiere traversează
Dar, mai mult ca înainte,
Umblă şi la cele sfinte.

În această abordare
Vin experți cu mic cu mare -
O modernă acuarelă
Sub o singură umbrelă.

Suntem mândri să rămînă
De heraldică română…
Cu-n cuvânt, le-avem pe toate:
Transdisciplinaritate!

14 Noembrie 2010, Las Vegas, NV

CEA MAI BUNĂ VESTE

Omenirea-i plină de mânie
La adresa relelor din lume
Infierând cu lacrimi sau cu glume
Un ocean de tragicomedie…

Unii plâng probleme rasiale
Că-i din veac prea multă nedreptate
Cât să le cuprinzi nici că se poate,
Că sunt mult prea multe haimanale…

Încă-s alții înjurând avortul
Dintre-acei care plătesc războaie.
Sar ca ipocrții la bătaie
Şi la urmă, vinovat e…mortul!

Cei mai mulți ne strigă azi în piețe
Că déjà ne-ndatorăm nepoții,
Care or s-ajungă sclavi cu toții
Pe la bănci mereu mai hrăpărețe.

Ne stropşim a nu ştiu câta oară
Că vecinul ia mai mult ca mine.
La ce bun te-ngrijorezi, creştine,
Pentru bruma ta de pensioară ?

Caută-L pe Domnul cât se poate,
Caută-L prin post şi rugăciune. –
Poate s-o-ntîmpla acea minune
Să te ierte astăzi de păcate.

Astfel, vei primi cu bucurie
De când lumea cea mai bună veste
În oceanul grijilor aceste;
Cu Iisus vei fi în vecinicie!

14 Noembrie 2010, Las Vegas, NV

5. LYRICS POETRY

From the high school years, when the direct access to the western music was a rare privilege, I found my way of singing beautiful songs whose lyrics I did not know, by writing my own Romanian lyrics for them. I continued to write this kind of lyrics for many years to come. The book [1] has an entire chapter, which brings together these lyrics under the title *Dedic un Cântec Tuturor!* Among them, an emotional connotation is tied to an original Italian song *Immensità,* written by M.Detto for the San-Remo festival in 1967 and interpreted there by Gigliola Cinquetti.

ATÂT DE SIGUR SÎNT

Sînt sigur că din orice strop de rouă,
Din orice strop, în zori de zi
O floare nouă va-nfori
Şi-n sânul ei un fluturaş va poposi!

Atât de sigur sînt
Că-n lumea asta cineva
Cu drag mă va purta în gând –
Nu mă va uita!

Da, e-adevărat!
Nu voi rămâne toată viața-nsingurat!
Voi strânge-n drumul meu
Puțină dragoste şi eu,
Aşa neînsemnat cum sînt
Pe acest pământ!

Da, desigur ştiu,
Că mâine încă n-o să fie prea târziu!
Să întâlnesc şi eu
O dragoste în drumul meu!
Ca fericit cu ea să fiu
De atunci, mereu!

4 Aprilie 2004, San Mateo, CA

The Romanian version I wrote for this beautiful song is the expression of the hope that those who are alone wait for the new love to come in their lives.

Finally, this is an attempt to make known beyond the Romania boundaries the powerful stream of friendship, as an effective weapon against fear and terror in a world that is increasingly obsessed by hate and ingratitude.

LET US SING TOGETHER!
(Alexandru Jula: Prietenia)

Let us sing together
For the beautiful dream
That builds up our team
For a better tomorrow!
This is always a song
Which unites us
In our joy and in our sorrow.

Let us sing together
The American dream
As a powerful stream
Sweeping all human error.
In a world full of love
Fight together
To demolish fear and terror!

R: Two friends are always
Taking care of one another
Just like a sister and a brother
Getting along!

Two friends are always
Beyond color, race and gender
Joyful, loving, kind and tender
All their life long!

11 November 2004, San Jose, CA

6. LIMERICURI

A **limerick** is a five-line poem in anapestic or amphibrachic meter with a strict rhyme scheme (aabba), which intends to be witty or humorous. It may have its roots in the 18th-century Maigue Poets of Ireland, although the form can be found in England in the early years of the century in literature, arts, science and many other human fields. The following example of a limerick is of unknown origin:

The limerick packs laughs anatomical
In a space that is quite economical,
But the good ones I've seen
So seldom are clean,
And the clean ones so seldom are comical.

Actuală

Orişicât ni-s de multe angoasele
Că trăim într-o lume de-a-ndoasele,
Fără griji şi nevoi
Se găsesc printre noi
Cei aleşi ca să tragă foloasele.

17 Octombrie 2010, Las Vegas, NV

Țigani

Nu poți ține cuiva o prelegere
Despre-un drept care-i azi la alegere:
Rromii noştri haihui
Chiar de-s ai nimănui,
Au permise de liberă trecere!

18 Octombrie 2010, Las Vegas, NV

Valută

Doar acesta-i talentul pigmeilor
Ca să cumpere grația zeilor
Cerşind din Olimp
Moneda de schimb
Care- aduce profit...fariseilor!

18 Octombrie 2010, Las Vegas, NV

REFERENCES:

[1] Leonte, D. I., *Amorfe si Cristaline,* Casa Cartii de Stiinta, Cluj-Napoca, 2006, 309 pages.
[2] x.x.xPROCEEDINGS ARA Congress XXXII, July 22-26, 2008, Wentworth Institute of Technology, Boston, MA, USA pp 337.
[3] *** Transdisciplinarity Theory and Practice – Edited by Basarab Nicolescu, (Advances in Systems Theory, complexity, and the human sciences) Hampton Press, Inc Cresskill, NJ 07676
[4] Alfonso Montuori Cybernetics and Human Knowing, 2005
[5] St. Lupasco, Romanian philosopher who developed Non-Aristotelian logic and defined the concept of "included tertium"
[6] CIRET stands for Centre Internationale de Recherche et Etudes Transdisciplinaires
[7] Basarab Nicolescu, Science, Meaning & Evolution – The Cosmology of Jacob Boehme, Parabola Books New York, 1991
[8] http://basarab.nicolescu.perso.sfr.fr/ciret/bulletin/b12/b12c8.htm

SUBCONCIOUS IN CONSCIENCE PYRAMID

Diana MICUŞA[1], Nicoleta TODOROI[2]
[1]ARA corr. member, AFCM, Chisinau, [2]"Gh. Dima" Music Academy, Cluj-Napoca,,
micusastil@micusastil.md, ntodoroi@yahoo.com

Abstract. Our conscious and subconscious minds have an evolutionary development. Conscience is ability or a faculty that distinguishes whether one's actions are right or wrong. It can lead to feelings of remorse when a human does things that go against his/her moral values, and to feelings of rectitude or integrity when actions conform to such norms. The subconscious mind is one of the most powerful parts of the human psyche and it has a hand in controlling every aspect of your mind. It is one that is living within your logic processes, and while it is not there for you to see in plain sight, do not be mistaken. Think of the subconscious mind as the storage room of everything that is currently not in your conscious mind; it stores all your previous life experiences, your belief system, your memories, your skills, all situations you've been through, and all images you've ever seen.

This essay is based on the communication „.Subconscious Mind evolution in Conscience Society" presented by Nicoleta Todoroi, Dumitru Todoroi and Catalin Creanga at The HUMBOLDT-KOLLEG "Knowledge, Culture, Science – the Fundament of Quality of Life in Society", Timişoara, November 23-28, 2010. It is discussing the Conscience pyramid of Conscience Society [1].

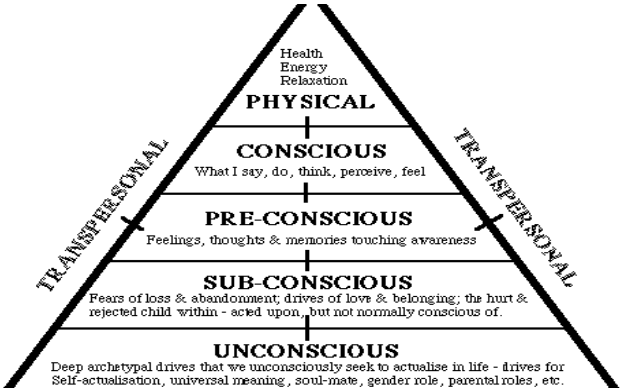
Keywords: Conscience, Subconscious, Subconscious Mind, Conscience models, Intent, Learning, Conscience Society.

Introduction

The extraordinary power of human information processing can be seen as a product of the third great thrust of neural development that Paul MacLean has called the "neomammalian brain" – culminating in the structure of the human neocortex. The quest for coherence in the world, the search for a pattern to sequential events, is a reflection upon a long series of evolutionary changes in brain organization and complexity. These changes have brought us to the point where we can study in others, and admire in ourselves, a level of thinking far beyond anything that can be achieved in even the closest of our nonhuman relatives.

The term **subconscious** (see next "conscience pyramid") is used in many different contexts and has no single or precise definition [2 - 6]. This greatly limits its significance as a meaning-bearing concept, and in consequence the word tends to be avoided in academic and scientific settings.

Sigmund Freud had explicitly condemned the word 'subconscious' as long ago as 1915: "We shall also be right in rejecting the term 'subconsciousness' as incorrect and misleading". In later publications his objections were made clear: "If someone talks of subconsciousness, I cannot tell whether he means the term topographically -- to indicate something lying in the mind beneath consciousness -- or qualitatively -- to indicate another consciousness, a subterranean one, as it were.



He is probably not clear about any of it. The only trustworthy antithesis is between conscious and unconscious."

In everyday speech and popular writing, however, the term 'subconscious' is very commonly encountered as a layman's replacement for the unconscious mind, which in Freud's opinion is a repository for socially unacceptable ideas, wishes or desires, traumatic memories, and painful emotions put out of mind by the mechanism of psychological repression. However, the contents do not necessarily have to be solely negative. In the psychoanalytic view, the unconscious is a force that can only be recognized by its effects — it expresses itself in the symptom. Unconscious thoughts are not directly accessible to ordinary introspection, but are supposed to be capable of being "tapped" and "interpreted" by special methods and techniques such as meditation, random

association, dream analysis, and verbal slips (commonly known as a Freudian slip), examined and conducted during psychoanalysis.

The unconscious mind [3] is a term coined by the 18th century German philosophy romantic philosopher Sir Christopher Riegel and later introduced into English by the poet and essayist Samuel Taylor Coleridge. The unconscious mind might be defined as that part of the mind which gives rise to a collection of mental phenomena that manifest in a person's mind but which the person is not aware of at the time of their occurrence. These phenomena include unconscious feelings, unconscious or automatic skills, unnoticed perceptions, unconscious thoughts, unconscious habits and automatic reactions, complexes, hidden phobias and concealed desires.

The unconscious mind can be seen as the source of night dreams and automatic thoughts (those that appear without apparent cause); the repository of memories that have been forgotten but that may nevertheless be accessible to consciousness at some later time; and the locus of implicit knowledge, i.e. all the things that we have learned so well that we do them without thinking. One familiar example of the operation of the unconscious is the phenomenon where one fails to immediately solve a given problem and then suddenly has a flash of insight that provides a solution maybe days later at some odd moment during the day.

1. What is Subconscious Mind?

Observers throughout history have argued that there are influences on consciousness from other parts of the mind. These observers differ in the use of related terms, including: unconsciousness as a personal habit; being unaware and intuition. Terms related to semi-consciousness include: awakening, implicit memory, subliminal messages, trances, hypnagogia, and hypnosis. Although sleep, sleep walking, dreaming, delirium and coma may signal the presence of unconscious processes, these processes are not the unconscious mind. Science is in its infancy in exploring the limits of consciousness.

The idea of the 'subconscious' as a powerful or potent agency [8] has allowed the term to become prominent in the New Age and self-help literature, in which investigating or controlling its supposed knowledge or power is seen as advantageous. In the New Age community, techniques such as autosuggestion and affirmations are believed to harness the power of the subconscious [3] to influence a person's life and real-world outcomes, even curing sickness.

One **example** often used to explain the subconscious mind is the process of car driving. Initially when you are learning to drive, you have full concentration on the gear, the clutch, etc. You are all concentration on the process of driving; you look at every pothole, every bump, and every obstacle. As you get trained on driving, the act goes into your subconscious mind and you tend to drive without making a conscious effort to drive. You automatically avoid the obstacles, you automatically change gears when required while you could be doing umpteen other things at the same time like talking to your wife sitting beside you, listening to the music and observing the countryside. As you practice driving again and again, you make decisions automatically and you drive naturally. Driving decisions and actions go out of the conscious mind to the subconscious mind. After you have reached the destination, if you ask yourself which potholes or bumps you crossed on the way, you may not remember as you did not even notice when you actually slowed down and possibly changed gear to cross the bump. You did all that without being conscious of it.

A**nother example.** You might know someone's phone number. This information is not stored in your conscious mind, but in your subconscious. If you think about it, you can produce the phone number, but it isn't simply floating around in your conscious mind. You need to direct your attention to memory in order to dredge up the phone number. Those memories you can recall easily are not conscious unless you pay attention and focus. When someone asks you to describe your perfect day, you reach into your subconscious mind for these memories.

Think of the subconscious mind [6] as the storage room of everything that is currently not in your conscious mind; it stores all your previous life experiences, your belief system, your memories, your skills, all situations you've been through, and all images you've ever seen.

2. The power of Subconscious Mind.

The subconscious mind is one that is living within your logic processes, and while it is not there for you to see in plain sight, do not be mistaken. It is one of the most powerful parts of the human psyche and it has a hand in controlling every aspect of your mind.

One thing you need to know is that we always underestimate the power of the subconscious mind and this is something that we need to stop doing. It is far more powerful that we take it for and we need to start learning how to use this to our advantage. What you need to first and foremost know about, is why it is there and how does it function as an entity living within the cortex of our brain.

The unconscious mind is considered as the storage room of everything that is presently not in your self-conscious mind; it stores all your previous lifetime experiences, your belief system, your memories, your skills, all positions you've been through, and all images you've ever seen.

3. What goes in our Subconscious Mind?

Based on whether our actions had positive or negative impact on us, we also made important judgements on do's and don'ts, things we should do and what we should not. We made our own judgements on where the life's potholes lie, what they look like, and what you do in life

to avoid them. The problem is that we started making these judgements very early in our life when we were small kids and did not have the capability to truly judge the situations. But based on our kid-brains, we did pass some important judgements about do's and don'ts in life. We accumulated some learning and created a knowledge base. We passed judgements about ourselves, about people around us, about what type of people are good and what type of people are bad.

All of us made conclusions about people based on their looks. Just because that person with long nose and grey eyes we met was bad, our kid brain concluded that all men with long nose and grey eyes are bad. So through our kid-eyes, we have actually identified the potholes on the path of our life. These potholes are mainly situations or conditions which our kid brain has directed us to either avoid, or to retract. Or they are people with some particular physical traits, etc. which we as kids have concluded to be 'bad guys' to be avoided.

If some of our illogical beliefs in the early childhood, purely by chance, got support by a similar experience, the judgement and the learning got reinforced. A great deal of these judgements and learning of our kid brain have actually gone into our subconscious mind by repeated re - inforcements before we could mature and analyse them with our mature conscious brain. Some of these rules may be completely illogical, but they have got so firmly set in our subconscious that now when we see a person we will automatically react in a particular way and won't even know that we reacted that way. So just as we drive the car while avoiding the potholes and slowing down for bumps without really noticing them with our conscious mind, we tread the life's path avoiding imaginary potholes, slowing down on bumps that we defined in our childhood without even realising that we do so, without realising why we do what we do. Just as while we drive a car our brain makes several hundred decisions every moment without our conscious mind knowing it, we make numerous decisions every second in our life and we obviously don't make them with the conscious mind. These decisions are based on the knowledge base built in our subconscious mind. Our behaviour therefore is not a voluntary behaviour but largely governed by involuntary actions. And we call ourselves highly balanced people acting on conscious decisions.

4. Our behaviour is driven by our Subconscious Mind.

We do certain things out of conscious mind, whereas most of our actions are dependent on the subconscious mind. They are like reflex action in some ways, but different in many ways. In case of reflex action, there is some action or disturbance in or around you, and before you know or you realise it, your body reacts to the disturbance. But immediately after the reflex action, you know how your body has reacted. However in case of subconscious behaviour, most often, our conscious mind is not even aware that we have reacted to certain sub conscious stimuli.

It is said that the conscious mind is logical, analytical. Subconscious mind is illogical. And since most of our behaviour is governed by the subconscious mind, you can imagine that will be the outcome.

5. How to discover the Subconscious?

We believe that what is in our subconscious mind is hidden in some remote corner under some self imposed cover which we prefer to keep under cover (since most of these are recordings of unpleasant experiences). The difficult part is to discover it hidden in our subconscious mind. Once discovered, it may be easy to remove it. Following exercise can sometimes help to discover and eradicate some unpleasant things from our subconscious mind which unconsciously influence our behaviour.

6. Subconscious Learning.

Subconscious learning almost certainly is probable [3, 9], and this has been backed up by many researches all over the world. What's more, subconscious education possibly will have an effect on our cognizant pronouncements - without any probability of us realizing it. Many researches from universities all over the Atlantic and North America have actually found that persons who had watched programmes and stimulation of a subliminal nature have found that they were able to learn better and pick up on the same, perceived patterns at a much faster rate than people who were not exposed to this before.

In fact, there has been some research into the whole subliminal learning when it comes to learning new languages. What has been seen is that when people listen to languages at a volume that is very soft, too soft for the person to actually hear properly but not too soft so that they can perceive it - have been found to not only learn the language much faster but also learn the syntax, pronunciations and the verbal skills.

These are some of the evidences that it is actually possible to learn subliminally, and this is just the tip of the ice berg when it comes to learning with the power of subliminal technology.

There are **three main aspects** that we want to look at when we are looking to unleash the **learning power** of the mind. For one thing, the mind is never turned off, even when we are in deep sleep, the preconscious aspect of the mind is much more aware and it is sensing the environment. This means that we are able to learn when we already asleep. Also, the brain's memory banks seem to be limitless, as there has been no scientific evidence or psychological evidence that we can actually forget things. The brain also does not overlap information, it actually neatly places and compartmentalises them into sections within the vast memory banks of the thalamus (arguably other parts of the lobe as well). When you combine these three things, you realize that there is a vast potential for learning far beyond what we are capable of.

Unlocking it means we need to be able to speak to the controlling agent of these three aspects, the subconscious mind and once we can address it directly and reprogramme it to learn at much higher levels, then we would have succeeded in unlocking the power of subliminal learning in our brain.

7. Reprogramming your Subconscious Mind for success.

Many people go through their lives without understanding why they make the same mistakes, follow the same patterns, and live in the same ruts. They aren't happy with their present situation, but they seem to be unable to make any lasting changes.

Perhaps you've attend seminars, read books, and taken courses, but, in the end, fallen back into the same dysfunctional patterns you've always followed! Why does it always turn out this way? We struggle to make permanent changes in our lives because we input information only into our conscious mind. Here's the problem: your conscious mind is not what directs your behavior and belief system.

To change your behavior [2, 3], you must first reprogram the hard-wired center of your mind: the subconscious mind. **Your subconscious learns behavior through repetition and practice**. Just as it learned to control your footsteps when you learned to walk, it also controls your footsteps in your life's journey based on what you've reinforced throughout your life. Just by reinforcing your new actions and thoughts, you will reprogram your subconscious mind!

There are several different techniques you can use to tap into the subconscious mind and reprogram how it works. Here are some strategies you can use to change your mind and change your life:

(1) **Affirmations.** Affirmations work to change your subconscious mind by using positive, personal, present tense statements to override the embedded negative thinking. By repeating these positive thoughts, you can create new pathways in your subconscious, giving it new attitudes.

Then your subconscious causes you to act in new ways that agree with these new attitudes. For **example**, repeating: "I choose healthy foods at each meal" can change your mindset about what you eat and why!

(2) **Visualization.** Visualization is the act of creating detailed mental pictures that depict a desired outcome so you can see success for yourself. These images stimulate the subconscious into accepting them as reality, which then directs behavior accordingly. Top athletes around the world use this technique during game-time.

(3) **Hypnosis.** Some types of therapy work with the subconscious mind, including hypnosis. Hypnosis works by easing you into a state of extreme relaxation. Once you're in this state, the conscious mind releases its grip, and the subconscious mind is easier to access. While under hypnosis, it's much easier to reprogram the subconscious into accepting new thoughts as reality.

(4) **Subliminal Audios**. You can use subliminal audios while you sleep. The conscious mind listens to music or someone speaking on one level, but the subconscious mind hears another layer of information recorded underneath the audible portion. When awake, the conscious mind is distracted with the audible portion of the audio, making it harder to tap into the subconscious mind.

Using techniques like these can help you reprogram your subconscious mind and remove the burden of the negative thoughts buried there. Imagine the freedom of living your life without the automatic dysfunctional behaviors you've had driving you for years!?

When you transform your negative outlook into a positive one, you can accomplish so much more. In doing so, your mind will be released from negative programming, allowing you to excel and succeed throughout your life.

8. The incredible power of intent.

Imagine two big spotlights. One is pointed upward, casting light far into the air. The other is pointed downward and buried into the earth - no light is cast at all. This is like intent. There are only two possible intentions in any given moment: the intent to learn about loving yourself and others, and the intent to protect against pain with some form of controlling behavior.

When you consciously choose the intent to learn, your light points upward, shining upon the truth that will guide you in your highest good [3]. Your mind opens and becomes a receiver of the information you need to support yourself in manifesting your dreams. Consciously choosing the intent to learn is the most powerful thing we can do. When we consciously choose the intent to learn, we open ourselves to our Higher Self - the part of us that connects us with the information and creativity in the universe.

When we unconsciously choose the intent to control, we shut off access to truth. Our mind closes and becomes like a closed circuit TV - recycling the old information that has been programmed into our mind. We become stuck in our limited mind, operating from the false beliefs that we learned as we were growing up. We become stuck in the past, recreating old hurts. The challenge here is that our unconscious automatic choice is to control.

When we were growing up, we all had to learn many ways to control to survive the challenges of childhood. We learned ways of trying to have control over how people feel about us and treat us, such as anger, blame, judgment, righteousness, or compliance. We learned ways to protect against losing ourselves to another's control, such as resisting or withdrawing. We learned many addictive ways of avoiding feeling our pain, such using food, drugs, alcohol, TV, Internet, sex, work, sports, gambling, shopping, self-judgment, and so on - all to have control over not feeling our painful feelings.

Most people immediately, and unconsciously, choose the intent to control the moment they feel any anxiety. The problem is that the intent to control is self-abandonment, always causing even more fear, anxiety or depression. Instead of shining the light of love upon your distress in order to learn and heal, you shove the light into the ground, causing more darkness.

Choosing your intent is the essence of free will, and it determines what you feel and what you manifest. While you might have momentary pleasure when something good happens, the deep joy and wellbeing that we all seek, and the ability to manifest your dreams, is the result of your intent to learn about loving yourself and others. The challenge in our lives is to remember that we are at choice - to remember to choose the intent to learn.

How can you remember to consciously choose the intent to learn? How can you remember the moment you feel any fear, anxiety, or any stress, to open to learning about what you are thinking or doing that is creating this stress? What can you do to stop your automatic reactive controlling behavior?

First of all, you need to accept that this is a lifetime practice - not something that will occur quickly [3, 9]. We have all been practicing the intent to control for most of our lives, so it will take much practice to even remember that there is another choice.

The place to start is to practice noticing your feelings throughout a day. Perhaps wearing a rubber band that you can snap on your wrist will remind you to check inside to see how you are feeling. You cannot begin to learn about your thoughts and actions that are causing your feelings until you are aware of your painful feelings. You cannot stop your addictive anesthetics until you are willing to feel your feelings and take responsibility for them.

If you decide that you are willing to feel your feelings, that willingness will lead you to becoming more and more conscious of your feelings. This is the beginning of being able to consciously choose your intent to learn.

9. Are Your beliefs holding You back?

Many people either tried to give up smoking or did all they could to lose weight, but in the long term were unsuccessful. Why is that? It is because their unconscious beliefs stood in their way?

Let's say you wanted to lose weight, you got excited, probably joined a gym or started going out for long walks or jogging. Perhaps you even made a decision to eat less fattening foods and more fruits and vegetables. Off you started with the 'new you'.

What happened a few days or a couple of weeks later? You went back to your old eating habits and your exercise regimen was added to the 'excuse jar'.

Again, we ask why is that? It's because your limiting beliefs stopped you from doing what you wanted. The limiting beliefs are by far more powerful than your wants and more powerful, in most cases, that your willpower. Limiting, self sabotaging beliefs reside in the unconscious mind. This 3 pound unconscious mind runs our lives - from our breathing, to our heart beat, to healing and much, much more. Approximately 90% to 95% of our lives are run by our unconscious mind.

Since our beliefs live within the unconscious mind, they, too, run our lives. The majority of your beliefs were formed when you were younger. You were initially programmed by your parents, teachers, friends, ministers, and more. As you grew older, your beliefs were formed from the media, people at work, your bosses, and so on.

You may be aware of some beliefs, but there are some you have no idea about, and do not even know they exist. They are buried deep within your unconscious mind.

Back to the example, if you are trying to lose weight and you have beliefs that skinny people look ugly, nothing but skin and bones, your unconscious mind will stick to those beliefs and will not 'allow' you to lose weight. It does not want you to look ugly and be nothing but skin and bones.

So, what do you do? You work on changing those sabotaging beliefs. You change them or eliminate them and then implant the beliefs that you do want.

How? Start off with one to three affirmations and say them to yourself as many times as you can throughout the day. Affirmations such as: "I give myself rewards for losing weight" or "I am determined to lose weight", or "I love and improve my body", or "I control my appetite", or "I eat right and exercise smart". Repeating your chosen statements often installs in your unconscious mind your intention and commitment to lose weight. In time, your limiting beliefs will have no power and you will have the new, enhancing beliefs. Be committed and be patient.

10. The Subconscious contains our unused potentials and our blockages

The subconscious contains within it our unused potentials, as well as the personal blockages that keep us stuck in the various problem areas of our life. The word shadow is a Jungian term and refers to those parts of us that are unconscious. Being unconscious, we do not see them (problems), but we often see their effects in our life, that is we don’t see what causes the shadow, but we see the effect.

Each of us has both a light and dark shadow, and each need to be examined so that energy captured there can be released.

10.1. Dark shadow: That which is holding us back. Repressed emotions, grief, hurts, inner wounds; all these are part of our dark shadow.

So are dysfunctional beliefs. For example, a belief such as, “If there is a flu around I’ll catch it!” which, as you now understand, would attract the flu to you, could be called part of our dark shadow, especially if we are unaware of how this belief operates in our life.

Any part of us that makes us unbalanced and that we

are unaware of can be called part of our dark shadow. The dark shadow is that part of us which is self-defeating, holding us back, often absorbing vast amounts of energy, leaving us feeling depleted, anxious, frustrated, and at the mercy of forces that we ourselves have set in motion.

The Mind Power student is keenly interested in both his light and dark shadows. He understands better than anyone what it means to ignore these shadow parts of his being. What is in our dark shadow is limiting us, so we do the inner work necessary to reveal these parts to us. Once revealed, we can design strategies to change those aspects of ourselves which are holding us back.

Now there is also the collective unconscious, which does not develop but is inherited. It consists of pre-existent forms, the archetypes.

The collective unconscious contains both dark and light shadows, and as such they are common to all of us. They reside as archetypal messages resonating in the human unconscious matrix and so find their way into all of us. One such dark shadow archetypal message is the belief, "I'm not good enough." This can be held as a general belief, "I'm not a good enough person" or something more specific, "I'm not a good parent / spouse/ artist/ mediator/ entrepreneur/ teacher, etc". When you find yourself thinking this, which you sometimes will, you can counteract the thought by first suspecting that it does not belong to you but rather to the collective. This works to make it non-personal, giving you the opportunity of nullifying it. It is our duty to overcome and heal the wound of "I'm not good enough" upon every occasion that it arises. By doing so we help not just ourselves but also the collective. We are helping our species when we refuse to accept shame.

Paradoxically, the act of eliminating shame is easier when we do it for the sake of others than when we do it just for ourselves. Doing this is not a selfish act; it is heroic. Shame is the original sin. What is not claimed and owned by the inner will manifest in the outer. The dark shadow must be faced and addressed or it will cause all kinds of problems in your life.

10.2. Light Shadow: Our potentials and those parts of us that have not been explored and brought to fruition in our lives. Special gifts and talents that lie underdeveloped, our art, our hidden desires, our unused and unexplored abilities, all these form part of our light shadow. Because we are a fragment, a holographic piece of the overall design of the universe [2, 3, 9], everything that is possible and good and excellent is potentially part of our light shadow.

While theoretically true, practically speaking, some things are more available to us than others. Not all the talents and gifts within the universe are ours to use, at least not in this particular lifetime. Some are more difficult to access, while others are waiting just below the surface, like a seed in a dried out river bed awaiting the rains to sprout and grow. Our light shadow can be discovered by following our bliss, our natural talents, our joys, our **creativity**. Trust what turns you on the most and follow it wherever it leads you.

The emergence of both light and dark shadow is always a positive event in our lives. It shows we are connected and in touch with the hidden parts of ourselves. When we awaken to these possibilities of transformation within ourselves, almost anything becomes possible.

Conclusions

How to come into relationship with your subconscious?

You come into relationship with your subconscious by desiring contact. You educate the conscious mind to the existence of the subconscious's functions and potential through daily mediations [3]. Until you are aware of its existence, and not just in an intellectual way, you cannot work with the subconscious effectively:

(1) Contemplate daily the existence of this second mind;

(2) Think about the fact that the subconscious is part of the etheric web of all reality;

(3) Think about the potentials of imprinting into it, how it works;

(4) Affirm to yourself daily, "My subconscious mind is my partner in success." This is a very powerful affirmation and has a threefold effect. First, by affirming "my subconscious mind," you are educating the conscious mind to the existence of this second mind. Secondly, by affirming "my partner," you are reminding the conscious mind of the possibilities and advantages of working with the subconscious. And thirdly, it is your partner "in success." By affirming this you are building up a success vibration [9]; you are weaving success into your etheric matrix. Make this a regular affirmation.

Dialogue with your subconscious.

Praise it and let it know how appreciative you are of its power and ability to create and interact with the etheric web:

(1) Tell it what you want to create and what imprints you are presently working with;

(2) Let it know that you are working diligently to have a functioning relationship established;

(3) Get to know this part of yourself as a separate and neglected component that is being welcomed back into the human matrix.

By doing all of the above you will find that you will enter into "relationship" with your subconscious, and when you do, a whole new level of working with it reveals itself to you.

References

[1] Nicoleta TODOROI, Dumitru TODOROI, Cătălin CREANGA. Subconscious Mind evolution in Conscience Society. // Int. HUMBOLDT-KOLLEG "Knowledge, Culture, Science – the Fundament of

Quality of Life in Society", Timişoara, November 23-28, 2010 (To be published)
[2]http://www.learnmindpower.com/articles/subconsciou s-contains-our-unused-potentials-and-ou/
[3] Kenneth S. Cohen. The Way of Qigong. The Art and Science of Chinese Energy Healing. // Ballantine Books, New York, 1997, 428 pages.
[4] Dumitru Todoroi. Muzica de la conştient la subconştient. / Proc. of the International Conference "Competitivitatea şi inovarea în economia cunoaşterii", Vol.II, Ed. ASEM, 2009, Chisinau, p.27-31
[5] http://en.wikipedia.org/wiki/Subconscious
[6]http://www.2knowmyself.com/Subconscious_mind
[7] http://en.wikipedia.org/wiki/Unconscious_mind
[8] David G. Myers, Social Psychology,, McGraw Hill, 1993,p.101-110http://books.google.com/ books?id= hrydA45e Ck0C&q= social+psychology&dq= social+ psychology&pgis=1
[9] Radu Mihalcea, Ion Gh Rosca, Dumitru Todoroi. Sisteme informatice in Societatea Conştiinţei. // Analele ASEM, Editia a VIII-a, Editura ASEM, 2010, p. 341 – 360.

LINGUISTICS, LITERATURE, MUSIC, FINE ARTS

LINGVISTICĂ, LITERATURĂ, MUZICĂ, ARTE FRUMOASE

A MODERN APPROACH OF SHAKESPEARE

Viorica BANCIU, Valentin MORGOVAN
The University of Oradea, e-mail:banciu_vio@hotmail.com, valentinmorgovan@yahoo.com

Abstract: This paper is an overview of how Shakespeare is perceived today. Over time opinions regarding the playwright have changed, depending on several factors. Among these may also be listed the following: the country's political situation, the nation to which the writer belongs, the interest which the public has for a writer, the actuality of his writings, how the ideas promoted by the writer in his work the influence those who read the book.

When talking about Shakespeare one can notice that the opinions issued by both, critics and ordinary readers, were likely spread throughout the entire spectrum of opinions, from positive, that is admiration for his work, taking some patterns and behaviors as models, citing various passages significant to highlight a particular case, comparing people in everyday life with famous characters from Shakespeare's works, be they positive or negative, to negative- that is disregarding the value of the writer or/and his work, denying the contribution that the author has in the general literature and by the vehement attacks against him and his work. In Shakespeare's case, views are either very laudatory or very declamatory. The English playwright is considered either the greatest writer of all times, or people came to challenge the paternity of his published works.

Many characters in the political life came to suffer one way or another the Shakespearean reputation. In an article published by Marjorie Garber, concerning the work of Shakespeare's, the English playwright's influence is apparent in everyday life: the premise of this approach is simple-Shakespeare influences modern culture and modern culture is influencing Shakespeare. Characters such as Romeo and Lady Macbeth have become cultural types are recognized immediately when their names are mentioned. In the modern version, *Romeo is a persistent romantic and a philanderer, not a lover to the death, Hamlet is an excessive undecided thinker, a Lady Macbeth is a politician who will stop at nothing to achieve her goals. [Cushman, Robert,* ***Book Review****:* ***Shakespeare and Modern Culture*** *by* ***Marjorie Garber*** *.... Available at network.nationalpost.com/.../****book-review-shakespeare-and-modern-culture****- by-****marjorie-garber****.aspx – Canada. Accessed: 2011-03-10]*

Key words: perception, actuality, point of view, influences.

Referring to Romeo, Marjorie Garber says that it is difficult for him to be confined to just a girl-friend. The name Shakespearean character's appears in the song of Petula Clark having the same name, whose lyrics begin with *I studied Shakespeare when I was at school* and ends with *are you mine or just only my Romeo*? [Elsner, Alan: Book review: Marjorie B. Garber's *Shakespeare and Modern Culture*. Available at www.curledup.com/shakcult.htm. Accessed 2011-01.25] Another related interpretation of Romeo's name is that it has come to signify the younger generation's revolt against social intolerance and family. The *Merchant of Venice* is a signal towards the contemplation of anti-Semitism, while *Othello* and *The Tempest* highlight the idea of racism. Marjorie Garber refers to other parts of the English playwright, giving also some funny examples: *the play Henry V can be used as a textbook for teaching management skills, leadership and decision making. The drama Richard III is a propaganda exercise*. [Dacayanan, Jordan: Book review: Marjorie B. Garber's *Shakespeare and Modern Culture*. Available at astore.amazon.com/mrwillshakand-20/detail/0307377679. Accessed 2011-01-25] Many of the ideas and concepts promoted by Shakespeare came to be regarded today as generally valid truths, which are used when referring to *human nature, individuality, uniqueness, self-interest, government, leadership, love and jealousy, men and women, youth and age* [Elsner, Alan., Dacayanan, Jordan: Mr.

Shakespeare's Store - **Shakespeare** and **Modern Culture**. Available at astore.amazon. com/ mrwillshakand-20/detail/0307377679. Accessed 2011-02-12].

It is a known fact that these ideas, which Shakespeare also advocated, were not encountered for the first time in the realm of literature, they being therefore, not an attribute of literature, or theater. Many other fields such as psychology, sociology, political theory, management, medicine and law have endorsed these ideas, seeing Shakespeare as the founder, the author and the forerunner of many important categories and practices in their fields. The writer Marjorie Garber, internationally recognized as an authority on what regards Shakespeare, mentioned these things too. She continues these ideas, but gives other examples, as well. Thus, she informs us that many case studies based on Shakespearean characters and events are an important part of education and institutions of management theory and business schools and in the history of psychoanalysis. It comes as a logical and visible idea that Shakespeare has influenced modern culture, and that it returns the favor done. The word *Shakespearean* has today a new set of connotations, often different from the references made about Shakespeare or his plays. These ideas, to be paid their full magnitude, have been incorporated in cinematographic performances in films that have used different Shakespearean themes, but adapting them to the requirements of the time. Also in the book this writer, one can find other examples of ways to use the English playwright's work, or even of the name Shakespeare. In a drawing by Bruce Eric Kaplan in the newspaper The New Yorker, we see a man and a woman walking down the street, being possibly headed for a theater or cinema. You can read the following dialogue: *I do not mind being something Shakespearean, as long as it is not Shakespeare* [Elsner, Alan: Book review: Marjorie B. Garber's *Shakespeare and Modern Culture*. Available at www.curledup.com/shakcult.htm. Accessed 2011-01.25]. The meaning of the word, the adjective Shakespearean is that of great, tragic or resonant. This adjective can be applied to all, events and people and emotions, whether directly or not in connection to Shakespeare. Journalists describe lately the fall from grace of a public leader as a major drop of *Shakespearean proportions*, an American military leader was talking about *self-imposed tragedy, of Shakespearean length and proportions*, the last episode, The Sopranos was a *huge bloodbath of Shakespearean magnitude*. Other U.S. figures are marked by their moral verticality of Shakespearean greatness. Speaking about the interaction between Shakespeare and politicians, about how the name of the English playwright can put to advantage or disadvantage those who use it, in an article published by Professor Todd Landon Barnes, PhD in rhetoric, we can see the connection between Shakespeare and U.S. President George Bush. In an interview which the President gave to MSNBC, moderated by Brian Williams in 2006, Bush states that he was in Crawford and he wanted to read something. His wife Laura suggested that and he try Camus. President Bush also stated that *I also read three Shakespeare* [Landon Barnes, Todd: George W. Bush's "Three Shakespeares": Macbeth, Macbush, and the Theater of War. Available at muse.jhu.edu/journals/ shakespeare_bulletin. Accessed 2011-02-20]. According to Kenneth T. Walsh of U.S. News and World Report (News from America and the world), one of Bush's Shakespeares is Macbeth. This is not the first interaction between Bush and Shakespeare. As of September 11 several representations took place, which have made the connection between the British playwright and the U.S. administration. We have noticed those representations symbolically called Macbush, whose main purpose is the pointing out the Bush administration's shortcomings, by implementing parallel with Shakespeare's. Thus, Professor Todd Landon Barnes lists a few of the highlights when the two important names, Macbeth and Bush, have come into contact with each other. The first event of this kind took place in 2003 when the play Michael Hettinger's The Tragedy of Macbush was held at the Alice Arts Theater in Oakland, California. In this play, Macbush is forced to confront a king in the Middle East, called Ranquo. Another example is Harold Bloom's satirical play called *Macbush, The Tragicomic History of Dubya the Great, King of America and Later Emperor of Oceania*. In this play, we can see the transition from the American plutocracy to the Oceanic Empire, *a transition that lasted twenty years after the date set by the Prophet Orwellius* [Landon Barnes, Todd: George W. Bush's "Three Shakespeares": Macbeth, Macbush, and the Theater of War. Available at muse.jhu.edu/journals/shakespeare_bulletin.
Accessed 2011-02-20]. Characters such as Richard, Duke of Helliburton, and Lady Leeza of Stanford appear here.

Shakespeare, The Movie, which appeared in 1997, was the beginning of these film productions, adaptations of such works of the English playwright. Since then, such films have appeared in a consistent manner. Richard Burt, in his book *Shakespeare the Movie II: Popularizing the Plays on Film, TV, Video and DVD*, makes an approach of the manner in which the modern media have managed to provide to the public the various facets of the English playwright's characters and of the plays, facets adapted to today requirements. At the beginning of his book, the

author reviews the main cinematographic productions which have been adapted from the works of Shakespeare. After the film production *Shakespeare, The Movie*, mentioned above, director Klaus Knoesel's German adaptation, Rave Macbeth, appeared in the 2001. It was the first movie that has used the new Sony progressive scanning digital cameras. Kristian Levring's film *The King Is Alive* was also among the first production recorded entirely on digital video film. Michael Almereyda's 2001 production *Hamlet*, includes extended film sections recorded by digital cameras. After the occurrence of these films on the big screen, they can now be enjoyed both on DVD and video equipment and computers.

In Almereyda's film, Hamlet and Ophelia represent the *postmodern crisis of communication and expression, confronting the perennial void of imagination in the act of its proliferation in the daily life.* [Starks, Lisa S., Laehmann, Courtney: *The Reel Shakespeare: Alternative Cinema and Theory* Fairleigh Dickinson University Press, Madison, NJ , ISBN 0-8386-3939-9 2002, p.14]

Among other adaptations of Shakespeare's plays one can account *Shakespeare in Love*, by John Madden, Baz Luhrmann's Romeo + Juliet and the earlier production *The Throne of Blood* by Japanese director Akira Kurosawa. This drama is an adaptation of Macbeth. The action takes place in feudal Japan in the city of Tokyo. The main role in this film is held by Toshiro Mifune. He plays the part of lord Taketori Washizu, the samurai equivalent of Macbeth. It is interesting to note that such a role was not attributed to anyone, Toshiro Mifune having been declared as the most representative actor of Japan, and Akira Kurosawa as one of the most influential and important directors in the world. *The Taming of the Shrew* play became the subject of a well-known screening, namely comedy *Ten Things I Hate About You*, by director Gil Junger. The subject is adapted to our life today.

Shakespeare still holds the status of the most revered, most celebrated and discussed the author in English, and indeed in the literature of the world [Grady, Hugh: *The Modernist Shakespeare: Critical Texts in a Material World* , Clarendon Press, ISBN 0-19-818322-4 Oxford.1994, p.3]. People have issued a lot more opinions about Shakespeare than about any other author. Of course, these opinions vary, covering the entire critical spectrum, from positive to negative. Thus, Shakespeare was regarded as *the culmination or the high point of the artistic fullness, and the elevated culture itself; he was also celebrated as a practitioner of the vital popular culture against a decadent aristocratic court* [Grady, Hugh: *The Modernist Shakespeare: Critical Texts in a Material World* , Clarendon Press, ISBN 0-19-818322-4 Oxford.1994, p.3]. The above mentioned author further expresses other points of view which are very laudatory, in which regards Shakespeare. According to critics, the English playwright was seen as representative of the completeness of forms and roles of his time, as the main spokesman for Tudor orthodoxy; at the same time he was seen as destroying and undermining that orthodoxy. He was also acclaimed as the voice of Christian Europe to its highest eloquence, and a feather of a *corrosive skepticism that announced the beginning of the early post-Christian modernity*.[Grady, Hugh: *The Modernist Shakespeare: Critical Texts in a Material World* , Clarendon Press, ISBN 0-19-818322-4 Oxford.1994, p.3]

The Iinterpretations of Shakespeare's work and the various opinions regarding him are constantly adapting and transforming, according to the time when those who are interested in playwright's work live. We have thus the views of his contemporaries, reaching in time to our contemporaries, from a modern Shakespeare, a postmodern, a deconstructed one, etc. Hugh Grady, in his book *The Modernist Shakespeare: Critical Texts in a Material World*, summarizes what the critics say about deconstruction as it concerns Shakespeare. Thus, deconstruction is difficult to define. On the one hand there is a dominant influence operating at levels such as the new textual critic and new editions of his work, new theater productions, and a significant redefinition in the disciplinary reduction of critical production. Thus, it can be recognized as plausible the claim that deconstruction represents *the major conduct of postmodern sensibility in studies on Renaissance* [Grady, Hugh: *The Modernist Shakespeare: Critical Texts in a Material World* , Clarendon Press, ISBN 0-19-818322-4 Oxford.1994, p.214]. Because Derrida has focused his attention particularly on the texts and philosophical issues, deconstruction studies on Shakespeare are among the most prominent as belonging to neither deconstruction, in general, nor to contemporary Shakespearean criticism. In the same work we find that, in the case of studies on Shakespeare, deconstruction tactics were combined with historicizing strategies.

In the book *Shakespeare and the Question of Theory*, edited by Patricia Parker and Geoffrey Hartman in consecutive editions from 1990 to 1993, textual deconstruction methods can be found in Section 1, entitled *Language, Rhetoric and Deconstruction*. Four examples of textual deconstructive approach can be seen here. As Hugh Grady notices, when addressing this topic in his book, The Modernist Shakespeare, these models are rather deconstructive theory, exemplifying how the

methodology might work, rather than offering *a critical practice with a sense of its own achievement* [Grady, Hugh: *The Modernist Shakespeare: Critical Texts in a Material World* , Clarendon Press, ISBN 0-19-818322-4 Oxford.1994, p.215]. Howard Felperin, the author of important books on Shakespeare, is the first mentioned here, as showing some basic principles of deconstruction practice, practice that leads to a redefinition of the literary language. He approaches these issues of language deconstruction in his work *Tongue-Tied our queen?: The Deconstruction of Presence in The Winter's Tale*. The second author of this introductory chapter is Elizabeth Freund's with the work the work *Ariachne's Broken Woof: the rhetoric of the citation in Troilus and Cressida*. The author presents a literary history of Renaissance in the style of Bloom, using the play *Troilus and Cressida* as *an instance of anxiety influence* [Grady, Hugh: *The Modernist Shakespeare: Critical Texts in a Material World* , Clarendon Press, ISBN 0-19-818322-4 Oxford.1994, p.215] in Shakespeare. The third place in this chapter is dedicated to Geoffrey Hartman in his work *Shakespeare's poetical character in Twelfth Night*. He shows that the language should be seen as being ahead of the character in the Shakespearean drama, concluding with the remark that *there is no present, no absolute gift, or moment of pure existence* [15. Grady, Hugh: *The Modernist Shakespeare: Critical Texts in a Material World* , Clarendon Press, ISBN 0-19-818322-4 Oxford.1994, p.215]. The fourth author of this chapter is Patricia Parker with the work *Shakespeare and the rhetoric: dilatation and delatation in Othello*. Parker suggests the renewing of the interest in post-structuralism in the rhetoric of Renaissance, giving as example the enigma in Othello. It is sought through deconstruction approaches the further search and the highlighting of other aspects of the works, issues that were either not considered important, or were addressed insubstantially. Also, as a consequence of the deconstruction approach, the strengths of the works are analyzed thoroughly and often, demystified and disqualified. New aspects are discovered, new topics of debate, new approaches. Still addressing Hugh Grady's book, we see that the author makes an overview of some of the best known deconstructionists who turned their attention to Shakespeare's work. The first author approached by Grady is Howard Felperin, author of popular works and articles with deconstruction topics, in the article *Tongue-Tied Our Queen?: The Deconstruction of Presence in The Winter's Tale*. According to Hugh Grady, this article is a demonstration of how the Shakespearean text should be seen as deconstructing itself from the inside. Thus, he gives the example Felperin's, who, approaching a play by Derrida with a vague interpretation, gives it as an example to prove the innocence of Hermione. And further quoting Felperin, Grady outlines his opinion according to which Shakespeare leaves the presentation of the oracle as an action extra-scenic action, not as in the case of theophanies created in Pericles and Cymbeline. The effect of all these is the lack of confirmation of the authority of the oracle. The result is the interpretative dimness in the absence of divinity, the play becoming its own regulation of the deconstruction theme mise-en-Abime.

What makes an author be read and appreciated long after he is gone? What makes an author be topical even when the times are different from the moment when he conceived his work? What makes an author, and therefore his work, to have value? The answers to these questions pertain primarily to address the internal structure of the one reading the writer's work.

THE DISCOURSE OF NEWS

Angela JIREGHIE
Universitatea de Vest ”Vasile Goldis” Arad

Abstract. In this paper, I deal with the discourse of news. In the first part , I show what researches found out regarding

a) media language should be divided in three main areas: genres , outlets and outputs (Bell)
b) news reports could be divided into three classes: the first class of news factors relates to the content of the news, the nature of its; events and actors and contains: negativity, regency, frequency, proximity, un-ambiguity, relevance, personalization, attribution, facticity; politics, fashion, sport, cookery, accidents, dancing and music are cultural forms available for building of fame and celebrity at television program.

In the second part, I analyze how celebrity coverage relates to some crucial areas of news.

Keywords**:** news, discourse, value,, genre, celebrity

The Discourse of News
Introduction

Types of News

Bell in his book The language of News Media considers that decisions on collecting a corpus of media language are needed in three main areas: genres (they contain particular kind of media content like news, game shows etc), outlets (they refer to television channels) and outputs (they refer to the products of media outlets and to the time period to be covered). He divides the genre of press news into four categories:

“hard news “(its core is spot news: reports of accidents, conflicts, crimes and other events; another category of hard news covers politics or diplomacy: news of elections, government announcements, international negotiations, party politics.),

“spot news “(one-off, unscheduled events like fires and disasters),

“soft news” (reports that include liberty of style),

“special topic news e.g.: sports, racing etc, headlines, crossheads or subheadings, by lines, photo captions”[1] (Allan ,Bell, The language of news media,ISBNo-631-16434-0, Blackwell and Cambridge, 1991,p.117-28)

“spot news” , headlines or certain topics like industrial, economic or international news are seen by researchers as subgenres .

News values

In media, journalists write articles and they are stories. Stories are embedded in all sorts of language use, from face to face conversation to public address. Bell makes a comparison between a fairy tale and a news story. The fairy tale starts with “Once upon a time…”, but the news story starts with “Fifteen people were injured today when a bus plunged…” .[2] (Allan ,Bell, The language of news media,ISBNo-631-16434-0, Blackwell and Cambridge, 1991,p.147) and persuades us that there are links between stories and fairy tales as this is reflected in snatches of phrases. In television, staple news consists of a number of short items of hard news, gathered into a bulletin usually of three or five minutes long. Many stations broadcast news programmes, between fifteen and two hours long, combine short news items with interviews and other material. **O**ne landmark in British studies of news has been the work from the 1970’s onwards, of the Glasgow University Media Group (G.U.M.G) among the first to argue an ideological influence for how news is constructed. Much has changed in the news landscape since the 1970s, when the B.B.C and I.T.N news programmes claimed enormous authority for themselves, since they were flagship programmes for the two main UK broadcasting stations. News programmes are still able to set the agenda (an agenda is a list of terms to be discussed at a meeting usually drawn up by the person chairing the meeting who has the power to arrange them in order of importance) of issues which we find ourselves thinking about, selecting some information for consideration and leaving some unexplored or unannounced. News is steel often able to set the agenda for giving the green light to current affairs and investigative documentary teams. The values of news drive the way in which news is presented and the factors established by Galtung and Ruge [3](J.Galtung, M. Holmboe ,Ruge,” The Structure of Foreign News”, Journal of Peace Research, vol. 2, 1965, p. 64-91; online edition (JSTOR access required),and Bell [4](Allan ,Bell, The language of news media,ISBNo-631-16434-0, Blackwell and

Cambridge, 1991) may make up them. Bell discussed about news values and divided news factors into three classes: the first relates to the content of the news, the nature of its events and actors; the second relates to the news process; the third relates to the quality of the news text.[5] (Allan ,Bell, The language of news media,ISBNo-631-16434-0, Blackwell and Cambridge, 1991,p.156). Factors that cover the nature of the events and actors in the news are established by Bell[6] (Allan ,Bell, The language of news media,ISBNo-631-16434-0, Blackwell and Cambridge, 1991) and they are the dimensions on which a story can be judged. Analysts decided that news reports could be divided into three classes: the first class of news factors relates to the content of the news, the nature of its ; events and actors and contains: negativity, regency, frequency, proximity, un-ambiguity, relevance, personalization, attribution, facticity.[7] (Allan ,Bell, The language of news media,ISBNo-631-16434-0, Blackwell and Cambridge, 1991,p.156) Negativity (It is what comes to people's minds as the basic news value.) Conflict between people, political parties or nations is a staple of news. Generally, news tends to take the normal or everyday for granted. It is driven to make stories out of the deviant crime, dissidence, disaster. In turn, news processes often augment the scapegoat of "out" groups, because of the ways it feeds on the thrill of their deviancy all those masked or digitally indistinct faces, for example, it may shape news coverage of "Third World" issues in terms of "coups, crisis and famine", now joined by "terrorism", "evil", or "ancient hatreds" as explanation of complex processes such as the Israeli Arab conflict. [8](Teun, Van Dijk , News as Discourse, ISBN 0-8058-0828-0 1, Hillsdale, NJ: Lawrence Erlbaum,1988.p.123) Regency (it is related to how well a story confirms with news work cycles; it is used by Bell (1983) and "means that the best news is something which has only just happened"[9]( ] (Allan ,Bell, The language of news media,ISBNo-631-16434-0, Blackwell and Cambridge, 1991,p.156) **I**t is about those events which occur into a twenty hour span are to be reported: the verdict or the murder is more newsworthy than the trial or respectively, police investigation. Frequency or the time scale of events perceived as "newsworthy": it is about those events within news stories which will be of about the same frequency as many news bulletins. They give the example of about a daily span. An oil spillage will be perceived as a new story. The slow work over time of legislation or protest which makes it less or more likely to occur will not feature as news. [10](Johan,Galtung, Eric, Ruge, ,1981,'Structuring and Selecting News'. In: The Manufacture of News: Social Problems, Deviance and the Mass MediaCohen, Stanley & Jock Young (Eds.), p 62-72, Constable, ISBN0094637806 0094637903 (pbk.),London: Constable,1981, p. 64) Proximity means that geographical closeness can enhance news value. The consonance of a story is defined as its compatibility with preconceptions about the social group or nation from which the news actors come. For example, the carnival comes to town is considered news only in the town it comes to. Unambiguity (it indicates that the "facts" are clear and the uses of if's, but's and maybe's are minimal) Relevance is the effect on the audience's own lives or closeness to their experience. [11](Van Dijk, Teun, ,Discourse as Structure and Process (Discourse Studies: A Multidisciplinary introduction), Sage ,ISBN 0-8039-7847-2,London, 1997, p.122) The second class of news factors is made up of actors that cover the news process and contains: continuity, co-option. Continuity If an event is defined by the powerful news companies as big enough, resources will be diverted to it for some time, and often even "non events" which seem part of that story will be covered. "The driver of the car in which Diana, Princess of Wales was killed has still not regained consciousness. Of course, this takes resources away from other areas where crucial events might be happening".[12]( ](G, Branston,R, Stafford, The Multimedia Student's Book, fourth edition ISBN 978-0415371438, Rottledge ,London and New York:, 2006. p. 140) Co-option (it means that a story which is only tangentially related can be interpreted and presented in terms of a high- profile continuing story). The third class cover the quality of the news text and consists of narrativisation, visual imperatives Narrativisation is the term that starts from items called "stories" and they are shaped into narrative form as soon as possible. "War and now "terrorism" coverage draws on an existing repertoire from Second World War narratives, the last "good" modern war.Themes such as "War is hell but it makes heroes", "The women wait while the men fight", and events like "11 September", 'London post 7 July 2005, the rhetoric of this "good war" against Hitler was revived via references to the London blitz', which quickly became the narrative of the London 2005 bombings. The "rescue" of Private Jessica Lynch was a highly embellished incident but one which audience research showed was the second most recalled incident of the 2003 invasion of Iraq.

Visual imperatives drive towards stories that have "strong" pictures, whether of celebrities "biblical- looking" famines or of scenes which resemble a blockbuster film, as in people fleeing from the explosions at the World Trade Center, 2001 or the 2004 tsunami. Visual imperatives are especially in television news as it uses computer-aided graphics to assist visualization. '[13]( ](G, Branston,R, Stafford, The Multimedia Student's Book, fourth edition ISBN 978-0415371438, Rottledge ,London and New York:, 2006. p. 142)

News can and should be as adequate and informative as possible for particular purposes. Revelations in the U K about "fakery" in television documentaries and the hiring of actors to pose as guests on talk shows rightly produced strong reactions in the late 1990s. An important breach of ethical standards of those programmes, designed to offer reliable information, had taken place. When "audiences" ("citizens") need to be informed about the justification for and conduct of, say, a war or major government spending decision, it is right to object to unnecessary censorship or

"spin" or fakery in such stories- especially if these exclude critical positions from outside the conventional spectrum of opinion.

Twenty-four-hour- television news services and chat show offer different accounts of events. The internet is a growing source of news, dissent, subversive blogs. Even the "rule" that music is never to be used as accompaniment to television news stories is occasionally broken. Philo and Berry [14](Philo, Greg, Mike, Berry. 2004. *Bad News from Israel,* Pluto, London,Theatre X520.W2 PH www.williambowles.info/media/philo.pdfI) suggest, from focus group work, that people appreciate being given a better sense of how news works, as well as the political events it covers. News images need to be understood in closer relation to the circulation of entertainment forms and celebrity etc. Personalization indicates that something which may be pictured in personal terms is more newsworthy than a concept or process. The term' personalization' is explained by Bell" as wherever possible, events are seen as the action of people as individuals. This runs all the way from endless shots of politicians getting in and out of cars (respectable "personalisation") through hospital waiting lists being put on the agenda of "Baby x" or a pensioner not getting the attention she needs, to celebrity gossip or scandal which is a kind of personalization usually dismissed as "trivial" part of "dumbing down" etc "[15]( ] (Allan ,Bell, *The language of news media*,ISBNo-631-16434-0, Blackwell and Cambridge, 199,p.158) Attribution (it has the function of reminding the audience that the the telling of news stories is an account which originated with certain persons and organizations . Facticity (it is the degree to which a story contains the kinds of facts and figures on which hard news thrives locations, names, sums of money etc) . [16]( ] (Allan ,Bell, *The language of news media*,ISBNo-631-16434-0, Blackwell and Cambridge, 199,p.150) The term stardom covers sport, television and popular music, for example it overlaps with the term celebrities. These are understood as having the same access to fame as stars, but they are not always as closely associated with specific areas of achievement.

Celebrity and news

Celebrity is subdivided by Chris Rojek into: ascribed (e. g. monarchs, president family members);

achieved (e. g. those with perceived accomplishments in open competition sporting or artistic); attributed (e.g. individuals who are represented as noteworthy or exceptional) ; celetoid (e.g. a media-generated, compressed form of media celebrity e.g. lottery winners etc.) [17](Chris,Rojek , *,Celebrity*, ISBN-10: 9781861891044 ,Reaktion Books, London,2007, p.113) Politics, fashion, sport, cookery, accidents, dancing and music are cultural forms available for building of fame and celebrity at television programmes. Football forms a considerable proportion of news coverage: a key site for airing questions around identity, behaviours for men and women, the limits of competiteveness as appeared in drug debates. The role of celebrities, along with scandal or gossip in television news generally, is often described as "dumbing down" or "tabloidisation". This ignores the facts that all media need a certain amount of "personalisation"-news as much as popular fictions.Even though the ideology of news announces that it is "serious", "objective", and "factual", it proceeds by endless interviews, stories and photos of individuals- even if simply politicians getting in and out of cars. Audiences" appetite for celebrities stories can be understood more sympathetically. Hermes, Joke [18](Joke, Hermes,, "Media figures in identity construction", in Rethinking Media Audience, Pertti Alasuutari (ed), Sage, ISBN 0-7619-5070-2. London,1999) suggests that the pleasures of celebrity news operate via two approaches: "the extended family repertoire" (this describes the sense that news gossip brings the powerful down to the level of ordinary human beings, imagined as part of the family and a place where readers/ viewers can test scenarios (divorce, parenthood or the desire for it, ambition etc) in case they occur in their own lives. [19](Joke, Hermes,, "Media figures in identity construction", in Rethinking Media Audience, Pertti Alasuutari (ed), Sage, ISBN 0-7619-5070-2. London,1999,p 80) It may be especially true of coverage of "the Royals " in the U K, who have since the nineteenth century been called "the Royal family " and "the repertoire of melodrama" (This refers to a form stretching from nineteenth century theatre and involving highly polarized struggles between Vice and Virtue: the wicked lord and the innocent maiden. It seems to be at play in the pleasures of much celebrity coverage, involving a "deep sense that the world is unjust, which points to a more collective sense of social inequality. To enjoy it when things go badly for "rich and famous people" is a way of imagining cosmic justice, rather than political justice, taking its toll. Commiseration and indignation are equal ingredients of the pleasure of "gossip" [20] (Joke, Hermes,, "Media figures in identity construction", in Rethinking Media Audience, Pertti Alasuutari (ed), Sage, ISBN 0-7619-5070-2. London,1999) Consider the celebrity image of the footballer David Beckhams who is an example of how "parallel narratives" matter for the production of celebrity. His marriage to "Posh Spice " made him a major star. All media need a certain amount of "personalization"-news as much as popular fictions. Even though the ideology of news announces that it is "serious" "objective" and "factual", it proceeds by endless interviews, stories and images of individuals even if simply politicians getting in and out of cars. The pleasures of celebrity news operate via two approaches: "the extended family repertoire". This describes the sense that news gossip brings the powerful down to the level of ordinary human beings, imagined as part of the family and a place where viewers can test scenarios (divorce, parenthood etc) in case they occur in their own lives .Panics about "dumbing down" often suggest that fans lose their own identities in favour of their admired favorite celebrities or

celebrity stories. Hermes suggests that the engagement with the celebrity takes place in a kind of "playground of identity construction".[21] (Joke, Hermes,, "Media figures in identity construction", in Rethinking Media Audience, Pertti Alasuutari (ed), Sage, ISBN 0-7619-5070-2. London,1999,p 81) In 2005, there were broadcasted images of a dishevelled, jailed Saddam Hussein in his underpants, and also sleeping under a rough blanket which it seems were taken by one of his captors. Like the pictures of him being medically examined just after capture in 2004 might such shots, advertising evidence of his "brokenness" act out those very bullying values.

In the next lines we will consider how celebrity coverage relates to some crucial areas of news. "Celebrity items" are now more widespread and commonly encountered than ever before. They blend into news and current affairs, especially in the UK and US where" huge amounts of apparently "straight" news coverage is skewed towards them, often in an attempt to boost ratings via "human interest" and glamour."[22] (](G, Branston,R, Stafford, The Multimedia Student's Book, fourth edition ISBN 978-0415371438, Rottledge ,London and New York:, 2006. p. 130).

Jamie Oliver's School Dinners series in 2005 is a case that shows that sometimes celebrities are seen as having done good with their image. At the beginning, he was seen as a commercially sawy "Essex boy" chef, and now is famous like a national hero. In 2005, Jamie Oliver made o series of programmes about state school meals, on which an average 37 per day was spent. The programmes faced the challenge of children's ad-fuelled addiction to junk food and its various effects on health. Jamie Oliver became famous cooker because of his physical presence: he is young, swearing, slightly urchin like, the very opposite of normal public service address, has an "ordinary" image and accent; his performance: willing to take risks, using his celebrity image in revealing how the making of the documentary affected his family life, confront a government minister and a food manufacturer.

Conclusions

News is a globally important media form. It flows at incredible speed 24/7, across radio, television, print, mobile phones and the internet, in both local and international contexts, and increasingly both formal and informal such as "blogs" and the immediate use of mobile phones footage in disasters like the tsunami of 2004 and the London bomb of 2005. Its audiences are huge and modern democracies depend on accurate news to give adequate accounts of a complex world, even though this is far from always being the case.[23](G, Branston,R, Stafford, The Multimedia Student's Book, fourth edition ISBN 978-0415371438, Rottledge ,London and New York:, 2006. p. 194)

ECONOMY, ENVIRONMENT

ECONOMIE, MEDIU

THE FINANCING FROM PUBLIC RESOURCES OF THE WAGE NECESSARY FOR THE CLERICAL PERSONNEL

Ionel BOSTAN
"Alexandru Ioan Cuza" University of Iasi,
11 Carol Bd., 700506 Iasi, Romania
ionel_bostan@yahoo.com

Abstract. Before adhering to the European Union, the Romanian state has initiated, then perfected continuously from public resources the system of legislative norms which bring under regulation the complete remuneration concerning the policy of religious cults both of the clergy and other personnel categories within the Church. The paper approaches the national system through which the allocation of the financial support to the clergy is realized, after priory making a presentation of the theme, specifying some general, historical and economical theory elements referring to the theme. The public wage support allocated to the clerical personnel is made by allocating funds from the state budget or from the local budget, within the context of which according to the Constitution of Romania, the religious cults are free and have autonomy towards the state and rejoice of its support.

Keywords: wage controversies, public financial support, clerical functions, remuneration, religious cults

1. Introductive considerations

Within the economical theory, the problem of work remuneration is of major importance, due to the connections on the plan of the relations created through employment, the usage and the work remuneration. This strongly and perpetually requires the attention of specialists in various domains, because, on the way of realizing the work remuneration depends the insurance with ways of existence of a significant part of the active population [1].

The argumentation of the affirmation is based on the fact that we take into consideration not only the general remuneration of the human resources but also the direct remuneration, situation which requires that other paid activities, not only the economical ones, be taken in consideration [2]. Then, a beneficiary of the presented remuneration rarely is only on his feet.

Approaching the problem of remuneration/ gratification in a special domain, suggested by the theme of this paper we demonstrate that generally speaking, the purpose of the allocation of financial resources to the cults and clerical institutions is of increasing the quality of the human factor by enriching the cultural and religious level and the moral ideals, in order to fulfill the personality of the members of the society. Financially speaking, the religious cults receive contributions from the state budget, which complete the personal incomes, to hedge the wage expenses of the church servants or to realize new cult places or the reparation of the existing ones.

In Romania, these expenses are financed by public sources, meaning the state budget, as well as by clerical and other cult places funds which participate differently in the financing of these actions [3].

A specific aspect is represented by the fact that the budgetary financing of these institutions is made significantly by means of local collectivities.

We appreciate the fact that is not of no importance to remember that by means of special norm, published in Monitorul Oficial nr.101 of May 1936, the Law for the organization of the Romanian Orthodox Church of May 1925 was modified, the state assuming the role to insure the expenses for the support of the cult, of its servants and of the church itself. The clergy were considered the same as the public clerks, rejoicing of all the rights and being obliged to obey all the specific obligations found within the status of the public clerks concerning the wage remuneration" [4].

The tutelary forum (The Cults Minister) proposes the equivalence of the priests wages with those of the teachers, the tuning of another two gradations, the reestablishment of the equal treatment of all the cults, etc., so that in April 1945 the system of the teachers' remuneration, but also the merit gradation in the case of the priests be adopted.

According to the stipulations of Law nr.142/1999 regarding the support of the state for the remuneration of the clergy, the number of jobs afferent to this type of personnel is established annually by the State Secretariat for Cults [5]. At the basis of the sizing of the involved figures, the proposals of the recognized cults are taken into consideration, also taking into account the number of adepts and the public funds allocated with this purpose.

According to the stipulations of Law nr.284/2010 concerning the unitary remuneration of the personnel paid from public funds, appendix II - the occupational family of budgetary functions "Education", Chapter III, Cults, letters B,C,D and E and with the stipulations of Law nr. 285/2010 concerning the remuneration in 2011 of the personnel paid from public funds, the State Secretariat offers financial support for the remuneration of the clerical personnel [6,7]. The budgetary credits regarding the contribution of the state to the remuneration of the cult personnel allocated according to the Law nr. 286/2010 – the law of the state budget of the year 2011 are of 248.637.000 lei [3].

2. Wage controversies within the economic theory. The detachment of the clerical personnel from the conditions concerning the status of the classical employee

The specialty literature defines relatively congruent the remuneration of the employee, as being "the totality of the material and monetary incomes, of the facilities and advantages, present or future, determined directly or indirectly by the quality of employee and the activity developed by him [8].

In what concerns the definition of the notion of wage, nowadays the formulation according to which it represents the sum of money received by the employed person for the contribution to the development of a social activity is accepted almost unanimous [9].

Furthermore, the treatises of Political Economy frequently work with definitions which are not radically different from the formulation: "the sum of money received for the contribution brought to the realization of labour as a production factor, by its possessor, the one who deposits it" [10].

Under the aspect of the economical content of the wage, this one is emphasized by the analysis of its facet of "labour price" [11]. Its treatment is also found in the work of some classics of the political economy, as Smith or Ricardo, but also in the papers of many contemporaries.

In sustaining such a formulation, the fact that the wage remuneration at certain intervals of time creates the appearance of price of the effectuated labour and that the variation of the wage sum depends on the effectuated labour volume is taken into consideration. Then, for one and the same volume of effectuated labour the employees demand a larger sum, while the employers have the tendency to pay less.

From a juridical point of view, the performance of labour and the labour remuneration are the main obligations which result for the employee and respectively for the employer by means of the individual labour contract. The obligation of labouring is also characterized by the fact that it has patrimonial character, allowing to be evaluated economically (in money).

According to the art.154 of The Labour Code, through wage one understands the payment of the employer paid for the labour effectuated by the employee according to the individual labour contract [12]. According to this concept, the legal reglementations establish the principle according to which for the effectuated labour, each person has the right to a wage in money, established when closing the respective contract [1].

Thus, we notice that the wage is concomitantly object of the contract, meaning that it represents the payment for the labour effectuated by the employee, and the cause of the contract, because, in order to obtain it, the person is hired.

But, we have to notice that all these are available differently when referring to the remunerations effectuated in favor of the clerical personnel, with or without financial public support. However, their availability aims at the system of direct remuneration.

Or, here we talk about the elements of an indirect remuneration because in the clergy remuneration the public authority realizes redistributions from the centralized budget of the state.

On the other hand, we consider that this type of personnel does not have a status of employee literally speaking. Let's mention only that the problem of establishing the tasks and the quantification of results (performance) raises sizeable difficulties as the editing of the job description or keeping the evidence of the labour time depending on the category of employees and the types of activities, etc. Then, it is difficult to talk about a policy of motivation and of promotion as the system of motivations/aspirations is totally unconventional.

That is why, in our opinion, the respective personnel can be considered the most as having a special status, which, concerning the remuneration from the public budget, has presupposed the appeal to more assimilations, borrowing by force characteristics found at other structures of employed personnel (classic). Otherwise, the frame-Law nr.284/2010 regarding the unitary remuneration of the personnel paid from public funds stipulates that the clerical personnel benefits of "monthly allowance" (and not of "monthly wage").

Referring to the way of calculating the rights and withholds afferent to these ones, as well as to the problems concerning the accountancy, audit, etc., we mention that it is common for all the juridical employers [13].

3. The financing from public resources of the wage necessary for the clerical personnel

The central public organism that has attributions established by law within the approached frame, inclusively concerning the financing, is the State Secretariat for Cults (SSC). This one has juridical personality, functioning within the working machinery of

the Government of the Government and having as responsibility the elaboration and the insurance of applying the policies and strategies in the cults domain [14,15].

The main objectives assumed by SSC:

- The improvement of the legislative/institutional frame;
- The application of the international principles and legislation concerning the compliance of the rights and religious liberties for all the Romanian citizens no matter their ethnic group or their confession;
- The reestablishment of the matrimonial rights of the religious cults;
- The sustentation of some activities of reconstruction and restoration of the ecclesiastical space;
- The construction/finalization/passing on of some new cult places;
- The increase of the public contribution to the wage of the cult personnel from the unities with low incomes, within the conditions established by the law.

Obviously, the way of using the funds allocated from the state budget are also exposed to the control of the General Secretariat of the Government, through SSC and other organisms established by the law.

In what concerns the allocation of the financial support for wages in 2011, according to the Law 286/2010 of the state budget for the year 2011 [3], the sum of 248.637 lei is allocated at the chapter "the state contribution to the remuneration of the cult personnel", and 1.958 lei for "the contribution of the remuneration of the auxiliary personnel".

According to the remuneration of the clergy of the religious cults which are legally recognized, we mention that a part from the expense made with the remuneration is supported from the personal incomes of the religious cult, and the other part is supported by the state budget. Thus, the contributions and the subsidies coming from the public budget do not represent more than a partial support which the Romanian Orthodox Church receives - together with the other recognized religious cults – for the development of its pastoral and social activity [4].

Referring to the orthodox cult, "the remuneration of the management clerical personnel, as well as of the clerical personnel and the auxiliary personnel is made according to the general norms effectual within the Romanian Orthodox Church, through contributions from the own budget of the cult unities, through contributions from the state budget, from the public, local administration budget and other institutions, according to the law" [16].

The clerical personnel bends to the stipulations of the Labour Code, concerning remuneration, art. 157 (2) stipulating that "the remuneration system of the personnel in the public authorities and institutions, financed integrally or for the most part from the state budget , from the social state insurance budget, from the local budget and from the special funds budget, is established by the law" [12].

The Romanian state supports cults, recognized according to the Law nr.489/2006 regarding the religious liberty and the general regime of cults [17], at their request, for the remuneration of the clerical personnel. The legislative frame for the establishment of the remuneration of the clerical personnel was represented a long period of time by the Law nr.142/1999 regarding the support of the state for the clergy remuneration, ulterior modified [5]. Then, at the end of the year 2009, together with the entry into force of the frame Law nr. 330 of 5 November 2009 regarding the unitary remuneration of the personnel paid from public funds [18], the stipulations of Law 142/1999 are abolished.

Since the end of 2010, the frame Law nr.284/2010 regarding the unitary remuneration from the public budget is being in force [6]. The section: "Settlements specific to the clerical personnel, who develops his activity within the country", establishes that:

a) the personnel from the management of the cults assimilated to the one hired on functions of public dignity benefits of a monthly allowance, which is the only way of remuneration for that particular personnel and it represents the calculation basis for the establishment of rights and obligations;

b) the personnel from the management of the cults, other than the dignitaries, benefits of monthly remuneration support, according to the functions he occupies, at the level of the basis wages established according to the law for the teachers functioning in the pre-academic system, through assimilation;

c) the clerical personnel who develops his activity within the cult unities benefits of monthly remuneration support totalizing 65% of the basis salaries established according to the law for the teachers functioning in the pre-academic state system, depending on their education level, their professional degree obtained and the age of clerical activity, according to the assimilations.

In Chapter III – Cults, Letter B [6], the allowances of the personnel in the management of the recognized cults and of the central unities of cult are established, assimilated to the one hired on functions of public dignity. Ex.: Function: The Patriarch of the Romanian Orthodox Church, Class: 109, Ranking coefficient: 14,63; Function: Archbishop, cult chief (metropolitan, bishop, mufti, chief Rabbi, union president, president), Class: 106, Ranking coefficient: 13,65.

The remuneration class consists of the 9 classes of remuneration corresponding to the tranche of age in labour at maximum level. According to art.4 from the Law 285 of December 28th, 2010 regarding the remuneration in 2011 of the personnel paid from public funds, the reference value is of 600lei [7]. In 2011 the reference value and the ranking coefficients corresponding to the remuneration classes stipulated in the appendix of the frame law regarding the unitary remuneration of the personnel paid from public funds are not applied [6].

The allowances of the personnel from the management of the cults and of the cult unities, other than the one hired on functions of public dignity (the number of

jobs: 1232) and the allowances of the clerical personnel hired within the cult unities recognized in Romania dignity (the number of jobs: 15237) – established for the teachers functioning in the pre-academic state system, in the basis of certain assimilations.

We mention that according to the same normative act, the clerical personnel who develops his activity within the cult unities with low incomes may benefit of a monthly remuneration support of 80% of the basis wages established according to the law for the teachers functioning in the pre-academic state system.

In this case, the level of education, the professional degree obtained and the age within the clerical activity detained within the cults in Romania, according to the assimilations, will be taken into consideration [6].

The only restrictions imposed by the law, in order to benefit from these stipulations is that the clerical personnel doesn't have rapports of the type employee-employer with the cult unities which obtain incomes from renting, land tenancy and the leasing of properties [6].

4. Conclusions

The tendencies manifested towards the financing of the clerical institutions aims on one hand at resizing the expenses together with a realistic value of the own incomes, so that the budgetary allocation of completion be more rigorously determined and, on the other hand, the co-interest of the cult institutions in the development of some activities to produce incomes without affecting the quality of the specific act of the domain analyzed in this paper.

In Romania, the expenses of the clerical institutions are financed both from public sources, respectively the state budget and from the clerical funds and other cult places that participate differently to the financing of these actions.

The personnel from the management of the cults assimilated to that hired on functions of public dignity benefits of a monthly allowance, as unique form of remuneration. The rest of the personnel from the management of the cults benefits of a monthly remuneration support appropriate to the functions they have, at the level of the basis wages established for the teachers functioning in the pre-academic state system, in the basis of certain assimilations.

Those having functions "of execution" within the schemes of the cult unities benefit of monthly support of 65% of the basis wages established according to the law for the teachers functioning in the pre-academic state system, according to their level of education, professional degree obtained and to the age within the clerical activity detained within the cults in Romania.

References

[1] Bostan, Ionel, *Managementul recompensei*, "Stefan cel Mare" Publishing House, Suceava, Pag. 9, 17, 31, 2006.

[2] Niță, Dobrotă et al., *Economia politică*, Bucharest, Pag. 216., 1995.

[3] Law nr. 286-2010 of the state budget of 2011, published in Monitorul Oficial, Part I, nr.879 of December 28th, 2010.

[4] Voinescu, G.L., *Contabilitatea şi fiscalitatea în lumina legislației de stat şi bisericeşti din România*, Doctorate Thesis, Ovidius University, Constanța, Pag. 175-176, 2010.

[5] Law nr. 142/1999 regarding the support of the state for the clergy remuneration, published in Monitorul Oficial, Part I, Nr.361 of 27/07/1999.

[6] Frame Law nr.284/2010 regarding the unitary remuneration of the personnel paid from public funds, published in Monitorul Oficial, Part I, nr.878 of December 28th, 2010.

[7] Law nr.285 of December 28th, 2010, regarding the remuneration for 2011 of the personnel paid from public funds, published in Monitorul Oficial, Part I, nr.878 of December 28th, 2010.

[8] Mathis, R.L. et al., *Managementul resurselor umane*, Economic Publishing House, Bucharest, Pag. 216, 1997.

[9] Buşe, Georgeta et al., *Dicționarul complet al economiei de piață*, Business Books, Bucharest, Pag. 303, 1995.

[10] Coşea, Mircea et al., *Economia*, The Didactic and Pedagogical Publishing House, Bucharest, Pag. 83, 1992.

[11] Adumistrăcesei, Ioan et al., *Piața forței de muncă*, Technical Publishing House, Chişinău, Pag. 226, 1995.

[12] Law nr.53 of 24th January 2003 regarding the Labour Code, published in Monitorul Oficial, Part I, nr.72 of February, 5th 2003.

[13] Bostan, Ionel and Costuleanu, Carmen, *Implications of accounting and tax regulations in the activity of religious establishments*, in European Journal of Science and Theology, Vol.6, No.3, Pag. 23-30, Sept.2010.

[14] The urgency decree of the Government nr.115/2009, regarding the establishment of some measures of reorganisation within the public central administration, published in Monitorul Oficial, Part I, nr. 919 of December 29th, 2009.

[15] The Government decree nr.22/2010 regarding the organisation and the functioning of the State Secretariat of Cults, published in Monitorul Oficial, Part I, nr.17 of January 11th, 2010.

[16] The Romanian Patriarchy, *Statul privind organizarea şi funcționarea Bisericii Ortodoxe Române*, Bucharest, The biblical Institute of Orthodox Mission Publishing House, 2008.

[17] Law nr.489/2006, regarding the religious liberty and the general regime of the cults, published in Monitorul Oficial, Part.I, nr.11 of January, 8th, 2007.

[18] Frame Law nr.330 of November 5th, 2009, regarding the unitary remuneration of the personnel paid from public funds, published in Monitorul Oficial nr.762, of November 9th, 2009.

THE COHERENT EVALUATION OF THE ASSETS AND PASSIVES FROM THE BALANCE OF THE INSURANCE COMPANIES

Ionel BOSTAN
"Alexandru Ioan Cuza" University of Iasi,
11 Carol Bd., 700506 Iasi, Romania
ionel_bostan@yahoo.com

Abstract. The uniformity of the European entities' balance sheets represent for the EU one of the objectives followed in order to supply their internationalization process. This objective has determined the EC to adopt laws aimed to normative uniformity in its member countries. This represents a first tentative towards real uniformity and European balance sheet comparability, be it under the aspect of editing but also under the aspect of patrimonial items' presentation. The committee has proposed, for all the companies in the EU, listed on regulated markets, the obligation to make starting January 1st 2005 the consolidated financial situations by using the IASC standards; the member states, in exchange, have the possibility of extending this obligation also for the non-listed companies.

Keywords**:** assets/liabilities, balance sheet, insurance contract, risks

1. Introduction

The activity of the insurance companies is, by its nature, one of the most complex; the IASB admits its importance, and in May 2002 it has decided to intervene in two steps. The first step includes the IFRS4 in its vast means, IAS32 (the exposure and presentation of the financial instruments) and IAS39 (presenting and evaluating the financial instruments). The second step concentrates, in exchange, on the much debated subject of balance sheet liabilities' evaluation of the insurer.

The IFRS4 includes also the accounting laws applicable to the companies' insurance contracts, that must present more detailed financial report regarding the insurance contracts (for example regarding the sensibilities of the profits varying whit the hypothesis its stands on), the reserves for catastrophes and equality no more being admitted, used previously to absorb extraordinary losses.

The most relevant modifications refer to accounting the balance sheet items at their fair value, most of the balance sheet assets therefore being needed to be included in the balance sheet at their market value and not at their historical cost [1].

2. The necessity of the IFRS implementation in the insurance contracts

The introduction of the IFRS4 produces, therefore, a strong impact not only over the accounting, but also over the management of the assets in the balance sheet of the insurance companies. The insurers, especially the ones that operate in the life insurances' domain, hold title assets, at present this assets being highlighted in the balance sheet at their nominal value, while according to the IAS39, most of the assets will be evaluated at their market value. In a context that is characterized by interest rate variation, the value of the assets will be subdued under variations, while the balance sheet liabilities, at least in first phase, stay essentially invariable, from here being derived the volatility of the management not only at an economical result level, determined from the new accounting standards [2].

In order to reduce this volatility and avoid a negative evaluation on behalf of the market operators, the insurers can choose between title volume reduction, in order to be more orientated towards bonds, with the advantage to manage the assets and liabilities in a more effective way; classifying some assent as being held to maturity, and this practice will be due to a normative that penalizes companies that sell assets classified as being held to term; reducing the exposure risk, by insuring assets on a less long term and adequate to the product's structure [3].

Unlike the damage insurers, the life policies insurers will sense more directly the IFRS being introduced; this is explained also by the nature of the balance sheet liabilities per title, which often get guarantee options. Based on the IFRS4, some guarantee options will

have to be evaluated at their market value. Companies that in the pas have not taken into account these options in their taxing models are due to make the necessary adjustments.

The insurers will not only have to intensify the information with the variety of the insurance risks that the portfolio contains, but also varying with the sensibility of own assets of interest oscillation, share prices and mortality. Realizing the new frame of the IFRS standards means taking into consideration the accelerated globalization of the trading and financial markets' internalization, which have made passed onto first place the necessity of a standardized financial reporting. Harmonizing of the accounting practices and annual accounts' preparing systems has also been favored by international companies, lots of these aspiring in fact to be listed beyond their own national market in order to access larger markets.

IASB has evolved a normative frame, IFRS, finalized to improve the transparency and compatibility between different domains and companies. The EC has declared, on January 1st 2005, that the enterprises listed in the EU must present consolidated financial situations, by applying only one accounting standards frame, called IFRD, elaborated by the IASB. It is also stipulated a temporary exemption of two years for the companies listed either in the EU, or on a third regulated market, and for making consolidated accounts by the accounting standards recognized internationally.

3. The European accounting strategy regarding the IFRS4 standard implementation

The uniformity of the European entities' balance sheets represent for the EU one of the objectives followed in order to supply their internationalization process. This objective has determined the EC to adopt laws aimed to normative uniformity in its member countries.

Among the directives that the EC has adopted, three have especially referred to the editing of the balance sheet principles in the EU enterprises:

- the 4th directive regarding the annual capital companies' accounts (98/660/CEE);
- the 7th directive regarding the consolidated accounts, afferent to group companies (83/349/CEE);
- the 8th directive regarding the abilities of the individuals tasked with annual accounts' audition(85/253/CEE).

This represents a first tentative towards real uniformity and European balance sheet comparability, be it under the aspect of editing but also under the aspect of patrimonial items' presentation [4]. The presented directives have codified the general principles elaborated internationally, but have not been adopted in many of the national European countries regulations. Among these principles we find: the faithful and fair frame, going concern, economical competition, non-compensating the assets with the liabilities or the income with the expense, the prevalence of the economical over the juridical, the continuity of exercise continuation, the permanence of the accounting methods, intangibility of the opening balance sheet, presenting the homogenous and comparable information.

The EC directives leave the possibility of choice between various options that can consent different accounting treatments, determining by that an incomplete harmonization. In the 508/95/CEE document, "The accounting harmonization: a new strategy in the international harmonization process", the Committee has highlighted in fact the way that the EU should act in order to consent to the wanting companies to be listed on the USA markets or other world markets to remain in the EU accounting frame.

The EC has realized in fact that the balance sheets made by the trans national European companies, according to the national law, that was based on European accounting norms, were not compatible with various accounting principles prescribed in other countries of the world from which they must obtain in order to penetrate the international accounting markets. The companies mentioned were constraint to make two series of accounts: one according to the European accounting directives and other according to the requests of the international capital market.

On an European, integrated and efficient real estate market, it is necessary for a listed company to make its own balance sheet based on a single set of accounting standards. The EU did not want to make a distinct set of accounting rules, exclusively for the European market- a choice of this type would have been incompatible with the globalization tendency of the financial markets and would have put to risk the capacity of the European companies to find their capital on third party countries' market [5]. Therefore, a set of internationally recognized standards seemed to be the most adequate basis for the financial information in the EU. In the 35/00/CEE document, called "The EU strategy regarding financial information: the way to follow", the EC repeats the necessities that appear from re-giving the European entities annual financial situations comparability, based on the standards elaborated by the IASC, ensuring the guarantee of an unique, efficient and steady market.

The committee has proposed, for all the companies in the EU, listed on regulated markets, the obligation to make starting January 1st 2005 the consolidated financial situations by using the IASC standards; the member states, in exchange, have the possibility of extending this obligation also for the non-listed companies [6]. The adoption of all of these has been approved in May 2001, by the directive CEE65/2001. On July 17, 2007, the Council of the Finance Ministers has proposed to the EC the introduction of these new rules and founding an adequate mechanisms regarding IAS approval. The communitarian dispositions actually want the 4th and 7th directives modified, aiming towards applying the IAS39 regarding the representation and evaluation of the financial instruments.

In June 2001, the EFRAG takes birth, with the task to assist the EC regarding the acceptability of each

document in Europe and emitting commentaries about these documents, made by the IASB. On July 19th, 2002 the EC elaborates the 1606/2002 regulation, through which it is stipulated the adopting, starting 2005, of the IAS for the annual consolidated accounts afferent to the listed companies.

The obligation is valid also for the companies that are preparing to solicit the allowing for negotiation of their shares. It is also stipulated the possibility that the member states impose the application of the IAS to the companies listed in their exercise balance sheet , to the non-listed companies, but also in important divisions, such as the banking and the insurance services, independent of the fact that the companies are listed or not.

Starting July 2003, the EU has introduced the IASs by then adopted, and from that moment, the future ones - IFRS, and the SIC Interpretations. The approval has been made official by the regulation CE 1725 of September 29th 2003, obligatory in each member state.

4. The development of the IFRSs in the insurance services' division

The IAS initiative regarding the fair value dates all the way back to 1997, when the IASC has started developing a model in order to evaluate the financial instruments at their market value. In the year 2001 there has been published a "Draft statement of Principals on Insurance Contracts"- DSOP, document evolved by a Committee made by the IASC. This project has raised numerous debates in the insurance division, the most debated aspect being about the approach of the market value for measuring and evaluating the financial instruments and the insurance controls.

In the year 1997, the IASC has made a certain Committee, the Insurance Sturind Committee, whit its goal to treat problems regarding insurance contracts. Taking into consideration that the initial definition presented by the committee excluded several types of insurance contracts, such as credit insurance and security plans for entities and personnel insurance, the international financial groups and the organizations of the insurance services and normative entities have strongly opposed to this proposal.

The IASC committee has been dissolved in June 2000, because of the IASB being created, to which followed the making of a new Insurance Advisory committee. In the same time with the Insurance Project, the IASB had evolved the IAS39 and the IAS32, which treat different accounting aspects regarding financial instruments [7]. In December 1998, the IASC had approved the IAS39 standard- Financial instruments, presentation and evaluation. This standard has formally introduced the classification of various financial instruments; in completion of the IAS39, the IAC had successively evolved the IAS2- financial instruments-presentation, balance sheet and informing, including general presentation principles of the financial instruments, and the accent being put on particularizing the differences between various financial instruments [8].

The DSOP, presented by the IASB in November 2001, proposed making a standard IFRS basis for the insurance contracts. The standards contained in the DSOP had various commentaries and recommendation on behalf of the private and public sector organizations all put together in a document published in 1999. Taking into consideration the particular situation that usually the insurance contracts are not actively negotiated, the IASB has introduced the concept of entity specific value, as an alternative to approaching the market value.

The DSOP recommends resorting to the entity specific value to all those whom the market information was not available. In July 2003, the IASB has published the so-called Exposure Draft (EDS), an orientation document for passing towards the IFRS, under which the insurers should expose the balance sheet liabilities at their market value, also the final version of the proposal being eliminated. EDS had consented to the IASB to collect the future commentaries and recommendations came from the organizations from the private and public domain, these serving as a basis for setting the IFRS4 standards regarding the insurance contracts.

In March 2004, the IASB publishes IFRS4-insurance contracts, but the appliance of the national accounting norms regarding insurance contracts is continued, with several modifications. It is good to remember that the IAS39 and the IASB standards refer to financial instruments held or emitted by the insurer, and the IFRS4 says that the insurer must present more detailed information regarding the insurance contracts.

5. The application sphere of the IFRS4

IFRS 4 is applied to all the insurance and re-insurance contracts (active and passive), that fulfill the definition of the insurance contract. The insurance risk supposes that at least one of these elements is random, being necessary certain conditions for the mentioned contract to be considered eligible for the re-insurance accounting, more than for deposit accounting: event checking, the moment that the event should take place and the economical impact for the insurer.

In the absence of the insurance risk, the contract is not included in the definition of an insurance contract; according to this definition, the contracts for which the insurer guarantees the payment of a sum without a possibility that an adverse event hits the insurer or other beneficiaries does not exist do not contain an insurance risk [9]. The insurance risk is different from the financial risk, which takes place when an entity assumes or transfers to another party one or more of the following risks: exchange risks, risks regarding interest rate, market risks, credit risks, or price variations.

The financial risk is practically the risk of a possible future change of one or more variables: specified interest rate, specified price of the financial instruments, specified price of the merchandise, specified exchange rate, specified index of prices or rates, specified evaluation of client solvability or specified index regarding credit, or

other variables, only in the case of non-financial variable not being specific to a contracted party.

The significance of the insurance risk must not be disclosed by the insurer over its portfolio or even him, but contract over contract. The unclassified contracts such as the insurance contracts can be reclassified if a significant variation in the insurer's treasury cash flow takes place.

If the insurer, at the date of the contract stipulation is capable to evaluate that the probability or the actual value of a significant loss could lead to growth in time, the contract becomes classified as an insurance contract, from the beginning, even if the actual value afferent to the loss is smaller at the moment, Once classified as insurance contracts, these cannot be reclassified.

A significant part of the contracts, that are legally defined as insurance contracts, do not satisfy the current definition of the insurance contract according to the IFRS4, because to these are not applied the contractual standards regarding the insurance contracts [10]. The combination between the financial risk and the insurance risk influences therefore the classification and accounting of the contracts. Based on this definition, we can classify the life insurance contracts as follows:

- products with insurance coverage: temporary insurances, Permanent Health Insurance;
- composite products: composite income, composite insurance;
- financial contracts: social insurance forms, investment contracts.

The Implementation Guide offers several contract models that are in the definition of the insurance contract: case of death insurance, immediate annuities, composite contracts with superior payment in case of death, investment contracts that contain participation discretionary components of the beneficiaries [11].

6. Conclusions

The IFRS4 is a first step in defining a reference frame exclusively for making the balance sheet of the insurance companies. Applying this principle regards all the insuring contracts, the insurers not needing to follow the dispositions afferent to the systematic frame or other IAS/OFRS any more, such as the case of incorporated reference derivatives, for which are already stipulated specific evaluation norms. They cannot represent provisions if they refer to events already passed at the date of the balance sheet writing, because it would be contrary to the IAS37 standard, and it is imposed therefore to them annual auditory in order to insure adequate character to the liabilities in the balance sheet.

The modification possibilities of the accounting principles are limited, although it is allowed to introduce a principle to stipulate the non-determination of the value of certain insurer's assets, which in any case cannot be put in the balance sheet if they are not updated so that they would reflect the current market values. The liabilities in the insurer's balance sheet cannot be compensated to the insurance connected assets, and must stay in the balance sheet until they are not out or regulated.

In the end, the IFRS4 does not offer an evaluation for the passive elements connected to the insurance contracts, at their fair value, circumstance in which the risk giving an incoherent evaluation of the passive values with the active of the same company.

References

1. Taliento M., *La stima del valore delle "sinergie" nelle acquisizioni di aziende în esercizio. Note metodologiche e rilievi economici-contabili*, Collana Quaderni Monografici RIREA, Roma, 2004.
2. Chiricosta A., *IFRS 4 – Insurance Contracts: alcune criticita interpretative, Institzuto degli attuari,* Reunione Seminarial, 24 iunie 2004, Triest, 2004.
3. Bacinelllo A.R., *Fair Pricing of Live Insurance Participating Policies with a Minumum Interest Rate Guranteed*, Astin Bulettin, Nr. 31, Pag. 275-297, 2001.
4. IASB), *Exposure Draft: ED 5 Insurance contracts* – 2003, www. iasb.org
5. Mates, D., Hlaciuc, E., Grosu, V., *La valutazione delle principali voci dell' attivo di bilancio secondo i principi contabili nazionali e internazionali IAS/IFRS, MUP Editore, Italia,* Pag. 102, 2009.
6. IASB, *IFRS 4- Insurance contracts*, 2004, www. iasb.org
7. IASB – IAS 32 – IAS 39, 2004, www. iasb.org
8. Mella, P., *The operative logic of the firm The Combinatory Systems Theory view*, Proceedings of the The 2002 International Conference in Management Sciences, Tamkang University, Taipei, Taiwan, 2002.
9. Baione F., de Angelis Fortunati A., *On a fair value model for Traditional Italian Life Insurance Policies*, 8 th, International Congress on Insurance Mathematics and Economics Rome, June, Pag. 14-16, 2004.
10. De Angelis, *Gli Standards Internazionali per la valutazione del fair value delle companie de assicurazione: implicazione atturiale*, Seminario Presso Instituto Italiano degli attuari, Roma, 2004.
11. Brennan M. J. Schwary, *The pricing of Equity tinked life insurance Pollicies with an asset Value Guarantee,* Journal Of Financial Economic, nr. 3, 1976.

EXAMPLES OF DETERMINING THE VOLUME OF PRODUCTION BY FUNCTIUON AND VICE VERSA

Rodica BERZAN
Academy of Economic Studies of Moldova, Banulescu Bodoni 59, Bloc B, office 603, Chisinau, MDA, e-mail: beromiss@gmail.com

Abstract. In the present work the production process described by Leontief's dynamic production function is considered. The volume of production is expressed in terms of production function and inversely, the production function is determined based on the volume of production.

Keywords: Leontief's production function, dynamic production function, production volume.

1. Introduction. We will consider the production process with two essential resources. Let x and y express the volumes of the resources, a and b represent unit expenses of the respective resources and the function $z=\min\left\{\frac{x}{a},\frac{y}{b}\right\}$, known as Leontief's production function, characterizes the production process in which z is the volume of production yield.

For any fixed values of the variables x, y, a and b $(a,b\neq 0)$ the value of z expresses the potential of the production process, that is the maximal quantity that can be produced having the volumes x and y of the resources.

Let us suppose that in the interval of time $[0,T]$ the values of the variables x, y, a and b are changing according to the laws $x(t)$, $y(t)$, $a(t)$ and $b(t)$, respectively, for $t\in[0,T]$, where $x(t)\geq 0$ and $y(t)\geq 0$ denote the quantities of resources available to the moment t, whereas $a(t)>0$ and $b(t)>0$ represent unit expenses of the resources at the moment t. Then the production function takes the form $z(t)=\min\left\{\frac{x(t)}{a(t)},\frac{y(t)}{b(t)}\right\}$, and expresses for each fixed value of t the maximal quantity of production that can be obtained of the resources $x(t)$ and $y(t)$, available at the moment t if the unit expenses of the resources are $a(t)$ and $b(t)$. As the production factors depend on the time t, the function $z(t)$ is a dynamic production function.

2. Determining the volume of production. Suppose $x(t)$ and $y(t)$ are differentiable functions in the interval $[0,T]$. If we denote their derivatives by $\dot{x}(t)$ and, respectively $\dot{y}(t)$, then for small interval of time $\Delta t>0$, the expressions $\dot{x}(t)\cdot\Delta t$ and $\dot{y}(t)\cdot\Delta t$ represent approximately the available quantities of respective resources during this interval, while $\frac{\dot{x}(t)\Delta t}{a(t)}$ and $\frac{\dot{y}(t)\Delta t}{b(t)}$ express the volumes of production that could be obtained of these resources in the period Δt.

Hence the real volume of production yield in the interval $\Delta t>0$ would be $\Delta V=\min\left\{\frac{\dot{x}(t)\Delta t}{a(t)},\frac{\dot{y}(t)\Delta t}{b(t)}\right\}$ or $\Delta V=\min\left\{\frac{\dot{x}(t)}{a(t)},\frac{\dot{y}(t)}{b(t)}\right\}\Delta t$. If we put

$$\dot{z}(t)\overset{def}{=}\min\left\{\frac{\dot{x}(t)}{a(t)},\frac{\dot{y}(t)}{b(t)}\right\},\qquad(1)$$

then $\dot{z}(t)$ represents the rate of production at the moment t, and the production yield in the period Δt would be approximately $\dot{z}(t)\cdot\Delta t$.

Assuming that the functions $a(t)$ and $b(t)$ are continuous in $[0,T]$, we can find the total production volume yield to the moment T, namely

$$V(T)=\int_0^T\dot{z}(t)dt=\int_0^T\min\left\{\frac{\dot{x}(t)}{a(t)},\frac{\dot{y}(t)}{b(t)}\right\}dt.\qquad(2)$$

Note. Unlike the function $z(t)=\min\left\{\frac{x(t)}{a(t)},\frac{y(t)}{b(t)}\right\}$, that denotes the maximum of production that can be obtained of the quantities $x(t)$ and $y(t)$, available to the moment t, the function $\dot{z}(t)=\min\left\{\frac{\dot{x}(t)}{a(t)},\frac{\dot{y}(t)}{b(t)}\right\}$ shows the maximal rate of production at the moment t, where $\dot{x}(t)$ and $\dot{y}(t)$ are the rates of entering of the resources in the production process, at the moment t.

To mention that here $\dot{z}(t)\neq\frac{dz(t)}{dt}$. For example, let $x(t)=t,\ \ y(t)=t^2+2,\ \ a(t)=t/2$ and $b(t)=t+1$. Then

$$z(t)=\min\left\{\frac{x(t)}{a(t)},\frac{y(t)}{b(t)}\right\}=\min\left\{\frac{t}{t/2},\frac{t^2+2}{t+1}\right\}=\min\left\{2,\frac{t^2+2}{t+1}\right\}$$

or $z(t)=\begin{cases}\dfrac{t^2+2}{t+1},\ \ 0\le t<2,\\ 2,\ \ t\ge 2.\end{cases}$

Hence $z'(t)=\begin{cases}\dfrac{t^2+2t-2}{(t+1)^2},\ \ 0\le t<2,\\ 0,\ \ t\ge 2.\end{cases}$

On the other hand,

$$\dot{z}(t)=\min\left\{\frac{\dot{x}(t)}{a(t)},\frac{\dot{y}(t)}{b(t)}\right\}=\min\left\{\frac{1}{t/2},\frac{2t}{t+1}\right\}$$

or $\dot{z}(t)=\begin{cases}\dfrac{2t}{t+1},\ \ 0\le t<\dfrac{1+\sqrt{5}}{2},\\ \dfrac{2}{t},\ \ t\ge\dfrac{1+\sqrt{5}}{2},\end{cases}$

and we can see that $\dot{z}(t)\neq z'(t)$.

Further on we will analyze two examples of computing the production volume based on the production function (*Example 1*) and vice versa, calculating the production function, given the production volume $V(t)$ (*Example 2*).

Example 1. Suppose that the resources x and y are entering in the production process according to the laws: $\dot{x}(t)=\frac{-t^2+14t}{3}$ (units/day) and $\dot{y}(t)=\frac{20t}{t+1}$ (units/day) during the period $t\in[0,10]$ (days), while the unit expenses of the resources are changing as follows: $a(t)=\frac{t}{3}$ (units/item) and $b(t)=\frac{2t+3}{t+1}$ (units/item).

In this case the rate of production with respect to each resource will be, respectively:

$\frac{\dot{x}(t)}{a(t)}=\frac{-t^2+14t}{3}/\frac{t}{3}=-t+14$ (items/day) and $\frac{\dot{y}(t)}{b(t)}=\frac{20t}{t+1}/\frac{2t+3}{t+1}=\frac{20t}{2t+3}$ (items/day), so as the rate of production will be $\dot{z}(t)=\begin{cases}\dfrac{20t}{t+3},\ \ 0\le t<6,\\ -t+14,\ \ 6\le t<10.\end{cases}$

Therefore, the total production volume during this period, according to (2), will be

$$V(10)=\int_0^{10}\dot{z}(t)dt=\int_0^6\frac{20t}{2t+3}dt+\int_6^{10}(-t+14)dt=$$

$$=[10t-15\ln(2t+3)]\Big|_0^6+\left(-\frac{t^2}{2}+14t\right)\Big|_6^{10}=$$

$$=84-15\ln 5\approx 60\ \ (items).$$

3. Determining the production function. If the production volume yield at each moment $t\in[0,T]$ can be presented as a function $V(t)$, differentiable in $[0,T]$, then the production function $z(t)$ can be determined for that period. Indeed, the relation $V(t)=\int_0^t\dot{z}(\tau)d\tau$ implies, at all points of continuity of $\dot{z}(t)$: $V'(t)=\dot{z}(t)$, or $\min\left\{\frac{\dot{x}(t)}{a(t)},\frac{\dot{y}(t)}{b(t)}\right\}=V'(t)$.

From the latter it results that $\frac{\dot{x}(t)}{a(t)}\ge V'(t)$ and $\frac{\dot{y}(t)}{b(t)}\ge V'(t)$ or $\dot{x}(t)\ge V'(t)\cdot a(t)$ and $\dot{y}(t)\ge V'(t)\cdot b(t)$.

Since the functions $x(t)$, $y(t)$ and $V(t)$ are nondecreasing in $[0,T]$, while the functions $a(t)$ and $b(t)$ are positive, we get:

$$\begin{cases}x(t)\ge\int_0^t V'(\tau)\cdot a(\tau)d\tau,\\ y(t)\ge\int_0^t V'(\tau)\cdot b(\tau)d\tau.\end{cases}\qquad(3)$$

Or, integrating by parts, we have

$$\begin{cases} x(t) \ge V(t)\cdot a(t) - \int\limits_0^t V(\tau)\cdot a'(\tau)d\tau, \\ y(t) \ge V(t)\cdot b(t) - \int\limits_0^t V(\tau)\cdot b(\tau)d\tau \end{cases} \qquad (4)$$

(suppose the derivatives $a'(t)$ and $b'(t)$ exist in $[0,T]$).

As a result, the production function will have the following expression (from (3)):

$$z(t) = \min\left\{\frac{x(t)}{a(t)}, \frac{y(t)}{b(t)}\right\} =$$

$$= \min\left\{\frac{\int\limits_0^t V(\tau)\cdot a'(\tau)d\tau}{a(t)}, \frac{\int\limits_0^t V(\tau)\cdot b'(\tau)d\tau}{b(t)}\right\}. \qquad (5)$$

Or, from ((4)):

$$z(t) = \min\left\{V(t) - \frac{\int\limits_0^t V(\tau)\cdot a'(\tau)d\tau}{a(t)}, V(t) - \frac{\int\limits_0^t V(\tau)\cdot b'(\tau)d\tau}{b(t)}\right\}. \qquad (6)$$

Particular cases.

(a) Let $V(t) = const$ for $t \in [t_0, T]$. It follows, that $V'(t) = 0$ and, consequently, $\dot{z}(t) = 0$ for $t \in (t_0, T)$. But the last equality, according to (1) implies at least one of the equalities $\dot{x}(t) = 0$ and $\dot{y}(t) = 0$ for the $t \in (t_0, T)$, that is $x(t) = const = x(t_0)$ or $y(t) = const = y(t_0)$.

Hence the production function will take the form $z(t) = \min\left\{\frac{x(t_0)}{a(t)}, \frac{y(t_0)}{b(t)}\right\}$.

(b) Let $V(t) = k\cdot t$ for $t \in [t_0, T]$, $k \in R$. It follows that $V'(t) = k$ in $t \in (t_0, T)$, therefore $\dot{z}(t) = k$ or $\min\left\{\frac{\dot{x}(t)}{a(t)}, \frac{\dot{y}(t)}{b(t)}\right\} = k$.

The last equality implies the relations $\frac{\dot{x}(t)}{a(t)} \ge k$ and $\frac{\dot{y}(t)}{b(t)} \ge k$ or $\dot{x}(t) \ge k\cdot a(t)$ and $\dot{y}(t) \ge k\cdot b(t)$.

Integrating both inequalities we get

$$\begin{cases} x(t) \ge k\int\limits_0^t a(\tau)d\tau, \\ y(t) \ge k\int\limits_0^t b(\tau)d\tau, \end{cases} \qquad (7)$$

which estimate the volumes of resources involved in the production process at the moment t.

Therefore, the production function in this case will be

$$z(t) = \min\left\{k\frac{\int\limits_0^t a(\tau)d\tau}{a(t)}, k\frac{\int\limits_0^t b(\tau)d\tau}{b(t)}\right\} =$$

$$= k\min\left\{\frac{\int\limits_0^t a(\tau)d\tau}{a(t)}, \frac{\int\limits_0^t b(\tau)d\tau}{b(t)}\right\}. \qquad (8)$$

Example 2. Suppose that the production volume changes in the period $[0,T]$, according to the law $V(t) = t$, while the unit expenses of the resources are: $a(t) = 1 + \frac{1}{t+1}$ and $b(t) = 2 - \frac{1}{t+2}$, respectively.

We will determine the functions $x(t)$ and $y(t)$ that express the quantities of the resources involved in the production process at the moment $t \in [0,T]$. According to (7) $(k=1)$ we have: $x(t) \ge \int\limits_0^t a(\tau)d\tau = \int\limits_0^t (1 + \frac{1}{\tau+1})d\tau = t + \ln(t+1)$ and

$y(t) \ge \int\limits_0^t a(\tau)d\tau = \int\limits_0^t (2 - \frac{1}{\tau+2})d\tau = 2t + \ln\frac{2}{t+2}$.

That's why (8) gives

$$z(t) = \min\left\{\frac{x(t)}{a(t)}, \frac{y(t)}{b(t)}\right\} =$$

$$= \min\left\{\frac{t + \ln(t+1)}{1 + \frac{1}{t+1}}, \frac{2t + \ln\frac{2}{t+2}}{2 - \frac{1}{t+2}}\right\} \quad \text{or}$$

$$z(t) = \min\left\{\frac{(t + \ln(t+1))(t+1)}{t+2}, \frac{(2t + \ln\frac{2}{t+2})(t+2)}{2t+3}\right\}.$$

It can be easily verified that $z(t)$ really permits getting the production volume $V(t)=t$, according to (2), in the period $[0,T]$.

References

1. Rodica BERZAN. *Evaluarea cheltuielilor pentru resurse în procesul de producție.* Conferința Științifică Internațională "Competitivitatea şi inovarea în economia cunoaşterii". Academia de Studii Economice din Moldova, 24 - 25 septembrie 2010.
2. Rodica BERZAN. *Unele aspecte ale determinării funcției de producție.* Analele Academiei de Studii Economice din Moldova. Ediția a VII-a. Editura ASEM, Chişinău, 2009, p. 437-440.
3. Rodica BERZAN. *Funcția de producție şi proprietățile ei*. Analele Academiei de Studii Economice din Moldova. Ediția a VI-a. Editura ASEM, Chişinău, 2008, p. 385-388.

THE BALANCE OF PAYMENTS - A FACTOR OF SUSTAINABLE ECONOMIC DEVELOPMENT

Camelia MILEA[*], Alina Georgeta AILINCĂ [**], Adina CRISTE[***], Iulia LUPU[****]
[*] Financial and Monetary Research Centre „Victor Slăvescu", Bucharest, camigheorghe75@gmail.com
[**] Financial and Monetary Research Centre „Victor Slăvescu", Bucharest, alina.glod@gmail.com
[***] Financial and Monetary Research Centre „Victor Slăvescu", Bucharest, cristeadina@yahoo.com
[****] Financial and Monetary Research Centre „Victor Slăvescu", Bucharest, iulia.lupu@gmail.com

Abstract. Sustainable development is a sort of systemic thinking and represents the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. All definitions of sustainable development require that we see the world as a system that connects space and time. In this respect, the balance of payments represents a statistical declaration that records the transactions of an economy with the rest of the world. Also, it is a reflection of the quality of economic development and citizens' life in that country. In the process of Romania's joining the Euro area, one field of major importance for sustainable development is represented by the balance of payments. Its sustainability and, implicitly, durability symbolizes a fundamental determinant of a healthy macroeconomic policy, and it is achieved through a series of factors such as: imports focused on economical growth; generative exports directed towards economic opening; foreign investments and supporting loans for structural transformation and sustainable economic development, loans for financing the budgetary deficits created by restructuring the economy (using loans to restructure activities, which will generate covering resources). In order that the balance of payments to be a durable development factor it is essential that it doesn't become a way for allowing outflows of domestic income or inflows which have a negative effect on the economic development.

Keywords: balance of payments, sustainable development, investments, loans

1. Introduction

Sustainable development represents the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains the following two key concepts: the concept of needs and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs. In theory, a development that is sustainable and not damaging to the planet is very possible. Of course, in reality there are a lot of politics and challenges involved.

A system's ***durability*** implies development on its own, with minimal outside influence, taking into account the interests of present and future generations, meaning that resource management should be made so that future generations do not suffer from the drastic reduction of resources' level. In contrast, the concept of ***sustainability*** requires the intervention of an external factor to stabilize or maintain the system on the desired trajectory.

One of the economic fields of major importance to any economy is the foreign one, expressed and defined best by the balance of payments. According to the International Monetary Fund Balance of Payments Manual, the balance of payments represents a statistical declaration that records, systematically, the transactions of an economy with the rest of the world, in a certain period of time. Also, it is a reflection of the quality of the economic development and citizens' life in that country.

In the process of Romania's joining the Euro area, one field of major importance for sustainable development is represented by the balance of payments.

The sustainability and durability of the balance of payments symbolize a fundamental factor of a healthy macroeconomic policy, and it is achieved through a series of other factors, that the authors have highlighted in this article, particularizing the specific characteristics of each determinant, and the conditions that they must satisfy. Among these factors, there are the following: imports focused on economical growth; generative exports directed towards economic opening; foreign investments and supporting loans for structural transformation and sustainable economic development, loans for financing the budgetary deficits created by restructuring the economy (using loans to restructure activities, which will generate covering resources).

It has been considered the term "sustainability" in order to describe the factors ensuring the improvement of the balance of payments development, and thus its contribution, supported by appropriate economic policies, to sustainable development of the emerging economies.

On the one hand, the problem of balance of payments sustainability occurs when the current account deficit is large and persistent. On the other hand, the balance of payments sustainability implies, also, the existence of "sustainable" sources for financing the current account deficit. In order to be a sustainable development

factor of the economy, the balance of payments evolution must fit into the general trend of economic development. Furthermore, in managing the balance of payments it is necessary a consistent decision, both at the economic agent level and the state level, meaning that imports should not be a substitute for domestic production and exports should depend, to a lesser extent, on imports.

2. Literature review

The concern about sustainability has been raised over the past decades and the concept is present among a wide range of social and natural science researchers. Usually, the available literature reviews have a disciplinary focus (ecological economics or environmental science) and a comprehensive overview is hard to find. In his paper, Pezzoli (1997) [1] identified and conceptually mapped ten fields of discourses by articulating four key challenges concerning: holism and co-evolution, social justice and equity, empowerment and community building, and sustainable production and reproduction. A more precise link between sustainable development and the economic analysis (including balance of payments) is done in the paper of Taylor (1996) [2] where the key assumption is that there are connections between the current level of economic activity (or capital utilization) and capital formation (that is determining the growth rate of potential output), such a relationship being imposed by the need for external balance. The author affirms that in the case of a developing country, more economic activity attracts intermediate and other forms of imports with a high gross capital formation content, while it may cut back on export sales. In the same time, for a given trade deficit (for instance, determined by net interest rate paid abroad for new private or public capital inflows), there is an inverse tradeoff between capacity utilization and growth rate of potential output.

Dellink, Bennis, and Verbruggen (1999) [3] paid an explicit attention to the "ecological trade balance", which measures the (environmental) balance between the domestic production structure and the domestic consumption structure. Engaging in sustainable economic structures implies that the analyzed country (Netherlands) "shifts" environmental pressure abroad.

Discussions about the factors that have a strategic influence on the balance of payments are dated back in 1958 when Bernstein [4] published his paper. One novelty at that time was the definition of a "proper" balance of payments: "*a proper balance of payments is one that enables a country, ... , to meet its international payments ... without compelling it to keep economic activity below a desirable level or to restrict imports*." Beyond the subjectiveness of the word "proper", the definition can be a start in analyzing the sustainability of a balance of payments.

Countries deal with balance of payments deficits by financing them or by pursuing adjustment policies. The growing globalization of financial markets has led to a debate about the sustainability and the desirability of global imbalances, the concept of current account sustainability being the focus of research and policy debate in economics. Reisen (1997) [5] highlighted the difference between unsustainability and undesirability. Foreign savings sharply decrease because they finance a current account deficit that is unsustainably large. In particular, during reform episodes a deficit may occur as a result of a desired stock adjustment from financial assets into real assets in the case of an investment boom, because the expected profitability of real assets has improved. This kind of current account deficit is temporary inevitably and undesirable as well. The author introduces the concept of the "current account benchmark" that is defined by the source of the current account deficit, but also the size and the time profile of the balancing adjustment.

During the last decades most financial crises highlighted the part played by large current account deficits in the run-up to crisis episodes. In these lines, Corsetti et al. (1998) [6] concluded that, on the whole, the countries most affected by the currency crises were those which had persistent current account deficits throughout the 1990s, without implying that a large deficit always leads to a crisis, nor that a crisis can only occur if a large current account deficit is present (Summers, 2000) [7]. This result is confirmed by Radelet and Sachs (2000) [8], Kamin et al. (2001) [9] and Edwards (2004) [10], whereby Edwards shows that the probability of experiencing abrupt current account reversals is closely linked to the size of current account deficits.

Studying the current account sustainability in seventeen transition economies, Aristovnik (2006) [11] observed that if the level of FDI flows is kept in the medium run, almost all countries could optimally have a higher level of external deficit, with the exception of countries such as the Baltic States, Hungary, Macedonia, Moldova and Romania. The conservation of relatively large FDI inflows to national economies is a key priority in securing future external sustainability. The empirical results indicate that current account deficits of transition economies that exceed 5 percent of GDP generally involve problems for their external sustainability.

Dumitru and Dumitru (2009) [12] focused on the current account sustainability in Romania by estimating its structural component, based on an inter-temporal perspective. The empirical results disclosed that the structural current account deficit could range between 6.3% and 10.9% of GDP, depending on the model used and the econometric procedure, the main drivers of the current account deficit in Romania, as well for other European transition countries, being the economic convergence factors.

3. Sustainability Factors for External Balance of Payments

Imports centered on economic growth represent one of the sustainability factors for the balance of payments. Therefore, the Romanian economy should be endowed with new technology and equipment in order to provide a high labour productivity.

Imports should be centered on developing both strategic economic fields and those industries which ensure high added value products. Such a direction creates premises for a sustainable development of the economy. The structure of the Romanian imported goods reveals that the largest share is represented by highly manufactured products. [13]

We would be tempted to expect that in Romania imports have had positive effects, such as: the increase in the quality of products, the enhancement of the economic agents' interest for improving products' quality and the promotion of production and commercial policies meant to create and to maintain comparative and competitive advantages. In fact, if we take into account the economic developments (the volume and the structure of stock production, the changes in the purchasing power of households income, the households consumption structure), we find different, even opposite conclusions. Imports have represented a little support for the economic restructuring and modernization process, and they have also induced a decrease in demand for domestic goods, which have a weaker quality or an unfavorable price/performance ratio.

Generative exports, directed towards economic opening are another sustainability factor for the balance of payments**.** Such an orientation requires investments designed to increase the external competitiveness, the products' quality and productivity. In this respect, the economic policies should play an active role both in guiding economic agents towards those activities which provide high added value products for export, and also in supporting the development of these activities by incentives for developing the strategic industries and fields.

In order to ensure the sustainability of the balance of payments, exporters should concentrate on gaining stable external markets where to sell efficiently the domestic products, and on maintaining and improving the market shares.

From the efficiency point of view, the trade relations are preferred to be durable. Thus, the long term trade relations, based on mutual trust and respect, help limit the marketing and distribution costs, such as: expenditures for creating the distribution networks, advertising expenditures, expenditures for connecting new trade partners.

However, the economic dependence on external markets could represent a vulnerability of the economy to the external shocks.

In Romania, the structure of exports [13] consists of a predominant share of medium complexity technology goods, and also of low processing goods, which do not provide significant competitive advantages on external markets. A small added value gained on exports limits the sources of financing for imports and harms the domestic producers.

Another sustainability factor for the balance of payments consists of **attracting foreign investments in order to sustain economic development**.

On the one hand, for an emergent country, with insufficient internal savings to cover the financing needs, the foreign investments are necessary for economic growth and for having a sustainable development path. The foreign investments represent not only a capital influx, but also a modern and free of charge technology influx. These investments entail also financial discipline, an important condition for an efficient functioning of the market economy. If the foreign investments generate high profit rates, the development of activities in strategic or sensitive fields of the economy and job creation, then one may say that they have a positive impact on the receiving country, and that they are efficient. In order to benefit from the positive role of foreign investments it is necessary to create a favorable economic environment for them, by providing an adequate, coherent and stable legal and institutional framework.

On the other hand, the investments flows into the economy should be dealt with prudence, considering that they may lead to the appreciation of the national currency, with negative effects on the trade balance. Yet, the national economy is the subject to relatively modest financial instability, if foreign capital inflows finance investment projects that bring about high profits.

Throughout the transition period, Romania has experienced a continuous influx of foreign investments, with variations from year to year, and with a drawback occurring as a result of increased risk aversion in global financial and economic crisis conditions, between 2008 and 2010. [14] [15]

Investments which entail other investments are also a sustainability factor for the balance of payments. The economic activities are interacting. The foreign investments in one activity may produce the development of some economic activities that will bring further related investments (the development of business conglomerates). [16]

In the category of sustainability factors of the balance of payments they may also be included the **loans for sustaining economic activity** (to develop other economic branches, related to the main industry, which may generate incomes for loans repayment). Getting loans for a given activity helps to develop both upstream activities (the suppliers) and downstream activities (the customers).

Supporting loans for transformation is another sustainability factor of the balance of payments. There are two types of loans for transformation:

- *for structural changes* of the economy to adapt to the existing demands and conditions. Thus, in 1990, Romania had an economic structure, specific to a planned economy. The transition from the planned to the market economy involves, necessarily, transforming the economic structure in order to respond to the new conditions. The legislation and institutions, the procedures for conducting economic activities, and also the economic policies' transmission mechanisms have undergone fundamental changes, to adapt to those existing in developed and democratic countries. The financial funds used for this purpose does not produce immediate profits, but they can rather be considered as long-term investments for the

economic development. Therefore, these loans are usually paid back from budget funds.

- *for stance changes* (from instability to stability, from disequilibrium to equilibrium). During the first years of the political regime change in Romania (1990-1993), the economy declined, suffering imbalances and instability on the domestic markets, and significant changes of the system. In order to overcome this situation, the authorities attempted to boost the Romanian economy by applying both a wide-range of reforms, made on several fields (institutional, legislative, political, social and economic) and macroeconomic stabilization programs. All these actions have given some positive results, as proved by the real GDP growth rate trend which has had positive values, especially between 2000 and 2008. [14] [15]

The loans for state changes are contracted by the national government and therefore they are a part of the public debt. These loans may be considered as long term investments, too.

Loans for financing the budgetary deficits created by restructuring the economy (by using loans to sustain those activities which generate covering resources) are also a sustainability factor for the balance of payments. Thus, directing the loans and grants towards research and development activities, towards stimulation of those productive or potentially productive industries, and towards infrastructure may represent a sustainability factor for the balance of payments.

4. Conclusions

In order that the balance of payments to be a sustainable development factor it is essential that it doesn't become a means of allowing outflows of domestic income or inflows which have a negative effect on the economic development, fact that has happened in Romania mostly between 2003 and 2008, due to the balance of current account deficit, caused by the trade deficit. During this period, the share of current account deficit in GDP has been extremely high, raising doubts concerning the sustainability of the current account. Since 2009, in the context of foreign investors' risk aversion increase and reduced demand (internal and external), Romania's current account deficit decreased considerably. [14] [15] This trend should be supported by structural economic reforms in order to be a factor of sustainable economic growth.

According to theory and to empirical studies, for emerging countries, the current account deficit is an acceptable situation, explained, partly, by the need of upgrading and modernization of the whole economy, as a result of the restructuring process. This situation is sustainable in the long term, if foreign loans and investments are directed toward those economic activities which should bring about the development of a competitive domestic supply, the expansion of the strategic fields of the economy and of those industries that provide high added value products. In time, in order to create the prerequisites for sustainable development of the economy, the emerging countries should have the same structure of the balance of payments as the developed countries, namely current account surplus offset by capital and financial account deficit.

References

1. Pezzoli, K.: *Sustainable development: A Transdisciplinary Overview of the Literature*. Journal of Environmental Planning and Management, Vol. 40, No. 5, 1997, p. 549-574, London, UK
2. Taylor, L.: *Sustainable Development*. World Development, Vol. 24, No. 2, 1996, p. 215-225, ISSN: 0305-750X(95)00130-1, Great Britain
3. Dellink, R., Bennis, M., Verbruggen, H.: *Sustainable economic structures*. Ecological Economics, No. 29, 1999, p. 141-154, ISSN: 0921-8009, Published by Elsevier B.V.
4. Bernstein, E. M.: *Strategic Factors in Balance of Payments Adjustment*. The Review of Economics and Statistics, Vol. 40, No. 1, Part 2. Problems in International Economics, February 1958, p. 133-137, Published by MIT Press
5. Reisen, H.: *Sustainable and Excessive Current Account Deficits*, Working paper no. 133, May 1997, The United Nations University, World Institute for Development Economics Research
6. Corsetti, G., Pesenti, P., Roubini, N.: *What Caused the Asian Currency and Financial Crisis? Part I: A Macroeconomic Overview*, NBER Working Paper, No. 6833, 1998
7. Summers, L. H.: *International Financial Crises: Causes, Prevention, and Cures*, American Economic Review, Vol. 90, No. 2, p. 12-28, 2000
8. Radelet, S., Sachs, J.: *The Onset of the East Asian Currency Crisis*, NBER Working Paper No. 6680, 2000
9. Kamin, S. B., Schindler, J. W., Shawna, S. L.: *The Contribution of Domestic and External Factors to Emerging Market Devaluation Crisis: An Early Warning System Approach*, FBR International Finance Discussion Paper, No. 711, 2001
10. Edwards, S.: *Thirty Years of Current Account Imbalances, Current Account Reversals and Sudden Stops*, NBER Working Paper, No. 10276, 2004
11. Aristovnik, A.: *Current Account Sustainability in Selected Transition Countries*, Working Paper, No. 844, November 2006, William Davidson Institute
12. Dumitru I., Dumitru I.: *An Assessment of the Current Account Sustainability in Romania an Inter-Temporal Perspective*, Romanian Journal of Economic Forecasting, No. 2, 2009
13. Popa, C., Crăciun, F., Panait, E. D., Mincu, M., Mocanu, A.: *Buletin statistic de comerț international. International Trade Statistics*, No.12/2010, National Institute of Statistics, ISSN 1843-049X, ISSN-L 1843-049X, Bucharest
14. National Bank of Romania: *Annual reports* 1990-2009
15. National Bank of Romania: *Monthly reports*, December 2010, February 2011
16. Porter, M. E.: *On Competition* 2008, ISBN 978-973-728-278-1, Meteor Press Bucharest (in Romanian)

A POSSIBLE TAX MODEL FOR ENVIRONMENTAL

Gabriela Cornelia PICIU [*], Carmen Lenuța TRICĂ [**]

[*] Financial and Monetary Research Center „Victor Slăvescu", Bucharest, Romania, gabriela_piciu@yahoo.com

[**] Academy of Economic Studies Bucharest, Romania, carmen_trică@yahoo.com

Abstract. In this paper it is emphasized the crucial importance of taxes as a tool for obtaining a fair market price but also to generate the positive benefic effects of development, in consonance both with the economic scientific research methodology and the political will. This implies the idea of a round table discussion organized by Finance Ministry with participation of specialists both in fiscal budgetary expertise area and other fields of research and interests.

Such initiative illustrates the well known connection between disciplinary-multidisciplinarity-transdisciplinarity, in the context of managerial process of analysis, elaboration and implementation of fiscal strategy taking into account the principles of fiscal stability, accountability and transparency.

Keywords: environmental taxes, model for environmental, political and fiscal instruments

1. Introduction

The intensive application of environmental taxes is inadequate due to the actual state of economic development, presenting a high potential for economic distortions. Non-application of environmental taxes could also lead to economic aberrations promoting environmentally harmful consequences both for technical economic and socio ecologic areas due to a superficial evaluation (apparently profitable) of a very complex socio economic panel.

Interest in environmental taxes is usually generated by intentions of their implementation by the EU. Romania union must ensure the compatibility with the communitarian financial systems and at the same time have a border harmonization of taxes.

This is important to prevent both a possible economic destabilization of border regions and other aberrant economic processes.

2. Transitional and collateral measures for tax regulation and implementation

Another measures with an impact on environmental issues take into account the macroeconomic framework by economic incentives attracting high technology industries with a low impact on the environment both indigene and foreign economic agents.

Despite the fact that long-term effects are positive in generally, the short term measures not be neglected to prevent aberrant development of economic delocalization of firms as a result of the initiative of the market factors. Thus must be established joint multidisciplinary committees to analyzing, evaluating, monitoring and development of implemented of these implemented environmental fiscal measures.

The long run outlook appears optimistic, but on short-term appears the risk of worsening economic situation. This could be managed through braking those foreign investments apparently positive but that in fact are environmentally harmful: the lower productivity of environmental expenditures generates more taxes probably due to the non professional management of fiscal and environmental regulation framework.

It is therefore advisable to make these developments in partnership with EU authorities to obtain the necessary technologic and financial support.

The development by Romania of these charges involves an intense exchange of information's involving many actors: governmental and non governmental (like research institutes in the specialized areas affected.

In this context will be necessary establishment and development in the Finance Ministry of a special department specialized in theory and practice of environmental finances to analyze, elaborate and implement the specific environmental fiscal strategy in the larger context of sustainable development strategy of the government

3. The economic culture and science

The tax system can stimulate the local scientific research if it is applied on the basis of a financing policy of development and research strategies in order to target national interest domains.

A new domain that aims to unify the economic notions with those from natural and environment science is the "Ecological Economy"[1], giving signification and

better objective, realizing the complex interconnections of the human civilization. It was generally applied through the tax exemption for sponsorship support and can be developed through tax exemption for products that develop local applicable technologies.

The cultural development is directly related to economic progress, from the appearance of the financing capacity and consumes the cultural activity.

The main headquarters of investments need to consider the following aspects:

- Providing qualified workforce with higher education, through the development of universities in the existent network;
- Is necessary to develop new forms of education (adult education and technical- vocational education);
- To equip universities with the latest technology to encourage the applied research;
- To develop the private sector – partnership with universities to facilitate the technologies transfer and know- how.

4. Impact Assessment of proposed fees

Proposals for implementing progressive "green" taxes as the main obstacle in Romania have the current level of economic development.

The main types of taxes [2] and their potential effects can be framed as (Table 1):

Table 1 Classification of political and fiscal instruments

<table>
<tr><td colspan="5">Classification of instruments oriented political and fiscal decentralization, flexibility in individual decision</td></tr>
<tr><td colspan="2">Minimal flexibility</td><td colspan="2">Moderate flexibility</td><td>Maximum flexibility</td></tr>
<tr><td colspan="3">Maximum involvement of the Government</td><td colspan="2">Increased private initiative</td></tr>
<tr><td colspan="2">Oriented Control</td><td colspan="2">Market oriented</td><td>Issue oriented</td></tr>
<tr><td>Regulations and sanctions</td><td>Taxes</td><td></td><td>Final intervention</td><td>Legislation</td></tr>
<tr><td colspan="5">General Sample</td></tr>
<tr><td>Standards: Government restricts the nature and amount of pollution or resource use for polluters and resource users - framing is monitored and are given sanctions (fines, closure, imprisonment for infractions)</td><td>Payments for the use or user: Payments to the Government for individual polluters or resource user’s reliance on the amount of pollution or resource use and environmental nature.</td><td>Tradable permits that the Government establishes a system of negotiable pollution permits use of resources, auctions or premises and monitoring of compliance distributions. Polluters or resource users, such as trout fishing permits, negotiated at the price of a free market.</td><td>Government Support for the performance evaluation of programs that require the publication of environmental information used in end-user products. Performance is based on standard ISO14000 Environmental labels attached to organic products</td><td>Legislation strict accountability: The polluter or resource user pays for damages to those affected. Affected parties collect outcome agreements in court, through the process.x</td></tr>
</table>

These free market-based instruments also named economic instruments have a profound character of environmental protection policy due to creation of necessary incentives to change market behaviour, thus resulting better environmental conditions. The fundamental purpose of using these instruments is to internalize environmental costs.

Romanian economic system is already dominated by a high taxation, at the point of breaking the economic processes and its increase may bring negative effects. Increasing some fees is not justified only by reasons of harmonization with those enforced in the European Union and border harmonization.

Observing the macroeconomic indicators, it is clear that the Romanian economic system is already burdened with obsolete technology, low productivity [3] and carrying out additional tax measures only leads to the exclusion from market of some apparently necessary activities, but polluting.

Developing the economy privatization makes more complex the enforcement of tax and environmental policies. There are currently over 400.000 small and medium companies [4] with various activities that will have to be integrated in the tax and incentive system in order not to affect their competitively compared with the other European Union firms.

In terms of future harmonious development, turns out that tolerating polluting economic activities becomes unacceptable and their abolition by environmental regulations and fines is likely to cause social convulsions. The environmental taxes belong to this area and they have, on one hand, a stimulatory effect and on the other hand lead to gradual extinction by uncompetitiveness of the economic activity, not harmful effects, creating the basis for developing healthy economic activities instead. Therefore, the enforcement of these taxes is a very delicate issue, with political connotations and complex measure packages must be developed in order to reduce unwanted effects of their implementation.

4.1. Taxes on transport

But it is possible and advisable to optimize the method of tax implementation as follows: water/fuel fees that include taxes for water/polluant emissions; the tax for using leaded gasoline and diesel fuel with high sulf content must be increased, so that it becomes more expensive than the ecological product, but only joined with incentive measures to convert and adjust engines to use fewer contaminant products.

In the same package of measures will be introduced a negative tax for users of catalyst vehicles, favoring the use of new vehicles having ecological systems. In this way, in a relatively short time, without the need of non ecological product prohibition legislation, they disappear from the market, giving economy the necessary respite to adjust to the new situation.

The organic taxes have a positive role in resolving both different problems of environment created from economic development, in prevention of the negative effects that will affect the economic development, and the present problems.

Between the actuality scientific studies, a major importance shows the prevention of the planet heating. Will be necessary complex measures at governs level that regulate the energy production.

From the view point of local pollution, transport represents an important pollution factor and, by his nature, this problem can be resolved at level of every member state.

On the environment state, Romania has a lot of problems to resolve. In the transport field a wise politic of applicable taxes, based on science and economy in harmony with that from neighbors countries, is meant to improve in short time actual environment problems.

Statistics shows that the transport is one of the main causes that affect the environment negatively, been responsible for 25% of the emitted CO_2 in UE countries [5].

The road transport have a strong component national and local, but, intensification European integration conditions, the component of international transport is in progress occupying an important share. In the existent data base, it prevents an approximate raise of 42% to the extern costs of the urban agglomerations being first the effect of environment damage because of road and air transport.

4.2. Reasons for applying transit duties

The development and integration of European economies implies the growth of exchanges between the states which are integrated in the European Union, in different field such as passenger transport, goods exchange and communications.

Besides the positive component of economic and infrastructure functions, transport brings also negative effect on the economy and the environment.

All the above motivate the measures for the improvement of transport domain, adoption of more effective forms of transport. As a solution, for short-term, the development of rail transport is able to reduce for over 4 times global costs of transports and, to gain profit as well. For example, for road transport, at a tone of freight transported over a distance of 100 km, 2,2 liters of fuel are consumed whereas on rail, just 0,5 [6]. Because most European railways are electrified, the environmental impact is minimized, the energy having a multiple origin which depends on the national energetic structure. The reorientation of road transport to naval and river transports, and to rail transport as well, represent important future alternatives.

4.3. Types of transit duties imposed in Europe

The evolution of transports has determined European states to look for the best methods for

compensation of the losses suffered by the economies and local communities of international transport.

The main reasons that led to each country choosing a method of imposing as a combination of the above criteria have been the necessity to obtain budget revenues - after a fair taxing - and fluency in customs points, doubled by the need to control the road [7].

Taxes based on weighing - These are based on direct weighing methods – having a specialized weighing system so that we can precisely determine the weigh of the vehicle. The operation requires a specialized operation point and takes a few minutes for every vehicle. The fee is equitable but takes time and it represents a taxable operation that increases the cost of transportation, often useless. It is hard to control in the field by the police patrols.

Taxes based on the determination of the weigh class depending on the number of axels - This tax represents a practical method to fit the vehicle into a tax scale, making it easy to check. Corroborated with the measured weigh, it increases the smoothness of taxing being proportionate with the distress of the carriageway's structure. More axels having the same weigh reduce pressure and bending of the carriageway lane. It is just apparently valid because, in most cases, the deterioration effect is known to be caused statistically by a lot of factors.

Taxes based on the distance - The distance is an interpretable parameter, although directly proportional with the amount of damaged national road – it is relatively easy to measure, at the exit point, giving the idea of a control of the route selected.

Taxes based on the transit duration - Most countries discourage one-day transit thru various methods. Small countries with modern road structure give one-day transit passes, being possible that, not speeding, the country to be crossed in less than half of day. Other countries, like Hungary, discourage one-day transit from financial and touristic reasons [8]. Nonetheless it is also a factor of increasing the road safety, making the drivers not to worry that their vignette will expire in a couple of hours. Under the commercial aspect, the tax price decreases proportionally with the duration, as a power function – the exponent and the specific value varies from a country to another – but, in fact, it shows the incapacity to economically abuse the pass authorization

Taxes based on pollution - The development of taxes based on the technical condition of the vehicle has a powerful environmental equity character and is meant to collect founds proportionally with the amount of pollution and to stimulate the clean vehicles. Some states, like Czech Republic, that give 25% off for Euro-2 and 50% for Euro-3, are registered in the European policy on fuel quality and reducing pollution.[9]

Taxes based on a combination of the above criteria - European countries apply a large combination of the taxing criteria, in the attempt to find an optimal solution between the taxing accuracy and the ease of application but the problem remains a subject of debate and permanent improvement [10].

5. Conclusions

It is visible that the main source of budgetary income consists of taxes on income, profit and VAT. Meanwhile, green taxes have been applied in various forms, but they could never generate more than a few cents of national budgets.

Intensive application of green taxes on time, inadequate economic development stage, presenting a high potential for economic distortions. Non-application of environmental taxes lead to economic aberration, promoting economic activities harmful to the environment and local communities, but which appear profitable because of incompleteness of the socioeconomic panel.

Interest generated from environmental taxes is their intentions for implementing the European Union. Romania has to ensure compatibility with the union and financial systems at the same time to have a border harmonization of taxes. It is important to prevent economic destabilization of the border regions and prevent aberrant economic processes.

References

1. Bradley, D.: *Ecological Course Note,* University of Pittsburgh, 1996
2. Arhip, I.: *The attractiveness of the Northern Transylvania Romania,* North West Regional Development Agency, Programmes Monitoring Division, 2005, p. 1-18
3. Mlesnita, R. A.: *Romanian Development Agency – RDAs,* Transilvania Business Center, 2003
4. Mitulescu, S.: *Environmental Protection – a major problem of the Europe of tomorrow,* INFRA/IWW, 2004
5. Statie, I.: *Railway Transportation – an Efficient Solution for Noxious Emissions,* INFRA/IWW, 2004
6. Peterlini, E.: *Innovative Technologies for Intermodal transfer Points,* Competitive and Sustainable Growth Programmed, 2001, p. 1-23
7. European Commission, *Quality of petrol and diesel fuels,* Air pollution, 1998, p. 1-6
8. Woxenius J., Roso V., Barthel, F.: *Terminals as part of the Swedish Transport System I-an overview,* Meddelande, 2003, p. 1-84
9. Bergqvist R.: *The Potential of West European Sea-based Intermodal System,* Goteteborg University Master Thesis, 2002
10. Markham, L.: *Ecological costs of not planning,* Forest planning, Wisconsin Ed, 2005

GLOBALIZATION AND THE ENVIRONMENT

Gabriela Cornelia PICIU [*], Carmen Lenuța TRICĂ [**]

[*] Financial and Monetary Research Center „Victor Slăvescu", Bucharest, Romania, gabriela_piciu@yahoo.com

[**] Academy of Economic Studies Bucharest, Romania, carmen_tricǎ@yahoo.com

Abstract. In relation with the matter approached, the main interests that stimulated globalization, its influence on the system of interests of each country are analyzed, as well as on the direction of the deterioration of the relations between nature, society and economy.

Starting from the predominantly negative effects generated by the orientation of globalization according to the criterion of profit maximization for a small minority, in the present paper it is shaped the possibility of re-orienting globalization based on the criterion of the triple efficiency (ecologic, social and economic), that would assure the gradual re-balance of the relations between nature, society and economy.

The purpose of this paper is: to identify the key links between globalization and environment; to identify the major issues addressed in multilateral economic agreements that affect environmental sustainability; and to review priority policy issues affecting the environment.

Keywords: globalization, environment, negative impact, Ecological Crisis, Environmental Governance

1. Introduction

Like any market, the global marketplace is both an economic and a social construct. Intelligent globalization implies willingness to incorporate such fundamental values as fairness and equity – and knowledge about how our planet can best sustain the production and consumption patterns of now close to 7 billion people [1]. Environmental sustainability and social equity have emerged as key determinants of whether globalization is a viable economic development path for the 21th Century. How we manage the opportunities and risks associated with it is ultimately for everyone to chose.

Environmental standards are unequally distributed and the ability of governments to regulate and ensure compliance with them differs similarly. So environmental costs are not internalized in the market. The environmental and social ramifications are severe. We must establish a better understanding of the drivers behind a globalized economy — and its environmental consequences — as a basis for effective decision-making.

2. How does globalization affect the environment?

The dominant discourse on globalization has tended to highlight the promise of economic opportunity. On the other hand, there is a parallel global discourse on environmental responsibility. It's important to understand of these two dynamics - how environment and globalization are linked and how they are likely to interact.

Some examples of interaction between globalization and environment are: scale and composition of economic activity changes, and consumption increases, allowing for more widely dispersed externalities; income increases, creating more resources for environmental protection; techniques change as technologies are able to extract more from nature but can also become cleaner. from development goals; global interactions facilitate exchange of environmental knowledge and best practices; environmental consciousness increases with emergence of global environmental net-works and civil society movements; globalization facilitates the spread of existing technologies and the emergence of new technologies, often replacing existing technologies with more extractive alternatives; greener technologies may also be spurred; globalization helps spread a homogenization of consumption- driven aspirations; globalization makes it increasingly difficult for states to rely only on national regulation to ensure the well-being of their citizens and their environment; there is a growing demand and need for global regulation, especially for the means to enforce existing agreements and build upon their synergies to improve environmental performance [2]; globalization facilitates the involvement of a growing diversity of participants and their coalitions in addressing environmental threats, including market and civil society actors.

Conflicts of interest manifested in the unfolding of globalization indicate that this trend is subordinate to maximize profits. As a result of the tendency to generalize to maximize profit, the relationship between environment, society and economy were affected by emphasizing multiple crises (Figure 1).

¶

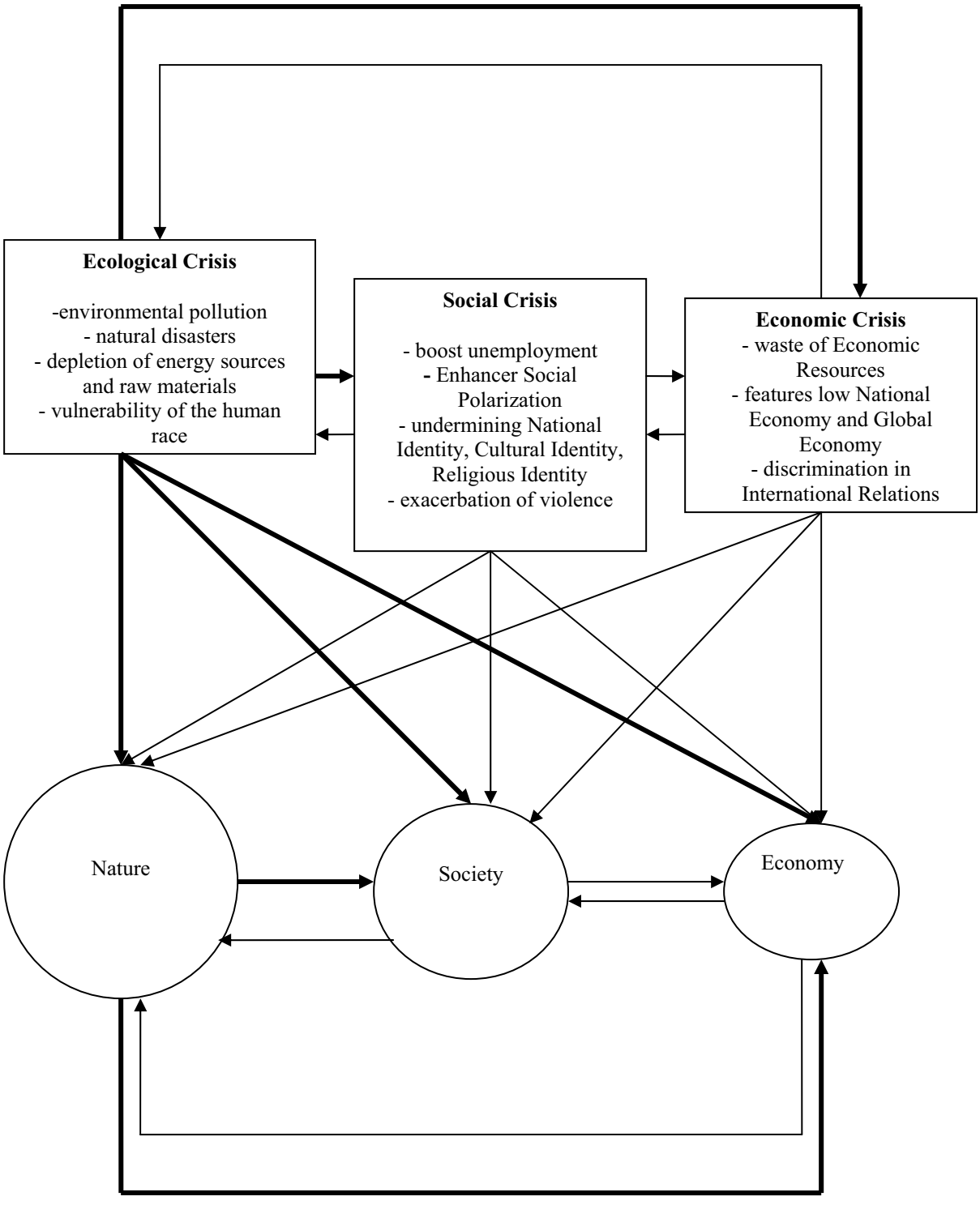


Figure 1 Relationship between environment, society and economy – crises

The linked processes of globalization and environmental degradation pose new security threats to an already insecure world. They impact the vulnerability of ecosystems and societies, and the least resilient ecosystems. The livelihoods of the poorest communities are most at risk.

3. Opportunity to consider the relationship between globalization and the environment

The human actions are depleting Earth's natural capital — putting such strain on the environment that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted. Governments will have to couple much more the horizontal distribution of environmental costs with vertical distribution between generations. If not, they will become famous — not for what they did while in power, but for the decisions they did not take when they had the opportunity.

We must combine visionary thinking with political brinkmanship and effective policies to consider fully the environmental consequences of globalization [3].

We should aim for the decoupling of environmental degradation from economic growth [4].

The challenge is to make sense of unfolding global trends as a basis for effective decision making. The evidence clearly demonstrates the fast changing conditions in which we live, consume, produce, and interact.

Transplanting industries to developing countries, job migration, increased transport of commodities and export of hazardous wastes, growth in tourism, rising world population, climate change, hyper-efficient long distance fishing technologies, and increased sourcing of natural resources in general — all help undermine the resilience of ecosystems everywhere, and carry with them the potential for more volatile global security.

Yet globalization also entails a number of benefits particularly relevant to the sustainable management of natural resources and ecosystems, not least the potential of the successful and effective sharing, take-up and deployment of more environmentally sound technologies and practices. Many of the technologies required are already fully proven, but not fully utilized [5].

The responsibility of securing the full deployment of these technologies and practices needs to move increasingly from government to business, industry and civil society. It must establish a framework where the demand for 'green' technologies, practices and policies is communicated from the bottom up, and where the governments cooperate collectively on the basis of common but differentiated responsibilities. Such an approach needs also to take into consideration that curbing the environmental consequences of globalization is an issue of the responsibility of governments to their constituencies, and hat it is not just related to the international assistance agenda. There is a striking lack of a coherent framework in world politics for considering these fundamental drivers. These processes are valuable, indeed crucial in enabling governments better to adapt to the environmental challenges posed by globalization.

A substantial response to this obligation depends on finding the proper solution to the globalization / environment equation — and doing so fast. The cost of inaction — or delayed action — will be extremely expensive not just in terms of financial losses and market deficiencies, but in terms of the irreversible loss in biodiversity and ecosystems.

If actors-Governments, non-governmental organizations (NGOs), the private sector, civil society, and the scientific and research community-have responded to environmental challenges in a variety of ways and have taken great strides towards incorporating environmental considerations in their day-to-day activities.

Increasingly, Government departments are called on to take environmental considerations into account, and consequently environment assumes a more important role in international relations and transactions. The participation of a broad range of ministries (other than those on the environment) in the negotiation and implementation of the Biodiversity, Climate, and Desertification Conventions and the increasing array of voluntary agreements, codes of conduct, and guidelines generated by the industry, banking, and insurance sectors all exemplify the encouraging trend [6].

Key areas for action must embrace the use of alternative and renewable energy resources, cleaner and leaner production systems world-wide, and concerted global action for the protection and conservation of the world's finite and irreplaceable fresh-water resources.

In the future, the continued degradation of natural resources, shortcomings in environmental responses, and renewable resource constraints may increasingly lead to food insecurity and conflict situations. Changes in global biogeochemical cycles and the complex interactions between environmental problems such as climate change, ozone depletion, and acidification may have impacts that will confront local, regional, and global communities with situations they are unprepared for. Previously unknown risks to human health are becoming evident from the cumulative and persistent effects of a whole range of chemicals, particularly the persistent organic pollutants. The effects of climate variability and change are already increasing the incidence of familiar public health problems and leading to new ones, including a more extensive reach of vector borne diseases and a higher incidence of heat-related illness and mortality. If significant major policy reforms are not implemented quickly, the future might hold more such surprises [7].

Over the last 30 years, therefore, the international community's quest for planetary stewardship has encompassed a variety of intergovernmental, governmental and civil society initiatives. The results are mixed and generally conceded to be inadequate. The disturbing trends in deterioration continue. It is also widely conceded that a much stronger system of environmental regimes is

essential, but those most deeply concerned have looked beyond this and asked what else must be done [8]. Several themes run through their efforts:

- The intergovernmental processes that constitute regimes are too closely allied with the forces that gave rise to the problems in the first place to produce real change.

Real change is only possible if we address the deeper issue of the forces underlying deterioration.

- The search for these underlying drivers leads quickly to institutions and ideas of extraordinary power: the large multinational corporations and their influence on major governments; an unflagging commitment to high rates of economic growth; consumerist and anthropocentric culture [9].
- Efforts fundamentally to change this operating system are essential, whether through wooing and conversion, creating powerful new incentives and disincentives, cutting its power centers down to size, or eroding its monopoly through community-based and other bottom-up initiatives [10].
- None of this is likely unless civil society ascends to a new prominence and new roles, and engages and a new politics the global environment.

Integral to the needed transformations is a change in values. A transformation which urges us to bring forth a sustainable global society founded on respect for nature, universal human rights and economic justice [11].

5. Conclusions

Nevertheless, despite this progress on several fronts, from a global perspective the environment has continued to degrade during the past decade, and significant environmental problems remain deeply embedded in the socio-economic fabric of nations in all regions. Progress towards a global sustainable future is just too slow. A sense of urgency is lacking. Internationally and nationally, the funds and political will are insufficient to halt further global environmental degradation and to address the most pressing environmental issues-even though technology and knowledge are available to do so.

The recognition of environmental issues is necessarily long-term and cumulative, with serious global and security implications, remains limited. The reconciliation of environment and trade regimes in a fair and equitable manner still remains a major challenge. The continued preoccupation with immediate local and national issues and a general lack of sustained interest in global and long-term environmental issues remain major impediments to environmental progress internationally. Global governance structures and global environmental solidarity remain too weak to make progress a world-wide reality. As a result, the gap between what has been done thus far and what is realistically needed is widening.

¶

References

1. Hempel, L.; *Environmental Governance: The Global Challenge*, Publisher Island Press, Washington DC, 1995
2. Castells, M.: *Information Technology, Globalization and Social Development*, United Nations Research Institute for Social Developmen (UNRISD), UNRISD Publications, Geneva, 1999
3. Porter, M., Van der Linde, C.: *Toward a New Conception of the Environment Competitiveness Relationship,* Journal of Economic Perspectives, Vol. 9, No. 4, Autumn, 1995, p. 97-118, ISSN**:** 1056-4926, New York
4. Brown, J.W., Chasek, P., Downie, D.L.: *Global Environmental Politics*, Publisher Boulder CO, Westview Press, 2006, p 25-27
5. Shafik, N.: *Economic Development and Environmental Quality: An Econometric Analysis*, Oxford Economic Papers 46, 1994, p. 757-773
6. Najam, A., Christopoulou, I., Moomaw, W.: *The Emergent System of Global Environmental Governance*., Global Environmental Politics, Vol. 4, No 4, 2004, p.23–35
7. Schelling, T.: *What Makes Greenhouse Sense*?, Foreign Affairs, Vol. 81, no. 3, May/June, ISSN: 0824-8001, Massachusetts, 2002, p. 73-81
8. Ruggie, J.: *Trade, Sustainability and Global Governance*, Columbia Journal of Environmental Law, vol 27, No 297-307, ISSN: 1472-0701, Columbia, 2002, p.297-307
9. Smarzynska, B, Shang-Jin, W.: *Pollution Havens and Foreign Direct Investment: Dirty Secret or Popular Myth?*, NBER Working Paper No. 8465, September, Cambridge, 2001, p.3-6
10. Stiglitz, J.: *Making Globalization Work*, Publisher W.W. Norton and Company, ISBN-10: 9780393061222, New York, 2006, p. 251-255
11. Stavins, R.: *Economics of the Environment: Selected Readings*, 4th Edition, Publisher W.W. Norton and Company, ISBN-10: 0393975231, New York, 2000, p.70-73

EXPLORING THE TOURISM IMAGE OF ROMANIA

C. SASU[1], Luciana SASU[2]
Al.I.Cuza University, Bd. Carol I, nr. 11, Iaşi, Romania, Technical University Iaşi
e-mail: c.sasu_49@yahoo.com, lil-lusiana@yahoo.com

Abstract: The purpose of this research is to identify an efficient mix of communication to promote tourism image of Romania as a destination for European tourism map reference. Conducting this research included three steps: an audit of tourist destination Romania by means of a documentary study; conducting a survey aimed to target the German population. Data were collected using a telephone questionnaire; proposing a mix of tourist destinations to promote Romania's tourism image in Germany. From our research resulted that from the point of view of the German tourists the most interesting vacations in Romania would be: Black Sea holidays; holiday tours (the Danube Delta, Transylvania, Bukovina, group coach tours); thematic channels (Dracula's footsteps, group tours by bus); cultural tours combined with stays at the Black Sea. Concerning the channels of communication, taking into account the efficiency of communication grid for tourists from Germany, it must be considered the following: Internet, events, billboards, advertising on transport, newspapers and magazines (general interest publications, newspapers, travel magazines).

1. Introduction

Despite the great variety of tourism attractions, Romania has a marginal place in international tourism traffic. The resources available to Romania are not used effectively and at their full potential.

To be interesting to potential tourists, Romania should focus its efforts to create a specific image and to promote it. Romania's country brand was a matter of controversy, from the "Eternal and fascinating Romania" to "Fabulospirit", a word coined to describe our country. And today, the discussion about Romania's image communication is restarted. So the branding process is a significant component for the development as a tourism destination internationally [4]. Without a functional tourism development strategy and a country brand remaining in the consciousness of foreign customers as a quality brand, Romanian tourism greatly reduce its chances of being considered at its true value on the global market. Therefore, the subject is very topical internationally. Many nations are engaged in building and promoting a brand and not just for tourism. Increasingly, many governments are beginning to understand that no country can no longer ignore how other countries see that country.

This research comes to meet the necessity to define and promote an attractive tourism image of Romania, in order to differentiate Romanian tourism among the competitors in the area.

2. Purpose, objectives and research hypothesis

The purpose of this research is to identify an efficient mix of promoting tourism image of Romania for attracting foreign tourists to our country as a destination for European tourism map reference.

Research objectives are:

1. Identifying the components of the tourism destination image of Romania among the population in Germany.
2. Designing a grid of effective communication for potential tourists from Germany.
3. Identifying an efficient mix of tourism destinations to promote Romania in order to improve its image in Germany.

Research hypothesis:

1. The image of Romania tourism destination among the population of Germany is a neutral one (neither good nor bad).
2. There are sources of information used in campaigns to promote the tourism image of Romania which have little relevance in the belief the individual to decide a trip to this destination.

3. Research methodology

Conducting this research included three steps:

The first step consisted in achieving an audit of tourism destination Romania. Through documentary study were examined issues such as:

1.The movement of tourists in Romania;
2.Marketing mix variables, focusing on promoting tourism in Romania;
3. Current state of Romanian tourism (SWOT analysis).

The second stage consisted in conducting a survey aimed at targeting the German population.

The research aims to identify an efficient mix of Romania to promote tourism destinations, in order to improve its image, in order to increase our country's

attractiveness among potential German tourists. Data are collected using a telephone survey questionnaire was translated into German.
The last step was aimed to develop conclusions on Romania's tourism image and effectively proposing a mix of tourism destinations to promote Romania's tourism market in Germany.
Research strategy consisted of the following methods: induction (inductive approach is the dominant one), dialectic, observation (continuous process conducted throughout the research) and qualitative approach complementing the quantitative. Some techniques will appeal to PEST analysis, SWOT analysis, benchmarking, based on questionnaire survey, sampling, clustering, tabular, graphical representation, statistical analysis. Instruments to be used: official statistics, regular reports and studies (radiographs necessary to establish the current situation in the proposed research), questionnaire, rating scale, utility and table. Some have called for scaling processes, statistical clustering and classification.
To test and validate / invalidate the results, we turned back to initial, intermediate or final conditions, to the mode we made estimates and analysis by even calling into question some assumptions or conditions.
Design research plan imposed decisions on data sources, the General Inspection methods, research instruments, sampling design and methods of contact. We choose for investigation the survey and for developing our own research tool. The questionnaire was translated into German and included both types of questions: open and closed.
Targeted population, which was chosen as a sample, was German. We used quota sampling method. It was considered useful in defining quotas to use three control characteristics. They are: region of origin, gender , and age.
The sample consisted of 200 people. Interviews were conducted by telephone using the fixed telephony services offered by telecommunications company Deutsche Telekom and the site htttp: // www.dastelefonbuch.de / telefonbuch. Data collection took place from June to August 2010.
To find the image of Germans about Romania as a holiday destination, we used a combination of structured (attribute-based scale) and unstructured (open) questions to measure destination image, as suggested Echtner and Ritchie [3].

3. Results

Regarding the characteristics of respondents, they met their quota allocation depending on region of origin, gender and age. Most had completed secondary education (61.5%) and 37.5% are couples with children.
Regarding the travel behavior of respondents, most (57.5%) had completed 1-3 holidays abroad for pleasure in the past three years, 25.5% are willing to spend between 1000 and 1499 euros for a such a vacation, while 22% would be interested in a holiday in Romania in the next three years.
The most common answers given by repondents to the three open questions are as following.
On the first question respondents are asked to present the image that comes to mind when they think of Romania as a holiday destination. The most commonly answer to this question was "Dracula/vampire" (43.5%), "beach/Black Sea) (41%), „nice relief /natural diversity" (20.5%). Among the responses were mentioned two negative features "poor/developing country (13%) and „poverty / insecurity" (8.5%).
The second question asks respondents to describe in few words the atmosphere that one expects to meet in Romania. "Welcoming people" was the most common response (29%), followed by „a new experience" (24.5%) and "archaic world" (20%).
The third question asked respondents to specify some unique tourism attractions held by Romania tourism destination. Of those who responded to this question, 32% mentioned "Transilvania/ middle ages castles", then it was mentioned "Bukovina" (26.6%) and "Danube Delta "(21%).
The most common answers to the three closed questions, and statements based on attributes with a value of 4.0 or more are: "Romania has beautiful landscapes" (4.02), "Find peace and quiet in Romania (4.03) "Romania has many painted monasteries" (4.08) and "A holiday is a real adventure in Romania (4.04) were placed on a tridimesional model of destination image of Eichtner and Ritchie.
To determine if respondents had heard of Romania in Germany through a particular channel of communication and to establish its importance in making decisions for travel to Romania, we used a grid of effective communication. Three methods of communication work effectively on travel in Germany: newspapers, magazines, brochures / catalogs / brochures and videos about Romania. Also, there are communication channels from which respondents say they have received no information about Romania: press releases, cultural and sporting events, air travel/railway agencies, spokesmen / celebrities, contests and interactive TV events.
Although there were no sources to fall in the sector "irrelevant excessive communication", 11 sources are in the category "need more effective communication": television, radio, press releases, cultural and sporting events, spokesmen/celebrities, books about Romania, travel agencies, billboards, transport advertising, events, Internet, and friends/relatives. Of these, billboards, transport advertising, events, internet and friends/relatives are most important to respondents. These should be the main communication tools of Romania tourism destination image on the German market. Also, in the sector "irrelevant communication", it seems that it needed long-term efficiency of activity of the Romanian tourism information offices in Germany, but also participation in tourism fairs.

4. Conclusions

The first hypothesis, which highlighted neutrality in evaluating images based on all factors was tested using the equality test with of an average with a specific value. Table 1 shows the average of the factors that determine the images, while Table 2 shows the values of t test and confidence intervals

Table 1The average of the factors that determine the images

	N	Mean	Std. Deviation	Std. Error Mean
Factor 1	4	3.6225	.40434	.20217
Factor 2	4	3.5600	.35449	.17725
Factor 3	4	3.4450	.22942	.11471
Factor 4	4	3.7300	.27514	.15885
Factor 5	4	3.6300	.56569	.40000
Factor 6	4	4.0050	.02121	.01500

Source: Result from SPSS

Table 2 Values of t test and confidence intervals

Test value = 3

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval for the Difference	
					Lower	Upper
Factor 1	3.079	3	.054	.62250	-.0209	1.2659
Factor 2	3.159	3	.051	.56000	-.0041	1.1241
Factor 3	3.879	3	.030	.44500	.0799	.8101
Factor 4	4.596	2	.044	.73000	-4.0465	1.4135
Factor 5	1.575	1	.360	.63000	.4525	5.7125
Factor 6	67.00	1	.010	1.0050	8144	1.1956

Source: Result from SPSS

Because we have 0.03<0.05, the null hypothesis was rejected. Factors 3, 4 and 6 were significantly different from the value 3 (a neutral value on a Likert scale with 5 gradations), with a with a confidence level of 95%. For factors 1, 2 and 5, p>0.05 which means that the null hypothesis was accepted. These factors were not significantly different from neutral value.

Finally, Romania's image as a holiday destination for German travel market is diffuse, ranging between a neutral and a positive value.

The second hypothesis has highlighted the importance of information sources used in campaigns to promote the tourism image of Romania to take decision to travel to the destination. Analyzing efficiency communication grid and promotional campaigns conducted at national level, we found that indeed sources of information like tourism fairs and tourism information offices of Romania in Germany have little relevance for Germans decision to travel to this tourism destination The hypothesis was confirmed.

In conclusion, communication program of the Romania tourstic destinations image seems to be quite inefficient, with too few sources of information successfully reaching potential tourists.

Analyzing data from surveys, we identify the most important guidelines and strategic directions for action that could be taken into account in drawing up the strategy for promoting the Romanian tourism image.

Promoting Romania tourism destination among people in Germany must take the following actions:

1. Creating a strong identity for Romania and for the main tourism areas of the country.
2. Introducing tourism products to compete with the best ones offered by competing destinations.
3. Identify an efficient communication mix of Romania tourism destination image.

Creating Romanian tourism brand that represents "an umbrella" for a number of individual issues or regional brands is a necessity. We believe that should be tested a new approach, centered on feelings of tourists, not on the objectiv value they visit. Emotional attachment is the essence of the relationship between a consumer and a brand [1]. Moreover, when starting a brand new relationship, the client is a need for a promise from the brand that not only must be trustworthy and convincing, but also must establish a personal connection with potential clients. Potential customers need to see the promised something that is unique not only desirable, but something that directly communicate with customers and staff [5]. In this context, it should focus on respect for tradition, the pure nature, the hospitality specific to Romanian people, on ambivalent existence, a synthesis between East and West.

We believe that most interest would be for Germans following types of vacations:

1. Holidays on the Black Sea (direct flights between cities in Germany and Constanta, packages of 7 or 14 days, all-inclusive system, three and four star hotels, good food, family specials).
2. Holiday tours (tours for a week in nature or cultural purpose - the Danube Delta, Transylvania, Bukovina, group coach tours, accommodation in hotels of three stars).
3. Thematic channels (Dracula's footsteps, group coach tours, accommodation in hotels of three stars).
4. Cultural tours combined with stays at the Black Sea (individual deals – flight + car rental offers, accommodation in 3 and 4 star hotels, special offers for families with children).

Concerning the channels of communication, taking into account the efficiency of communication grid for tourists from Germany, it must be considered the following:

1. Internet.
2. Events.
3.Billboards.

4. Advertising on transport.
5.Newspapers and magazines (general interest publications, newspapers, travel magazines and travel).
Most important is to promote Internet development and interactive marketing. More and more customers are interested in online attractive offerse. More and more traditional services offered to tourists waived by airlines, travel agencies or tour operators to take advantage of lower prices related packages available on the Internet. Ministry of Tourism should support the creation of a website for the latest Romanian tourism and subscribing to a variety of websites dedicated to independent travel, offering accurate information. It should also be improved website created especially for the German tourism market, so as to present offers of tourism products.
Another good opportunity to attract tourists to our country would be creating events that take place in Romania and to attract people to this destination to discover themselves through interaction with the Romanians, with inside knowledge of the country, with good and bad them, changing their mentality.
One of the ways for promoting a view that is inviting representatives of tour operators and travel agents to come to Romania to discover the characteristics of the tourism destinations themselves. As the presence of a significant number of programs for Romania in catalogs and on websites such prestigious tour operators adds credibility and should stimulate the interest of potential tourists.
Carrying info tours in Romania with journalists could also have success, given the items that would appea rafter visit.
To influence the perception of Romanian tourism offer to overseas markets, it is essential that regular media interest and also topics that specializes in tourism and travel, lifestyle, hobbies include positive stories in their pages in connection with Romania. Therefore, should be submitted, in a rhythmic way, newsletters and news releases to allow publication as frequent, a significant amount of positive news about the destination turtistică Romania should be highlighted news that Romanian tourism industry may be of interest to visitors from abroad, should organize special events for international media representatives.
The emphasis should, therefore, the travel press in Romania, interviews with personalities, creating events to draw attention to Romania, placing written or audio-visual materials as testimonials of some important people who know the country, promoting opportunities for creating films artistic feature film in Romania, etc.. It indicated the organization of roundtables, workshops and seminars, galas honoring journalists from radio, television and print media. In this context, cooperation with media will materialize through live shows, topics excusive, extinse.Pe promotions on these promotional efforts can then add a series of commercials to reinforce previous statements.
Strategy on advertising in media that targets both potential tourists and tour operators should be modeled according to the degree of compliance with market requirements Romanian tourism interest. Initiate a comprehensive advertising campaign on television would not be effective in terms of cost / benefit.
Be redesigned, based on efficiency, network marketing offices abroad and participation in specialized fairs. Travel fairs offer hardly can gain new customers because most visitors are already oriented towards a particular destination before the expected start of the fair. At the same, studies are needed to assess the benefits of participation in fairs, as well as monitoring systems for these activities. Advertising material which is participating in international tourism fairs exceed common image must focus both on photographic image, but the information conveyed.
The most effective means of promoting tourism in Romania is still advertising "word of mouth" made by tourists who have visited the area and were so happy sights and quality of service they received.
Given that both awareness of Romania turist destination and tourism traffic volume varies from country to country should formulate courses of action distinct main groups of countries. Each country should be approached differently. Communication channels to be used will be similar, but their share in the communication mix will consider the particular cultural and consumption of potential tourists. Moreover, the image must be built from the audience, taking into account the wishes, preferences and expectations, but also the existing reality [2]. Regarding the promotion mix, it should be developed so as to best manage the perceptions of tourists on destination image.

References

1. Baloglu, S., Bringberg, D., Affective image of tourism destination, *Journal of Travel Research*, Vol. 35, No.4, 1997, p. 11-15.
2. Bignon, V.N., Hammit, W.E., Norman, W.C., French perceptions and images of the United States as a destination country, *Tourism Analysis*, Vol. 3. No. ¾, 1998, p. 159-171.
3. Echtner, C.M., Ritchie, J.R.B.,The Measurement of Destination Image: An Empirical Assesment, *Journal of Travel Research*, Vol. 31, No.4, 1993, p. 3-13.
4. Gartner, W.C., Image Formation Process, *Journal of Travel and Tourism Marketing*, Vol. 2, No.2/3, 1993, p.191-215.
5. Schneider, I., Sonmez, S., Exploring the Touristic Image of Jordan, *Tourism Management*, Vol. 20, No.4, 1999, p. 539-542.

POLICIES AND STRATEGIES AT THE EU AND NATIONAL LEVEL REGARDING IMPROVEMENT OF WORKING CONDITIONS IN KNOWLEDGE-BASED SOCIETY

Cristina LEOVARIDIS
Faculty of Communication and Public Relations, NSPAS, Povernei no.6, Bucharest, leovaridis@yahoo.com

Abstract. The article presents a short analysis of the crystallization and development process, in EU policies and strategies, of some basic principles regarding workforce - quality of employees' life and improving working conditions. We will make a comparison between how these concepts are translated into EU policies and strategies relating to employment and how they are approached in national legislation and strategies. The study will continue with an analysis of statistical data, with sources Eurostat, European Foundation for the Improvement of Living and Working Conditions, European Agency for Safety and Health at Work etc., which will highlight the comparative situation on working conditions offered to employees in the EU Member States, taking into account in particular the new challenges that influence employment, specific to knowledge-based society. For high-skilled professionals in knowledge-intensive economic sectors, work-related stress is one of the most important risk factors that affect their health and performance at work. In the last ten years, there were reductions in the share of EU-15 workers who said they are affected by stress or other health, while at the same time increased the proportion of employees in New Member States suffering from stress and diseases caused by it.

Keywords: working conditions, quality of employees' life, non-manual occupations, stress.

1. Introduction

In the current context of increasing number of European employees working in services and especially in knowledge-intensive areas (such as research and development, computer and related activities, air transport, financial intermediation, education, health and social work, cultural activites, advertising, marketing, public relations, mass-media etc), specific to knowledge-based society, whose performance and efficiency is directly proportional to the creativity of employees, the rigid, hierarchical, management is completely inadequate, requiring its replacement with a management which focuses on the concern for employees satisfaction and thus for their working conditions. Job satisfaction, largely generated by quality of employees' life and working conditions, becomes human output of the organization, which should be considered, in addition to economic output.

The study does not consider the analysis of some theoretical principles as such, but the cronological process of elaborating them, with some recovery, rewording etc. Social concepts on a such scale can not be developped suddenly, but implies a problematization of social reality; in this regard, our study will present the stages through which the EU, namely professionals working within it, have acknowledged the shortcomings of the old (but still current) practices of firms focused primarily on the direct interests of winning and success in business, neglecting social dimension of their organizations.

In the context of new developments on the European labor market, including the aging of working population, increasing participation of women in employment, self-employment, outsourcing and employment in SMEs, recent technological developments, etc., priorities in improving working conditions must they adapt too, and must include psychosocial issues (stress caused by too much intensity of labor and too long working hours), musculoskeletal disorders, dangerous substances, the potential risks associated with nanotechnologies etc. [1]

2. Policies and strategies at the EU level regarding improvement of working conditions

From the perspective of EU concerns, the issue of improving working conditions and ensuring health and safety at work appears as an independent subject for the first time in the European Council Framework Directive on the safety and health of workers at work, in 1989 [2], giving importance to the obligations of employers to assess risks at work, based on employees consultation and participation, and to avoid them. It represented an important tool in improving occupational safety and health: it guarantees minimum safety and health requirements throughout Europe, while Member States are allowed to maintain or establish more stringent measures. Subsequently, the theme becomes even more consistency, being developed also in other official documents, such as *Integrated Guidelines for Growth and Jobs 2005-2008* [3], *Integrated Guidelines for Growth and Jobs 2008-2010* [4], *Community Strategy on Health and Safety at Work 2002-2006* [5], *Community Strategy on Health and Safety at Work 2007-2012*, the latter aims for a 25% reduction in the total incidence rate of accidents at work by by 2012 [1].

Among recommendations in these official documents, aimed directly at improving the quality of employees' life, we note: achieve a better reconciliation of professional and private life and ensuring affordable facilities for children and other dependents care (flexible working arrangements play a key role in trying to provide women with children the possibility to have a career); support for active aging, including by providing appropriate working conditions to keep health [4]. Also, promoting social dialogue and employees involvement (including for elaborating collective agreements) is an important tool in shaping industrial relations, the creation of mechanisms for informing and consulting employees, resulting in improved quality of work [6].

Given that Europe is in transition towards a knowledge-based economy, marked by profound changes affecting society, employment and working conditions, new priorities and health and safety at work have been set. Thus, society is becoming increasingly feminized, 83% of employed women work in services, which explains why they suffer a lower rate of accidents than men, but have high rates of occupational diseases: they have 45% of allergies, 61% of infectious diseases, 55% of neurological diseases, 48% of skin diseases etc. On the labor market appear increasingly more new forms of employment, some of them with higher risk in respect of health: employees who work temporarily, with fixed term contracts, with non-standard working time (in shifts or night) often suffer accidents at work; this is explained by the lack of safety training, psychosomatic problems caused by shift or night work, lack of concern from managers, lack of motivation for workers with an uncertain employment contract. Also, changes occur in the nature of the risks; changes in how work is organized (particularly more flexible ways of organizing working time, including teleworking, with emphasis on the obligation of obtaining results within a fixed time limit) has a profound effect on the welfare at work. Today the new occupational risks are stress, depression, anxiety, workplace violence, harassment and intimidation, which are responsible for 18% of health problems in the workplace, a quarter of them resulting in two weeks or more absence from work. These problems are twice as common for profesionists in education, health and social services [4].

In another Communication from the European Commission to the Council and European Parliament, entitled „The future of the European Employment Strategy (EES). A strategy for full employment and better jobs for all" [7], the idea that recurs is that the quality of work is one of the central points of the European social model, aimed at increasing its multiple dimensions, leading to a balance between flexibility and security, particularly on job satisfaction generated by the wages, safety at work, flexible arrangements for working time; improving the quality of work is increasingly viewed as a lever which seeks to combine efficiency economic and social cohesion.

According to the same communication [7], quality of work has great influence on the decision to enter the labor market but also on those to remain at a job or remain in the labor market. Jobs shift to higher quality is closely linked to the transition towards a knowledge-based economy, the data showing that most new jobs created are in knowledge-intensive sectors, involving a high-skilled labor; quality of work is also closely related to labor productivity and thus has a key contribution to competitiveness of European firms. Therefore, attention should be paid to investment in human capital, in technology and work organization.

Two years later, in the Communication „Working together for Growth and Jobs. A new start for the Lisbon Strategy", European Commission takes from the Lisbon Strategy the imperative for creating more and better jobs, but it correlated with the need for sustainable and sustained economic growth. Thus, in terms of employment, it is recommended: increasing employment and social protection systems, improve adaptability of workers and enterprises and the flexibility of labor markets, greater investment in human capital through creating and improving competences adapted to the requires of knowledge-based society [8].

In last years, researches on working conditions in Europe have shown an upward trend in the incidence of psychological disorders, especially for non-manual employees (professionals) in knowledge-intensive sectors. In order to reduce the incidence of these new diseases, specific to non-manual occupations, in recent years European trade unions and employers confederations have established two framework agreements, one on harassment and violence at work, another on stress at work [9], [10].

3. Policies and strategies at the national level regarding improvement of working conditions

The laws of our country, like the European ones, establishes the employer responsible for ensuring employee health and safety measures at work. An official document essential for establishing the legal framework for ensuring health and safety at work for employees, at national level, is the *Law 319/2006* regarding the protection and safety of work, according to that the employer shall take necessary measures to ensure the safety and health protection, prevention of occupational risks, informing and training workers, providing the necessary resources and organizational framework for safety and health. These measures should be implemented on the following general principles: avoiding risks; evaluating risks which can not be avoided; combating risks at source; adapting work at individual, particularly in regard to design work position, choice of work equipment and production methods, to reduce the monotony of work, the work with predetermined rhythm and to decrease their effects on health; the adaptation to technical progress; replacing the dangerous by the non-dangerous or less dangerous; development of a coherent prevention policy that includes technology, work organization, working conditions, social relationships and the influence of work environment; provide appropriate instruction to workers [11].

In *Romania's National Development Plan 2007-2013*, elaborated by the Romanian Government, in the paragraph dedicated to health and safety at work, there are some statistical data regarding the current situation: in Romania, 61% of employees felt that their work affects the safety and health, while EU-15 average was 60% and EU-12 average was 69%. Regarding the indicator on the health problems caused by work, the most frequent complaints were related to general fatigue, back pain, stress, muscle pain and impaired vision. General fatigue affects employees in Romania in a proportion of 42%, more than employees in EU-15 (23%), but at a level comparable with the average of EU-12 countries (41%) [12].

Equality between women and men is regulated by *Law 202/2002,* setting out measures to eliminate direct and indirect gender discrimination in all spheres of public life in Romania, especially in labor. Thus, „employers are obliged to ensure equal opportunity and treatment between employees, men and women, in the labor relations of any kind, including the introduction of provisions to prohibit discrimination in the organization and operation regulations and in the internal order ones of units" [13].

Another law relevant for improving working conditions in our country, *Law 130/1996 regarding the collective labor contract* emphasizes that „the collective agreements aim to promote fair labor relations, to ensure social protection of employees, prevent or limit collective labor disputes or avoid strikes" [14]. The trade union law mentioned, but indirectly and insufficient, involvement of trade unions to improve working conditions by participating in discussions concerning these aspects [15].

There are also numerous other laws, less general than the above, applicable only at the sectoral level, particularly in high risk sectors in terms of health and safety at work, laws which are each transposition of one or more European directives in the field.

3. Comparative statistical data on working conditions in European countries

The occupational structure of European employees consists of high-skilled white collar (37%), low-skilled white collar (25%), high skilled blue-collar (18%) and low-skilled blue collar (20%); in nine Member States (Luxembourg, Netherlanden, Finland, Sweden, Belgium, Germany, Great Britain, Estonia), high-skilled white collar employees represent over 40% of the workforce [16].

One of the most common health risks for employees in non-manual occupations, working in specific sectors of the knowledge society, is the stress. Risk factors leading to stress caused by work are related to the job characteristics, such as: too long hours worked, too many demands, complex tasks to be solved in a very short deadline, a weak control over work, low social support, ambiguity and role conflict, too littele opportunity for career development, job insecurity, harassment at work etc.

Stress was experienced on average 22% of European workers, the prevalence of stress was higher in the new Member States than in the old, stress was reported by 20% of EU-15 workers, 31% of the EU-12 countries. Other problems caused by stress (chronic fatigue, headaches, back pain, irritability, sleep problems, heart disease etc.) are also felt by a higher proportion of workers from former communist countries, new Member States, to old members countries [17]. Research has shown that workplace stress is associated with cardiovascular disease, musculoskeletal, immune problems, mental health problems (anxiety, depression), but also it can cause more serious diseases such as myocardial infarction, hypertension, angina pectoris, stroke, diabetes.

Regarding the number of weekly working hours, in recent years the share of European employees who work over 41 hours per week has decreased, increasing the proportion of those working part time, less than 34 hours per week. Shortening the work week, however, is associated with an increase in work intensity; between 1991-2005 it was a continuous increase in the proportion of employees who say that in at least three quarters of their work time are working at high speed (in 2005, 61% of EU15 employees said that, more than those in the EU10 - 52% or EU2 - 57%). Furthermore, over half of European workers noted they have that strict deadlines in over three quarters of the work time: 62% of workers in the EU15, 59% of those in the EU10 and 60% of those in EU2. Control over own work is a stress reduction factor, in 2005 lack of control over methods for performing the tasks is mentioned in higher share by employees in the new Member States than in older ones, while the figure for lack of control over work speed or lack of ability to take a break when they wish are similar for both groups of countries. The feeling of job insecurity is more common to workers from new Member States over the old ones: 11% of employees in the EU15, 25% of those in the EU10 and 20% of those in EU2 said that they can lose job in the next 6 months. Regarding job satisfaction, employees in EU15 are more satisfied by their wages compared with work (47%) than those in the EU10 (29%) and those from EU2 (25%), stating also that their workplace offers opportunities for career development (33%, 23% and respectively 20%). Satisfaction on the work-life balance is expressed by 81% of employees in the EU15, 73% - EU10 and 74% - EU2. On average, 5% of overall EU employees said they were victims of a form of violence or harassment (6% of employees in EU15, 5% in EU10 and 4% in EU2), larger shares in older Member States could also be due to a higher awareness of this phenomenon among employees, and cultural norms in different organizations or countries [17].

Consultation with employees on changes in work and working conditions are found in high levels in Scandinavian countries and Netherlanden, where over 70% of employees were consulted last year on these issues, share of two times higher than found in southern European countries; it have been consulted predominantly managers and professionals (70%), compared to only 40% of skilled and unskilled blue collar [16]. The economic sector in which employees operate represent a factor influencing the level of stress at work. The data indicate that stress is high

predominantly in education, health, social work, public administration, financial intermediation [18]. In terms of professional training, an essential condition for the competences development of employees in areas specific to knowledge-based society, in 2010 European high qualified specialists receive the largest proportion of training paid by employers (47%), compared with 36% of low-skilled white collars and 22% of high or low-skilled manual workers [19].

Conclusions

In our country, legislation on safety and health at work meets the requirements of EU directives, containing legislative measures aimed at avoiding risks in areas that require physical labor, feeling the absence of legislative measures that consider the life quality of employees with non-manual occupations, in new areas, specific to knowledge-based society.

Both stress itself and various problems due to stress (anxiety, chronic fatigue, headaches, back pain, irritability, sleep problems, heart disease etc.) are felt by a higher proportion of workers from former communist countries, new Member States, to old members countries; the factors generating stress (large number of weekly hours, over 40 hours per week, low control over their work, strict deadlines, job insecurity, low participation in training, lack of autonomy, lack of consultation and participation in decision making, inability to balance work and private life etc.) are mentioned also by a higher proportion of workers from new member countries, compared to old ones. In both groups of countries, employees dissatisfied with this aspect belong to the same economic sectors, mainly knowledge-intensive services, and have the similar nature of work - high-skilled employees with non-manual occupations. So, they are employees whose goal is career development, which have high expectations from work and whose health, satisfaction and quality of life must be a priority both for management and for national authorities, which must develop specific protection measures adequate to the intangible nature of their work, knowing that the performance of intensive-knowledge economic sectors represent a prerequisite of the transition to knowledge-based society. Ignoring the new arising risks for the health of high-skilled employees, negative effects, not only at individual and organizational performance level, but at the entire economy, will not delay to occur.

References

1. European Commission: *Improving quality and productivity at work: Community strategy 2007-2012 on health and safety at* work, Brussels, 2007, pp. 3, 4, 13, 14.
2. European Council: *European Framework Directive on Safety and Health at Work* (Directive 89/391), Brussels, 1989.
3. European Commission: *Integrated Guidelines for Growth and Jobs 2005-2008*, Brussels, 2005.
4. European Commission: *Integrated Guidelines for Growth and Jobs 2008-2010*, Brussels, 2007, pp. 26-33.
5. European Commission: *Adapting to change in work and society: a new Community strategy on health and safety at work 2002–2006*, Brussels, 2002, pp. 5-8.
6. European Commission: *Improving quality in work: a review of recent progress*, Brussels, 2003, p. 17.
7. European Commission: *The future of the European Employment Strategy (EES). A strategy for full employment and better jobs for all*, Brussels, 2003, pp. 9, 10.
8. European Commission: *Working together for growth and jobs. A new start for the Lisbon Strategy*, Brussels, 2005, p. 9.
9. ETUC, UEAPME, CEEP, BUSINESSEUROPE: *Framework Agreement on Harassment and Violence at W*ork, 2007.
10. ETUC, UEAPME, CEEP, UNICE: *Implementation of the European Autonomous Framework Agreement on Work-Related Stress*, 2008.
11. Romanian Parliament: *Law 319/2006* regarding the protection and safety of work, Bucharest, 2006, art. 7 (Parlamentul României: *Legea 319/2006 privind protecția și securitatea muncii*).
12. Romanian Government: *Romania's National Development Plan 2007-2013,* Bucharest, 2005, p. 144 (Guvernul României: *Planul Național de Dezvoltare al României 2007-2013*).
13. Romanian Parliament: *Law no. 202/2002 on equal opportunities between women and men*, Bucharest, 2002, art. 7, 8 (Parlamentul României: *Legea nr. 202/2002 privind egalitatea de şanse între femei şi bărbați).*
14. Romanian Parliament: *Law. 130/1996 regarding the collective labor contract*, Bucharest, 1998, art. 2 (Parlamentul României, *Legea nr. 130/1996 privind contractul colectiv de munca).*
15. Romanian Parliament: *Law. 54/2003 – Trade Unions Law*, Bucharest, 2003, art. 30 (Parlamentul României: *Legea nr.54 / 2003 – Legea sindicatelor*).
16. European Foundation for the Improvement of Living and Working Conditions: *Fourth European Working Conditions Survey*, Luxembourg, 2007, pp. 4-6, 70.
17. European Agency for Safety and Health at Work: *OSH in figures: stress at work – facts and figures*, Luxemburg, 2009, pp. 21, 24, 25.
18. Eurostat: "8.6% of workers in the EU experienced work-related health problems. Results from the Labour Force Survey 2007 ad hoc module on accidents at work and work-related health problems", in *Statistics in focus*, no. 63, 2009, pp. 3-5.
19. European Foundation for the Improvement of Living and Working Conditions: *European Working Conditions Survey 2010,* 2011, available at http://www.eurofound.europa.eu/, accessed at 28.04.2011.

This paper is suported by the Sectorial Operational Programme Human Resources Development (SOP HRD), financed from the European Social Fund and by the Romanian Government under the contract number SOP HRD/89/1.5/S/62988.

CONTROVERSIES IN USING DERIVATIVES IN THE CONTEXT OF THE FINANCIAL CRISIS

Alexandru OLTEANU
Mădălina Antoaneta RĂDOI

Abstract. As a phenomenon, risk is specific for any human activity. Following this logic, we can say that this concept is a constituent element in the definition given to the financial sector, investments and market competition. The questions that the whole range of operators (governments, regulation bodies, financial institutions, companies and shareholders) must answer are:

- Which type of risk should one assume within an economic entity and to what extent should that risk be taken?
- If risk is materialized, to what extent will the financial consequences affect the involved parties?

By enforcing laws that might eliminate economic risk, regulation bodies attempt to create an ideal regime in which the concept of"bankruptcy" does not exist. Thus, financial institutions and companies which hold a key position in the different economic sectors are prevented from performing actions that might lead to their bankruptcy. The positive effects of the regulation are doubled by less appreciated effects, such as the limitation of the investment potential. Working in this environment, the financial and economic agents' behaviour has significantly modified, i.e. it has mitigated the degree of risk aversion.

The solution for this is establishing more flexible regulation lines that do not have as a main objective the elimination of failure, but rather the reduction of frequency with which such incidents occur and to manage the individual investors'/consumers' losses. One must preserve a balance between the need for facilitating risk internalization and the efficient use of capital (a fundamental operation for maintaining competitiveness and innovation spirit), on the one hand, and maintaining a certain protection level for the investor/client, on the other hand.

For regulation bodies any of the two options will be a priority, since it is obviously in the commercial interest of any company (and, certainly, of the suppliers, customers and associates) to efficiently manage risks that derive from its activity and, for this purpose, to take into consideration the use of derivatives. Recent financial collapses have illustrated the consequences generated by the improper application of the basic risk management principles and of the efficient implementation strategies for derivatives.

Keywords. risk internalization, derivatives, CDOS (Collateralised debt obligation), CDS (Credit default swap), financial transaction taxes, Paul Volker's financial theories, the Tobin tax.

1. Introduction

The use of derivatives – an innovation of the second half of the XXth century – has imposed itself thanks to the **advantages** it offers:

1.Despite the controversies that exist as to the use of derivatives, they remain the best financial instruments for market risk/credit management, as well as for other forms of risk. Both on the stock market and OTC (non regulated market), derivatives have three highly appreciated characteristics: geographical area coverage (derivatives exist on most important financial markets in the world); diversity (derivatives cover the range of all monetary instruments); liquidity (usually, any position may be occupied, diversified or cancelled at low costs).

2.When derivatives are transacted on a stock exchange market, the company benefits of certain advantages:

a. on this completely regulated market, transactions are guaranteed by compensation houses, significantly mitigating credit/counterparty risk;
b. due to the standardized form of contracts, positions may be closed without the least inconvenience. As to OTC, the advantages are: direct choice of counterparty and flexibility of the form of the contract.

3. By using these markets, debtors and creditors can fix the cost of money; importers and exporters may be protected from currency fluctuations; companies can avoid unexpected price rises for raw materials. The way insurance contracts are used by companies to protect their fixed assets is similar with the way derivatives are used for insuring liquid assets. In both cases a premium/its equivalent is paid for purchasing such a means of protection.

In spite of the"pro-derivatives" arguments, **doubt is cast upon derivatives** when managers conceive risk management strategy.

2.Literature Review

A. The role of derivatives in risk management and their speculative use.

Historical data concerning risk management strategy reveal cases of operators that have recorded significant losses. For a risk manager, giving up derivatives as an efficient means for covering risk is not a solution. The surest solution is to understand the causes that lie behind these wrong movements which lead to important losses. However, discovering these causes is not simple, for they are a constituent part of human behaviour which sometimes does not take into consideration econometric models and results of simulation software. Besides the role they play in risk management, **derivatives are** also **used in a speculative way**. This is not surprising at all. Companies and speculative operators share a different opinion on derivatives. Derivatives have inner characteristics that, in case of minimum investments, allow companies to manage a series of risks. However, speculators perceive derivatives as a potential source of substantial profits and, thus, speculators choose to adopt a position and wait for a market evolution that might bring profits.

Despite operations initiated by speculators who amplify the endogenous market risk, in reality: most treasury and investment funds departments use these instruments for successfully managing market and commercial risks. Consequently, managers cannot ignore the potential of derivatives in managing a significant number of risks to which companies are exposed, except for the case in which one chooses to internalize risk and potential losses.

If the few enumerated arguments have consolidated the decision to pay the necessary attention to derivatives when evaluating risk management for a company, then afterwards one must regulate procedures for managing risks that derive from the use of derivatives. We consider that the following directions are essential for efficiently implementing risk management by means of derivatives:

1. Strategy Compliance. Human Capital

Running financial and banking institutions must maintain compliance between risk management policy by means of derivatives and the company's strategy, economic objectives, financial situation and its attitude as regards risk. To accomplish this function, managers must identify those risks to which a company is exposed (e.g. market risk, credit risk, operational risk, legal risk), establish what is the role of transacting derivatives for the company (a potential profit source or simple hedging operations) and ensure efficiency for the internal control system of transaction operations. In this respect, the appointment of professionals with a proper level of knowledge as to derivatives transaction is absolutely necessary and compulsory.

2. Organizational structure. Internal Control

The manager should establish an organizational structure and an independent control frame for transacting derivatives. This structure should comply with the principles of efficiency and facilitate risk management. The functions of this structure are: identifying, measuring, managing, monitoring, mitigating and reporting present and provisioned risks. This frame should monitor report transmission, usages for sent/received document, the proper accounting of sent/received documents, the competence of transaction department members, responsibility assignment and procedures provided for unpredictable situations.

3. Managing risks associated with derivatives transaction

The most important risk categories – which one must take into consideration when laying the foundation of the derivatives transaction department – are: market risk, credit/counterparty risk, operational and legal (regulatory) risk.

An efficient risk management associated with derivatives transactions implies efficient procedures and work techniques for every type of risk, namely:

- Market risk – may be generated by unpredictable prices for shares, securities, merchandise, currencies, other market indices, or by their volatility. Market risk policies refer to approval, execution, confirmation, as well as recording, measuring, monitoring and reporting transactions and they set forth procedures for establishing relationships with the authorities in the field, adopting limit positions and evaluating exposures.
- Credit/counterparty risk – we appreciate this risk can be reduced by a collateral guarantee of credits and by techniques that increase loan capacity. Besides the credit/counterparty risk, the risk manager must take into account: third party risk, country risk and risk regulation. The risk manager's functions must include: differentiation of risk profiles for the stock exchange and the OTC market, assessing the advantages and disadvantages of portfolio diversification, the proper use of collateral guarantees for mitigating credit risk and establishing an action plan in case unpredictable changes appear (a partner's position or the position of a broker who faces financial difficulties).
- Operational risk, including the technological one – may be managed by identifying the impact - generated by the new products, partners and clients, the modification of the transaction methods, of the IT services sources or any inconsistency that might occur in running the business - upon risk management.
- Legal (regulation) risk has certain important particularities. Compliance with the legal frame is absolutely necessary for the operational capacity to make transactional operations and the basic principles that set up its functioning. Documentation must refer to the relationship between trader, the own bank and brokers, and it

must observe the legal principles according to which the market functions.

It is obvious that these general directions are neither an insurance policy for companies which adopt them, nor an immunization treatment to risks deriving from transacting derivatives; even if followed, these directions cannot cover the different circumstances in which individual operators might be placed. Anyway, the above mentioned directions are a landmark for identifying, managing, assessing and mitigating risks deriving from derivatives transactions. If carefully used and properly controlled, derivatives play and might play an important part in risk management strategies.

B. The origins of the present international financial crisis and directions for regulating the financial market.

Such a leitmotiv used for explaining the present international financial crisis refers to the complexity of the new financial products, the so-called "synthetic" products, which are issued by important banks by means of the "originate and distribute" process. In fact this leitmotiv is used as a self-justification and it avoids tackling the problem.

However, complexity can be defined differently; one can mention an inner not dangerous complexity if the cognitive limits do not generate fatal errors. And there is a human made complexity, which, for example, consists in risky individual actions and precarious control mechanisms.

There are opinions according to which the financial products occupying a central place in the present crisis (CDOS/Collateralized Debt Obligations, CDS/credit default swap) should not be criticized. In our opinion, the problem is that a part of the bank securization activity (titrization) – transformation of loans and more and more sophisticated securities – contains fundamental vices.

Let us explain what is perceived as a "congenital" flaw of the "originate and distribution" pattern. We admit that in the simple transaction involving the lender and the borrower risk is one and it is illustrated by the borrower's reliability. This transactional (counterparty) risk can be checked by means of credit conditions on the market.

However, when loans are transformed into securities or other derivatives, the individual transactional risk starts to increase; the longer the chain of transactions is, the more complex is the securization (titrization) operation (by security "synthesis"); what appears to be more dispersed and smaller as an individual risk becomes more threatening for the system. This effect appears because markets are less and less transparent; some financial products are neither transacted on the effective markets nor do they benefit of credible evaluations (prices). At a certain moment, the cost of identifying risk is overwhelming and the market is blocked, a situation which in fact has already occurred.

The big rating agencies which used quantitative methods (patterns) have been caught in this chain of flaws. These agencies have major vices as to evaluating risk for the new securities.

For banks securization has appeared as a very profitable business to the extent to which they have managed to apparently eliminate risk. Banks used to sell securities to investors or to place them in special derivatives, taking them out of their own balance sheet. However, what appeared as a convenient dissemination of individual risk in the entire financial economic system led to increasing risk in the system. It is naive to state that banks (or at least the ones who were responsible for ensuring securization) did not understand the dangers of the pattern they used. In fact, all banks specialists realised that this was a dangerous attempt. Anyway, these specialists benefited of enormous amounts of money by means of compensation schemes that encouraged risk instead of a cautious attitude.

The collapse that the financial system has experienced in the economically advanced world – especially in the USA – obliges us to reconsider the existing financial markets regulations and surveillance mechanisms.

In the USA reforms are approached from two different positions. Both positions have common points, such as: imposing limits for leverage; more transparency; compulsory transactions of derivatives at specialized exchange offices; regulation of operations performed by all financial entities which generate systemic risk (including risk funds and hedge funds, as well as private equity funds); eliminating (as much as possible) interest conflicts; regulating rating agencies activities; modifications in paying bankers; consolidating surveillance mechanisms; paying more attention to systemic risks.

There are important differences between the position adopted by Paul Volcker (former FED Governor more than 20 years ago and at present counsellor of President Obama) and the position adopted by Lawrence Summers (former Treasurer and at present one of the main counsellors of President Obama). Volcker, together with other specialists in finance - Alexandre Lamfalussy in 2001, Paul Krugman in 1999, Nouriel Roubini in several deep studies, Warren Buffett in his studies on International Bank Regulations and the Bank of England etc. - have warned about the great dangers existing in the financial system and the financial derivative innovations used by important banks, as well as about the imminent financial collapse. In this context, Volcker considers that it would be wrong not to tackle the dimension of certain financial institutions which can hostage a system (see the collapse of the Lehman Brothers investment bank and the USA Government intervention to avoid the collapse of the AIG Insurance Company – which, ironically, acted as a gigantic risk fund).

Volcker and others who share his view suggest that commercial banks should no longer make "proprietary trading" operations, which are operations made in one's own interest. In this way, risky operations are reduced for

financial institutions which encourage and use deposits riskily.

The measures announced by President Obama in February 2010 – measures which follow Paul Volcker's ideas – represent a new key step taken in building a new regulation system for supervising financial markets.

For example, let us consider the measure adopted for taxing financial transactions. Such a measure was proposed by the American economist James Token for discouraging speculative transactions on currency markets in order to mitigate their volatility. Today this idea is embraced by specialists in London, Paris, Berlin, in international financial institutions (FMI) with a view to reduce the volume of financial transactions and obtain incomes that might help states intervene in case of systemic risks. Actually, there are countries (Australia, Switzerland, Greece, Hong Kong, India etc.) which tax some security, shares and derivatives transactions. Recently, Brazil has imposed takes on the entrance of speculative capital.

There are opinions according to which taxes on financial transactions should not be imposed with a view to collect fiscal incomes (i.e. Tobin tax, differently from Pigon taxes, which would attempt to collect negative externalities generated by market flaws). This reasoning is supported by envisaging financial mediation as an intermediary production (see P. Diamond's and J. Mirrlees' study), respectively the taxing of intermediary (not final) production would introduce dissensions in the production chain, reducing efficiency.

3.CONCLUSIONS

The conclusion is that the present financial crisis is basically generated not by the complexity of the new financial products, but by a financial innovation pattern and the characteristics of financial products (e.g. CDOS, CDS) which have disrupted the good functioning of markets: **transparency** and **trust**.

Besides proposals for fundamentally reconsidering the existing regulations and surveillance market mechanisms, imposing a tax on financial transactions is not senseless since: it is necessary to register fiscal incomings that would allow necessary interventions to be taken; this would mean imposing a tax on an activity which represents a bad allocation of resources.

Consequently, it is desirable that the financial system should lose a considerable part of its speculative nature. In the USA, in European countries (e.g. Great Britain), the financial system is now over dimensioned and if we take into account the volume of profits obtained in relationship to the total profits obtained (e.g. the USA received 40% of the total profits, though its GDP is a lot inferior to this percentage), one can appreciate that certain states obtain an incorrect revenue. In time this has led to a distorted allocation of resources and it has also generated unacceptable systemic risks.

BIBLIOGRAPHY

1. Anthony Belchambers, *Managing Derivatives Risk*, Futures and Options Associations, 2003
2. Liliana Paraipan, Corina Stanciu, *Managementul Riscului Financiar*, Adevărul Publishing House, 2002
3. Alexandru Olteanu, Mădălina Antoaneta (Rădoi) Olteanu, *Managementul Riscurilor Financiar-Bancare,* vol I+II, Dareco Publishing House, Bucharest, 2006
4. Fong H.G., Vascek O., A *Risk Minimizing for Portfolio Immunization,* Journal of Finance, vol. 34, 1984
5. Jarrow R.A., Turnbull S.M., *Pricing Derivatives on Financial Securities Subject to Credit Risk*, Journal of Finance, vol. 50, 1995
6. Queruel M., *Memoire de DESS d'inginerie matematique*, Université Claude Bernard, Lyon, 1991
7. Lefebvre Francisc, *Nouveaux instruments financiers*, 1990
8. Beaufils B., Py. G. Richard B., Thiry B., Guimbert I. P., *La banque et les nouveaux instruments financiers*, Revue Banque Ed., 1986
9. Jaquillat B., Solnki B.: *Marché Financiers*, Ed. Dunod, Paris, 1997
10. P. Diamond, J. Mirrlees, Studiul: *Optimal Taxation and Public Production*, American Economic Review, 61, 1971.

FISCAL SECURITY – AN EFFICIENT METHOD FOR ENSURING BUDGET INCOMES

Diana CRICLIVAIA, Inesa BRUMĂ
Universitatea de Stat din Moldova, Chişinău, Moldova
E-mail: criclivaia @yahoo.com, ina_rum@mail.ru

Abstract: The article deals with economic security, particularly tax security as one of its most important components. The scientific investigations of the article could help to develop the concept of tax security in terms of internalization of national economies, to improve methods to combat tax evasion and reduce or stop illicit and licit escape of capital.

Keywords: Fiscal security, fiscal risk, budget resources, fiscal system.

1. Introduction

The organizing process of fiscal security ensuring should not merely bear a complex character; it has to be based on fundamental analysis of possible negative consequences. Meanwhile, it is important that some significant aspects not be avoided. Nowadays, the complex system of fiscal security is not only a collection of means, but also a series of steps taken to prevent the loss of budget incomes.

As the budget resources of the Republic of Moldova are scarce, the government cannot waste its money any more and, in order to build a reliable system of protecting its incomes, it is compelled to make only necessary procurements, certainly at low costs. Even V.G. Belinschi, a Russian literary critic, used to contend that 'to find the cause of the evil is the same as to find the cure for it'. Therefore, it is necessary to know the nature of possible hazards [3].

On the other hand, it is useful to look into the ways of studying these perils. We could, for example, 'step on a rake' with a shout o 'hurrah', then 'glue' any 'bump on the forehead' with any new amendments in the legislation, such as firewall and VPN (*Virtual Private Network*). As a result, certainly, a secure and verified protection is obtained, used as a shelter for tax authorities to act peacefully, if any funds are surely left over for them. We can definitely learn from the others' mistakes. But, first of all, our country' citizens are not accustomed to learning from the others' mistakes, and, second of all, who is going to reveal one's faults? All it has to be done is to investigate all possible options and select the most appropriate ones so that they can be applied in each particular case. We can either use the data bank of all accumulated types of known threats (one might be less sure here whether all options have already been verified), or try to create a methodological instrument enabling the formation of a field of possible manifestation of threats - a tool based on the study of all influence factors allowing a careful examination of even the least probable variants. In the USA, for instance, it is only after tragic events of September 11, 2001 that the many national airlines authorities had the plane's cockpit doors armored in all civil aircrafts, whereas this sort of threat was anticipated in the ex-Soviet Union long before, at the very beginning of civil aviation forming [4].

2. Analysis and evaluation of fiscal security condition

At present, there is a series of well-known ways of risk analysis, though these available methods, unfortunately of foreign origin, offer only a qualitative evaluation. These methods are designed to have the fiscal security appraised according to key-points of control that represent either compulsory requirements (requirements of the legislation in force), or they are considered main structural elements of budget incomes security (for example, the study of rules of fiscal administration and security). These verification points are applicable to the fiscal authorities in the Republic of Moldova. They comprise: 1) Documents referring to the institution's policy related to fiscal security; 2) Distribution of responsibilities related to the ensuring of fiscal security; 3) Personnel instruction and training in the maintenance of fiscal security regime; 4) Advising of protection infringement; 5) Protection measures against legislation infringement; 6) Protection of organization's documentation; 7) Data protection; 8) Control over conformity with security policy.

The procedure of internal audit of the fiscal system includes verification of the above-mentioned key-points availability and evaluation of integrality and correctness of their application, as well as analysis of

their adequateness to existing risks. This approach can generate answers only in terms of 'this is good', 'this is bad', but questions such as 'how bad or how well', 'to what extent it is subject to critique or not' are left unanswered. Therefore, at present, there is a necessity of developing such a method that would display to national fiscal authority principals a complete image of the situation, confirming in figures recommendations of specialists responsible for fiscal security within the organization.

Greediness governs the world; which is why, the activity of many organizations that ensure fiscal security is orientated towards not admitting damages to the budget in the event of fiscal incomes losses. Fraudulent schemes are correspondingly supposed to exist resulting in the state's fiscal incomes losses.

SOURCE OF THREAT – FACTOR (VULNERABILITY) – THREAT (ACTION) – CONCEQUENCES

At present, the threat to fiscal security is identified, as a rule, with either the character (type, method) of destabilizing action upon budget fiscal incomes, or the consequences (results) of such actions. Even though the practice in the field demonstrates that such complicated terms can have lots of interpretations, however there is another possible approach to the definition *threat to fiscal security*, which is based on the concept of 'threat'. '*Threat'* is an intention to provoke material, physical damages to public and personal interests, a possible danger (S.I.Ojegov, Dictionary of the Russian language). In other words, the notion of *'threat'* is tightly related to the legal term 'prejudice', meaning all expenses that a person whose right was infringed was/is going to be charged with in the event of the re-entitlement to the right infringed, loss or damage caused to his belongings (effective prejudice), as well as benefit not obtained from right infringement (failed income) (Civil Code of the Republic of Moldova, art.14) [1]. The analysis of *threats* negative impact supposes compulsory identification of possible *sources of threats, vulnerability* that contribute to threat manifestation and fulfillment. Therefore, the scheme chain increases and is presented in Figure 1.

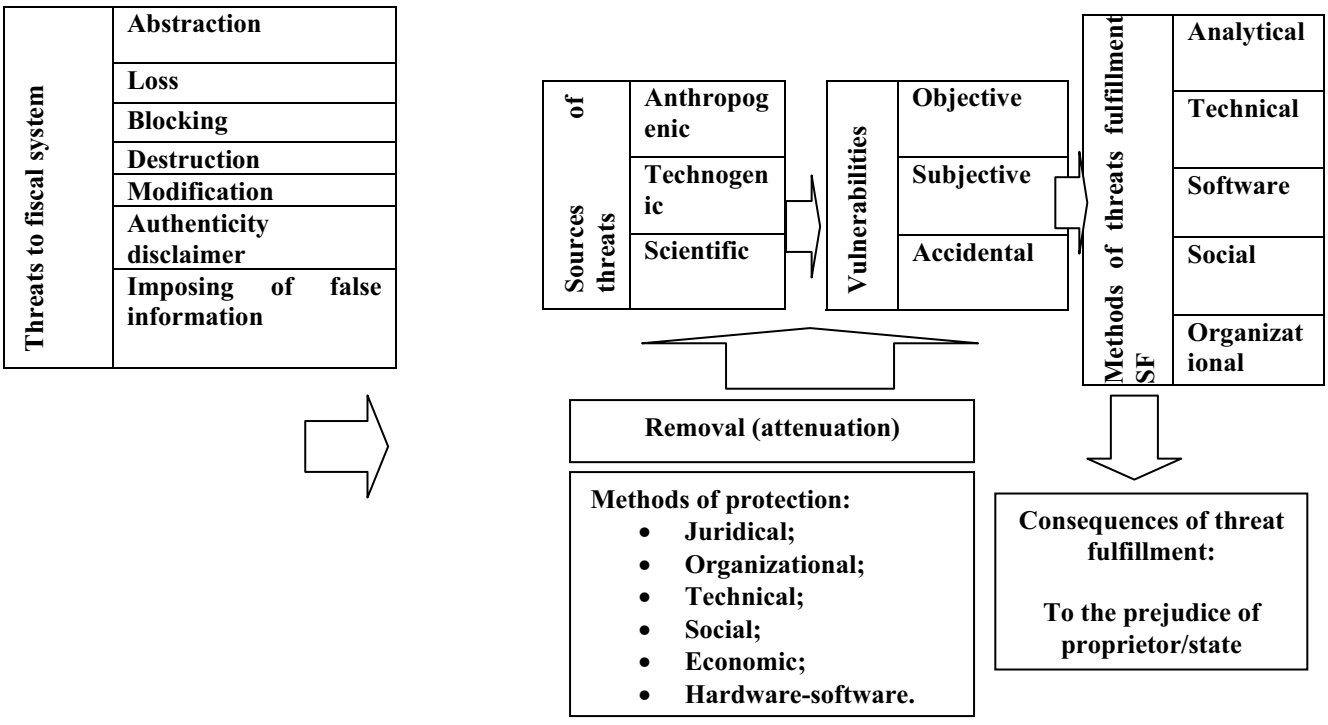


Figure 1. Schematic model presentation of threat fulfillment to fiscal system
Source: developed by authors

During analysis it is necessary to get convinced of the fact that all possible sources of threats and vulnerabilities are identified and compared one with the other and all the sources of threats and vulnerabilities are compared with methods of fulfillment. Also, without changing methodological instruments themselves, it is important to have the possibility of introducing when necessary new types of sources of threat, fulfillment methods, and vulnerabilities that will become known as a result of extending knowledge in the field.

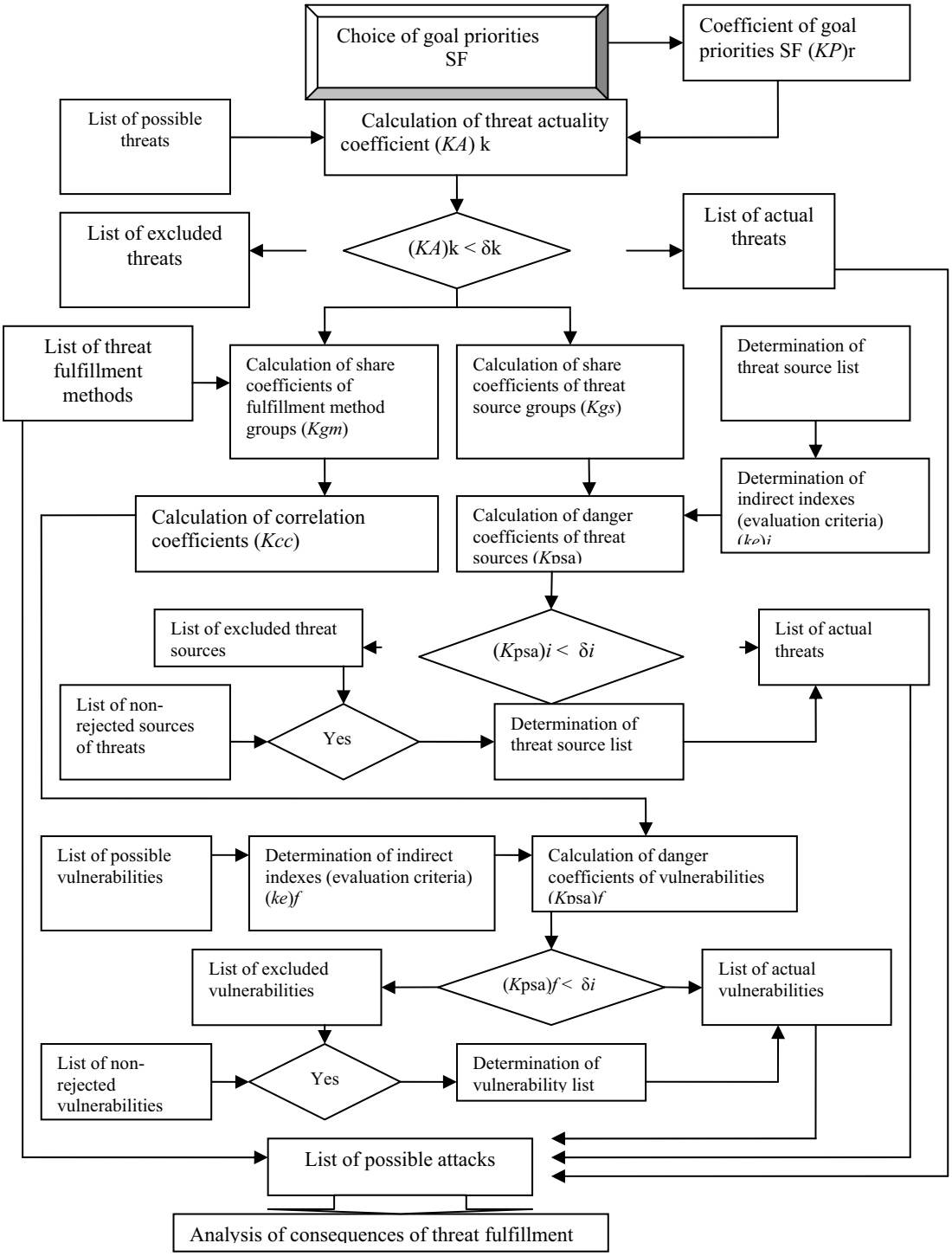


Figure 2. Algorithm of performing the analysis and evaluation of fiscal security condition
Source: developed by authors

Threats are classified according to the possibility of causing prejudice by the subject of relations in case of acting in violation of security goals. Prejudice may be caused by a certain individual (crime, guilt or negligence) and may be a consequence of manifestations independent from the individual. Threats are limited to:

- ensuring of tax levy:

- abstraction (concealment) of a part of income or tax base lowering;

- loss (voluntary/involuntary loss of primary /bookkeeping documents) or leakage of information related to fiscal verification;

- ensuring of tax levies integrity:

- alteration (distortion) of information;

- disclaimer of information authenticity;

- imposing of false information.

- ensuring of accessibility of information related to taxpayer's activity:

- blocking of information;

- destruction of information and processing devices.

All sources of threat can be divided into classes according to the type of support, and classes, in their turn, can be divided into groups in accordance with location.

Vulnerabilities can be also divided into classes according to their belonging to the source of vulnerabilities, and classes – into groups and subgroups in accordance with manifestations.

Fulfillment methods can be divided into groups according to fulfillment means. At the same time, it is necessary to take into consideration that the notion 'method' itself is applicable only when a serious examination is conducted over threat fulfillment through anthropogenic sources. For technogenic and spontaneous sources this notion takes the meaning of 'condition'.

The classification of threat (attack) fulfillment possibilities represents a set of possible variants of threat source actions through certain fulfillment methods using vulnerabilities that lead to attack objective fulfillment. The attack objective may not coincide with the goal of threat fulfillment and may be orientated towards obtaining an intermediary result, necessary for further achieving of threat fulfillment. In case of such non-coincidence, the attack is examined as a level of preparation for committing actions orientated towards threat fulfillment, i.e. 'preparation for committing' an illegal act. The attack result is the consequences that make up threat fulfillment and contribute to such fulfillment.

The approach itself of the analysis and evaluation of fiscal security condition is based on the calculation of share coefficients of dangers for threat and vulnerability sources, comparison of these coefficients with pre-established criterion and the consequent reduction (exclusion) of a complete list of possible sources of threats and vulnerabilities to the actual minimum for the corresponding objective.

The input data for evaluation and analysis performing (Figure 2) are abstract, but, in our opinion, the information may regard the correct orientation of the fiscal authority activities, presupposed priorities of security objectives, fulfilled tasks by fiscal authorities, etc [2].

Thanks to these approaches it is possible to:

- establish priorities of security goals for the *subject of relations*;
- establish the list of actual sources of threats;
- establish the list of actual vulnerabilities;
- evaluate the interconnection of threats, sources of threats and vulnerabilities;
- establish the list of possible attacks against the object;
- describe possible consequences of threat fulfillment.

The results of evaluation and analysis may be used in selecting adequate optimal methods for combating threats and in auditing the real condition of the state's fiscal security with the purpose of ensuring that security [2].

When establishing actual threats using the method of expertise and analysis what is determined is the object for protection, which is exposed to this or that threat, and the typical source of those threats and vulnerabilities that contribute to threat fulfillment. The analysis, then, serves the basis for making up the interconnection matrix of sources of threats and vulnerabilities, which, in their turn, serve for determining possible consequences of threat (attack) fulfillment and calculating the danger coefficient of attacks as an output of danger and threat coefficients and the corresponding threat sources, determined previously. The proposed classification may serve as the basis for developing the method (algorithm) for evaluating the actuality of this or that threat, emphasizing the most actual ones, which may further be the subject of their combating, of course, after all measures have been taken and appropriate methods and means have been carefully selected. As S. Dali mentioned "don't fear perfection, you won't achieve it" – all that has been said above is our purely subjective opinion and is not a panacea for the establishment of the security system for tax levying into the state budget [5]. Nevertheless, there is always a call to perfection and the principle of systemic approach for solving problems of fiscal security offers a series of measures to combat threats to fiscal security even at the stage of designing a secure system, thus saving us from useless expenses in the future.

Bibliography:

1. Codul Civil, Legea Republicii Moldova №1107-XV din 24.12.2004, Monitorul Oficial al RM, № 34-35/112 din 03.03.2005

2. Criclivaia D. Securitatea fiscală: identificarea surselor de amenințări În Studium Universitetus. Chişinău: USM, 2010, nr. 12, p. 165-173

3. Vorontov B.V, Fiscal security of the state and economic systems. – M: Problems of modern economics, N 3(27), 2009, pp. 28-32

4. Tihonov D.N, Basics of fiscal security. – M.: Analitica-Press, 2002.

5. Timofeeva I.U, Fiscal security in the field of small business: evidence of tax-related crimes and mechanisms for taxpayer's protection. – M: Bookkeeper and law, 2009, pp. 40-42

INFLUENCE OF ECONOMIC CRISIS ON FINANCIAL PERFORMANCE OF COMMERCIAL BANKS IN MOLDOVA

Larisa MISTREAN, Denis MISTREAN
Academy of Economic Studies of Moldova, Chisinau, Moldova, mistrean_larisa@yahoo.com
Academy of Economic Studies of Moldova, Chisinau, Moldova, denismi90@mail.ru

Abstract. As witness to the most spectacular economic crisis since the 1930s, today we face unprecedented negative effects and implications of the current crisis in the world economy, especially in the global financial sector because of economic recession and the worsening financial situation of the borrowers but not least also due to a ineffective and inadequate management policy. In this context, appears the need for a prudential policy to minimize negative effects on financial stability and to prevent contamination of the interbank payment due to the inability of one or more credit institutions simultaneously.

In order to determine financial vulnerabilities that have occurred in the interbank market during the last decades and the global economic crisis, at the present moment, the research subject of banking supervision is particularly important.

The double role of banks, independent economic entities, which aim to maximize profits on the one hand, and elements of the banking system led by the monetary authority, with the objective of monetary policy implementation, on the other hand, implies a new risk approach in the sense that the policies pursued by banks in order to achieve its business objective may conflict with monetary policy measures imposed by the central bank at a time.

Keywords: banking crises, banking performance, return on equity, return on assets, capital adequacy, liquidity.

1. Introduction

Banking crises have always been a cause for reflection and analysis of their negative impact on financial systems, particularly with regard to the specific risks of banks' activity, which attract funds from savers and forward them to the real economy.

To speak of crisis influence on the development of the national banking system, we analyze its performance in recent years that could be considered a starting point for the separation of assumptions about future developments in banking in the Republic of Moldova.

We want to emphasize that banking is a special economic activity, in which trust is the cornerstone for the proper functioning of the banking system. Once impaired that confidence, even when the performance of banking institutions is high (see the case of Northern Rock in Britain), everything crumble like a sand castle. Therefore, the opinion makers (domestic or international) should be more responsible for making public analysis.

Of course, the rude behavior of some banks should be reported and punished, but it's a big difference from that and the unrealistic and inappropriate influence (often malicious) of the public opinion.

Thus, let's follow the development in Moldova's banking system relying on the results obtained by him during the economic crisis.

2. Banking system liquidity

The world economic crisis had a big influence in 2009 on Moldova's economy and banking system, demonstrating the vulnerability of the economy to external economic shocks.

Although affected by the crisis in the years 2008 and 2009, Moldova's banking system has good prospects for development.

Moldavian banks hold significant minimum reserves in the central bank, until recently 22% (from 25. 9. 09 NBM passed to lower the minimum reserve requirement) of deposits (currently 11%). This demonstrates that the CB has sufficient liquidity available, and can pump it gradually to the system in case of liquidity crisis, which he did in 2009. Because of the significant fiscal constraints in 2009, caused by the alarming fiscal deficit, the only immediate solution to support the economy in the fall was easing monetary policy. Thus, the CB has injected significant liquidity of about 2.2 billion. lei in the banking sector by reducing reserve requirements from 17.5 to 8.0 percent and cut the base rate (the interest rate for its main refinancing short-term monetary policy) from 12.5 to 5.0 percent. CB has granted loans to banks in amount of 1.6 billion. lei to increase liquidity and ensure the integrity of the banking sector, and has injected in the market additional liquidity amount of 1.4 billion. lei, by acquisitioning in December 2009 about 116.4 mil. dollars. The CB has pursued these actions to ensure the stability of the banking sector and to support lending in the real sector.

In 2010 the national currency reserves have increased gradually due to an increased volume of attracted funds, moving to the level of 1294.9 million. lei at the end of December. Unlike reserves in MDL in foreign reserves (U.S. $ / euro) in 2010 had a less pronounced positive behavior as a result of slower growth in the respective currencies attracted funds. On December 31, 2010 and the amount of required reserves maintained by banks where about 44.5 mil. dollars and 51.8 mil. euro's, an increase compared to December 31, 2009, respectively, with 6.5 and 6.6%.

In December 2010, base rate was increased again until the 8.0%. Also, the CB informed about the imminent increase of bank reserves. Thus, in January 2011, the minimum level of reserves was increased from 8.0% to 11.0% from the amount of deposits, thus intensifying the fight against inflation. CB projections indicate an acceleration of inflation in the third and fourth quarters of 2011 and a slowdown in inflation towards the end of 2012.

Also, during 2010 the process of placing money in banks has manifested itself by recording an annual rate of decrease of 4.0%, its volume was 36507.3 mil. lei, instead of the rising to 12.6% recorded in 2009. On the one hand, the decrease of new deposits was determined mainly by the reluctance of people to place deposits under a fragile global economic recovery. On the other hand, low income households and lower interest on deposits as a result of excess liquidity in the market, were the main factors that have discouraged investment banking performance. As a result, the dynamic of attracting new deposits was negative during the year 2010, except for February and November.

Market changes that may occur in Moldova's deposits are generated by several factors: the volume of remittances, which is one of the main sources of population deposits, inflation, exchange rate developments and CB's monetary policy.

3. Legislative restrictions

In crisis conditions of particular importance is found to be amended and supplemented by the normative acts related to banking supervision that are taken into account and respected by the banks.

Thus, to minimize the risks associated with large exposures, and to diversify the loan portfolio, it is necessary to introduce some restrictions:

- reducing net exposure limit assumed by the bank to a person or group of persons acting jointly to 25% 15% of total regulatory capital;
- reducing the amount of net debt to ten credits from 50% to 30% of the total portfolio of loans;
- banks should respect the new requirements by 31.12.2010 and respectively 31.12.2011;
- reducing exposure and issued guarantees by international organizations;
- disposal of banks' appropriate internal policies of identification, evaluation, monitoring, verification of exposure concentrations within the portfolio, knowledge of person's activity to whom the bank is exposed, with others.

To enhance the capacity of banks to cover financial losses resulting from their work:

- Compliance with the minimum requirement from Tier I capital to 200 million. lei, banks will comply with new requirements in stages:
  - From 31.12.2011 - 150 million. lei;
  - From 31.12.2012 - 200 million. lei;
- To fulfill the requirement of capital (initially) for banks already operating in the amount of 100 million. lei, with term compliance to 31.12.2010;
- Banks have to notify the CB about their intention to distribute capital;

Central banks evolution for financial indicators and savings.
during the years 2005 - 2011 (%)

INDICATORS	2005	2006	2007	2008	2009	2010	30.04.2011
Capital adequacy (>12%)	27.23	27.86	29.63	32.06	32.28	30.11	29.35
Assets quality (Past due loans and past due plus non-accrual loans / Total loans)	4.30	4.39	3.70	5.86	16.30	13.33	10.55
Principle I (Assets with maturity over 2 years / Financial resources with maturity over 2 years, no more than 1)	0.53	0.58	0.73	0.64	0.60	0.67	0.70
Principle II (Liquid assets / Total assets A 20%)	36.71	33.53	29.05	30.67	38.27	34.15	32.82
ROE	17.34	20.47	24.16	9.13	-2.51	3.04	9.92
ROA	3.16	3.40	3.91	3.35	-0.46	0.54	1.70

SOURCE: *financial indicators on the banking system of the republic of moldova.//* www bnm.md**.**

To limit the risk of bank exposure to liquidity and to improve the system of internal control in that area, it is necessary to:

- Assets that are not placed as collateral, are not burdened by duties and are free prohibitions must be places as liquid assets;
- Banks should have adequate internal policy for identifying, monitoring, control and limit liquidity risk they are exposed to.

Indicators of vigilance and profitability over the last years show that although they had deteriorated slightly from the previous period now they have a tendency to improve and show that the banking system is strong.

4. Credit risk

One of the most worrying trends in the banking system from 2007 until 2010 was the increase in the ratio of bad loans in total loans. The results obtained by analysis based on the indicators mentioned shows that in 2009 considerably worsened the credit portfolio of banks in Moldova, which negatively influenced the quality of assets. Share of nonperforming loans in total loans at the end of 2009 reached 16.30%, following a decrease in the next period. The share of overdue loans and the accumulation state of total loans reached 17.66% (2007 - 2.44%, 2010 to 11.25%) and expired appropriations and state share of accumulation in the TRC was 60.45% (2007 - 9.7%, 2010 - 41.73%).

Deterioration of the banking system loan portfolio is explained by decreasing trends in the economy and the worsening financial situation of debtors.

This trend has two major implications for the banking system. Firstly it has undermined the key indicators of profitability of commercial banks. Thus, in late 2009, ROA and ROE indicators registered negative values, which mean that for the first time in the last decade, banking had become an unprofitable business. This means that shareholders and bank officials were less paid in 2010. However, there are notable exceptions, some banks more easily than the rest passed through the difficult year 2009. Second, deteriorating loan portfolio increased risk of long-term liquidity. While those indicators were at the permitted levels, the accumulation of bad loans deteriorated banks liquid assets. The risk margin has been included in commercial bank loans, which led to the maintenance of relatively high rates on loans, despite the steady decline of rates on bank deposits since May 2009.

Referring to the concentration of loans in various sectors of the economy, we have noticed that the situation is relatively constant throughout the period under review, and trade credits in 2009 industry accounted for 51.6% of total loans (2007 to 48.57%, 2010 to 51.41%), and this dependence r demonstrates the development of bank sector of the economy.

Another trend was the increase in funding reductions for any loss of commercial banks that shows the commercial banks policy as a response to the deteriorating lending portfolios. The ratio of losses on bank loans and total loans at the end of 2009 stood at 9.65%, almost twice as the beginning of 2009, but at 30.04.2011 it was. 62%. These actions reflect a conservative approach of the domestic commercial banks to avoid possible loss (right, from our point of view), even at the expense of short-term profitability loss.

Increased liquidity in the banking system indicators is another effect of the commercial banks' conservative approach to risk management. Banks were in 2009 and still remain quite reluctant in lending to real sector, instead investing the available assets in state securities. At the end of 2009 long-term liquidity indicator was 0.6 (maximum is 1) and short-term liquidity indicator has reached 38.27% (2007 -29.05% 2010 to 34.15%), the minimum is 20%. However, very high level of liquidity in the banking system is a stick with two ends: on the one hand, it reflects the ability of banks to cover any losses and raises immunity from any turmoil in the economy, but on the other hand, maintaining such levels of liquidity involves huge costs generated by the missed opportunity to turn these assets into long-term bank loans.

5. Banking system profitability

Consequently profitability indicators have shown a poor outcome. So, ROA and ROE in 2009 recorded negative values respectively -0.46% (2007 - 3.91%, 2010 - 0.54%) and -2.51% (2007 - 24.16%, 2010 - 3, 04%).

The degree of concentration of the banking sector, reflected by the share of total regulatory capital (TRC) held by 5 largest commercial banks in total TRC in the system, at the end of 2009 amounted to 63.23% from 61.73% in early 2009. Taking into account that substantial damage was characteristic for the loan portfolio, particularly for smaller commercial banks, these banks had to allocate large amounts of capital to finance reductions in funds for possible loan losses. These actions have had a corresponding impact on the TRC levels in these banks, conditioning a strong growth of this indicator in large banks and increasing the level of concentration in the banking market.

At the same time, the degree of bank capital adequacy remains approximately constant throughout the analyzed period, peaking in 2009 at 32.28%. In conclusion, the conservative majority of commercial banks vis-à-vis the risks management during this period, suggesting their willingness to abandon short-term profitability of bank assets to reduce risk of deterioration. Increase liquidity indicators, the allowance for losses on loans at the end of 2009 and registering negative indicators of profitability for ROA and ROE is a direct result of this risk management policy. Banks caution is determined primarily by the uncertainty about the economic outlook of the country as a whole, but also the poor financial situation of debtors. Banks will be more eager to resume lending to the real sector of the economy only when the first signs of economic recovery appear. They appeared in the second quarter of 2010, when we saw an outlined increase in lending economy.

6. Conclusions

So, in conclusion, the domestic banking sector stability is closely related and interlacing with the situation in the real sector of national economy.

Given the foregoing, we conclude on the idea that until now, it is inappropriate to speak of a new banking crisis, although a number of indicators show the tension.

Thus, the stability of the Moldovan banking system has been built up over many years due to such factors as prudent management of risks by banks, improved quality of bank management, increased foreign investment in the sector, and in 2009 was partly hampered by the risks which can be induced by problems facing some sectors against the backdrop of economic decline in the real sector of economy. And here I refer to the primary banking risk - credit risk, called as the deterioration of bank asset quality.

Based on several indicators that may characterize the level of bank liquidity and safety can be established the degree of stability of the domestic banking system.

To ensure efficient and stable development of the bank, the bank was focused on maintaining an acceptable risk to the condition and compliance with regulations of the NBM on liquidity, capital adequacy, and maintenance reserves.

References

1. George G. Kaufman. *Banking and currency crises and systemic risk: Lessons from recent events*.// Journal of Economic Perspectives. - 1999 – p.9.
2. Olivier de Bandt and Philipp Hartmann. *Systemic risk: a survey//* European central bank working paper series– 2000. - Nr.35.

CALIBRATION OF CONVECTIVE HEAT TRANSFER MODELS FOR COMBUSTION ANALYSIS IN SPARK IGNITION ENGINES

Adina GHEORGHIAN[1], Adrian IRIMESCU[2]
[1]Politehnica University of Bucharest, Faculty of Mechanics and Mechatronics, Splaiul Independentei 313 Sector 6, Bucuresti, Romania
[2]Politehnica University of Timisoara, Faculty of Mechanical Engineering, Bld Mihai Viteazul no 1, Timisoara, Romania, e.mail: iamotors@yahoo.com

Abstract: Pressure trace analysis is an investigation tool frequently used in studies of combustion in spark ignition (SI) engines. Based on in-cylinder pressure measurements, heat transfer can be evaluated with fairly good accuracy. Compared to compressions ignition engines, where flame radiation has a significant contribution to heat losses during combustion, in SI power units, convection is the main mechanism that governs heat transfer from the working fluid to engine components. For this reason, heat transfer models usually focus on this phenomena and contain several correction coefficients to account for other influences and to properly fit experimental data. This study presents an analysis of several convective heat transfer models and their calibration to fit experimental data measured on an automotive gasoline engine. Several simulations were performed at fixed engine speed and variable load, and heat transfer rates predicted with three different models were compared.

1. Introduction

Heat transfer plays an important part in spark ignition (SI) engines operation. Given that during combustion peak temperatures are much higher compared to temperature levels throughout the rest of the working cycle, most convective heat transfer models are focused on predicting heat losses during this short process from ignition to fuel burn-up completion.
Thermodynamic models must also consider the variation of fluid specific heat, as this parameter shows large variations [1]. Another issue is the variation of heat fluxes during the working cycle, as large temperature gradients are present for different engine components [2].
All the complex issues of heat transfer in SI engines require the application of several correction coefficients in order to properly predict heat transfer rates. These coefficients can feature significant variations for different engine types and working conditions [3].
A surprising result is that certain conditions allow for simple correlations to deliver results closer to measured values, compared to models that are usually more comprehensive [4].
This study aims to evaluate the calibration requirements for several heat transfer models. Experimental data recorded on an automotive port injection SI engine was used to evaluate predicted heat transfer rates.

2. Convective heat transfer models

Given that heat transfer in SI engines is influenced by fluid pressure, temperature, kinematic viscosity, fluid motion and combustion chamber geometrical features, a fully comprehensive model would have to account for all these influences. One of the most difficult issues that arises is that fluid motion is not isotropic and even changes from one cycle to the next.
Most convective heat transfer models are based on the equations used for studying the flow of fluids in pipes

$$Nu = c \cdot Re^{x} \cdot Pr^{y}, \tag{1}$$

where *Nu*, *Re* and *Pr* are the Nusselt, Reynolds and Prandtl numbers, with *c*, *x* and *y* constant values.
This results in several difficulties of properly describing the heat transfer, as the combustion chamber features change significantly throughout the working cycle [5]. Several corrections are required, with parameters that need to be fitted for certain types of engines or even particular working conditions.
One of the most commonly used equations is the one proposed by Woschni (2)

$$h_c = 3.26 \cdot \frac{p^{0.8}}{T^{0.55} \cdot B^{0.2}} \cdot w^{0.8}, \tag{2}$$

where h_c is the convective heat transfer coefficient, measured in W/m^2 K, p in-cylinder pressure, in kPa, T working fluid temperature, in K, B cylinder bore, in m, and with speed w as defined by equation (3)

$$w = C_1 \cdot S_p + C_2 \cdot \frac{V \cdot T_r}{p_r \cdot V_r} \cdot \left(p - p_m\right), \tag{3}$$

where w is measured in m/s, S_p mean piston speed in m/s, V cylinder volume, in m^3, T_r, p_r and V_r temperature, pressure and volume at a reference point, usually at the start of combustion, p_m motored cylinder pressure at the same crank angle as p, with C_1 equals 6.18 for gas exchange and 2.28 for compression, combustion and expansion, C_2 equals 0 for the gas exchange and compression period, and $3.24 \cdot 10^{-3}$ for combustion and expansion [6].

An alternative to this calculation is to develop the cylinder-pipe flow analogy, using equation (4)

$$h_c = 86.39 \cdot \frac{p^{0.8} \cdot w^{0.8}}{T^{0.546} \cdot L^{0.2}} \cdot C_1 \cdot \left(\frac{L_{BDC}}{L} \right)^{C_2}, \quad (4)$$

where C_1 equals 1.9, C_2 can be calibrated with a value of 0.4, and L is a specific length for disc shaped combustion chambers (with subscript BDC meaning Bottom Dead Centre), defined by equation (5)

$$L = 2 \cdot \frac{h}{1 + \frac{h}{B}}, \quad (5)$$

where h is the clearance height, measured in m.

Equation (6) is used to define speed w as

$$w = r_i \cdot w_r, \quad (6)$$

where w_r is a mean average speed of the working fluid, at a reference state, usually mean intake flow speed, and r a kinetic energy dissipation factor, defined by equation (7)

$$r_i = \left(1 + 18 \cdot \frac{\theta_i - \theta_r}{6 \cdot N} \cdot \frac{\upsilon^{0.2}}{L^{1.2}} \cdot \left(r_{i-1} \cdot w_r \right)^{0.8} \right)^{-0.5}, \quad (7)$$

where θ_i is the momentary crank angle, with θ_r at the reference state, both measured in deg, N engine speed, in rev/min and υ kinematic viscosity, in m^2/s.

A simple correlation was proposed by Hohenberg and can be used to evaluate global heat transfer with equation (8), once the reconstructed pressure trace is available

$$h = C_1 \cdot \frac{p^{0.8}}{V^{0.06} \cdot T^{0.4}} \cdot \left(S_p + C_2 \right)^{0.8}, \quad (8)$$

With h as the overall heat transfer coefficient measured in W/ m^2 K, 130 and 1.4 as suggested values for C_1 and C_2 for a diesel engine [7].

3. Results and discussions

A simple thermodynamic model was used to calculate several in-cylinder pressure points during combustion. After calculating these points, a Wiebe function was used to fit the mass fraction burned [8], rather than a Fourier transform for reconstructing the pressure trace [9], [10]. This resulted in much smoother in-cylinder pressure (figure 1) and temperature (figure 2) traces. In order to verify the thermodynamic model, calculated fuel conversion efficiency compared to previously measured values at 3000 rev/min engine speed [11], throughout the entire load range (figure 3).

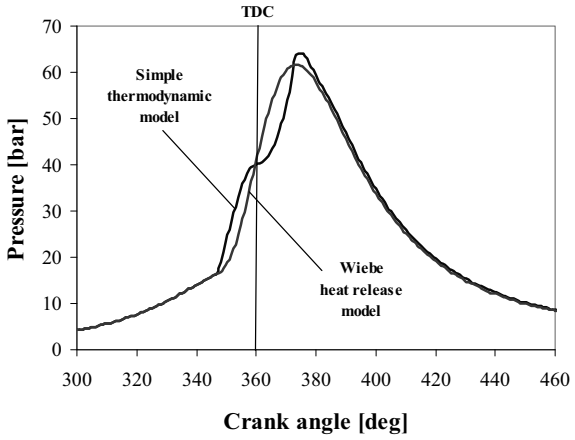


Figure 1. Reconstructed in-cylinder pressure trace at full load, 3000 rev/min.

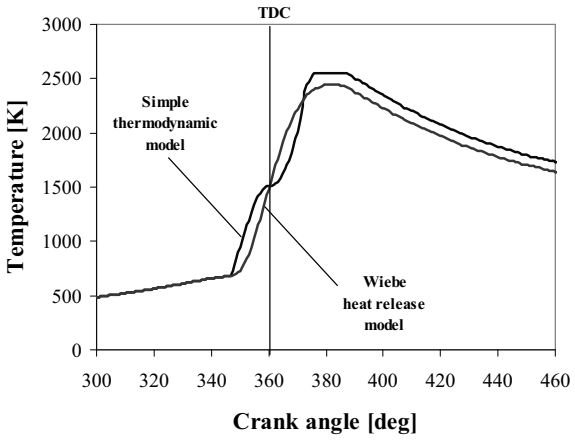


Figure 2. Reconstructed in-cylinder temperature trace at full load, 3000 rev/min.

Simple non-dimensional combustion models feature an accuracy of ±5..8 % [5]. One flaw of these models is that they can predict engine performance with such accuracy only at high load. Relative errors of up to ~ 10 % were recorded at light-to-medium load (figure 4). It should be noted that calibration at part load would ensure the predicted accuracy level throughout the entire load range.

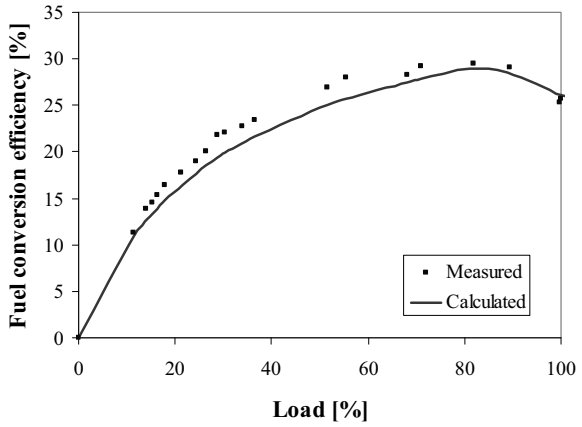


Figure 3. Calculated and measured fuel conversion efficiency at 3000 rev/min.

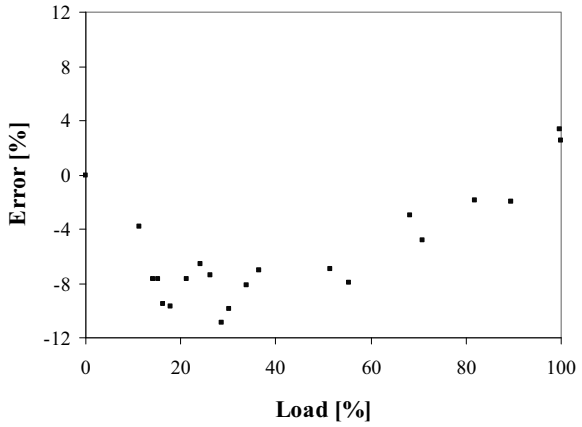


Figure 4. Relative error of calculated values compared to measured fuel conversion efficiency.

All calculations assumed heat losses during combustion (Q_w) as a fixed percentage (ξ_w) of the released heat (Q_{rel}), i.e. $Q_w = \xi_w \cdot Q_{rel}$, with ξ_w = 8 %. Equations (2) and (8) under-predicted the heat transferred from the working fluid to the combustion chamber walls, while equation (4) gave much closer full load values (table 1).

Table 1. Predicted heat loss during combustion

Equation No.	C_1	C_2	ξ_w	
			Fixed	Calculated
	[-]	[-]	[%]	
2	2.28	$3.24 \cdot 10^{-3}$	8	5.633
	3.51	$3.24 \cdot 10^{-3}$		8.015
	2.28	$9.5 \cdot 10^{-3}$		7.989
4	1.9	0.4		7.353
	2.07	0.4		8.011
	1.9	0.51		8.007
8	130	1.4		4.873
	213	1.4		7.983
	130	10		8.005

All equations under-predict heat losses when using the coefficients prescribed by the authors. Equation 4 gives the highest values (figure 5). After calibration, all equations give similar heat transfer coefficients. Equations (2) and (8) under-predict heat losses during compression and combustion, while during expansion a higher transfer coefficient was calculated, compared to correlation (4) (figures 6 and 7). This is the result of predicting fluid motion inside the cylinder. Higher velocity results in increased heat flow, while during expansion mean fluid flow speed, as well as turbulence intensity drops significantly [6]. In this respect, equation (4) seems to be the most appropriate correlation. When performing the calibration, coefficients C_1 and C_2 were modified.

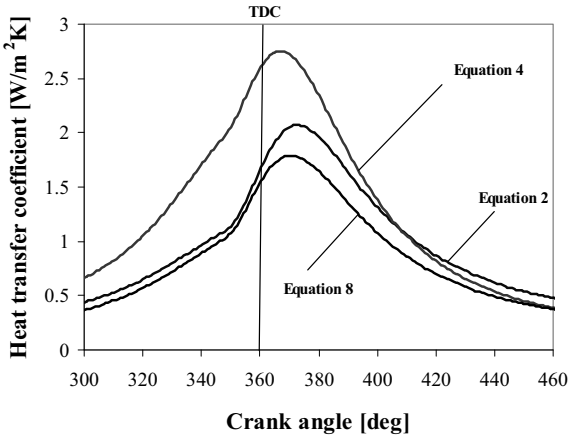


Figure 5. Calculated heat transfer coefficients using un-calibrated equations.

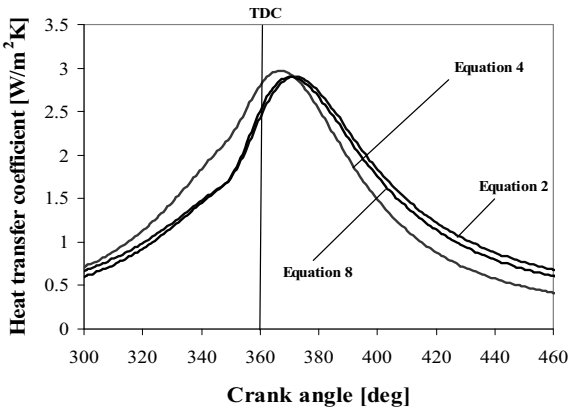


Figure 6. Calculated heat transfer coefficients using calibrated equations, with C_1 modified.

A surprising result is that the simplest correlation predicts roughly the same values as the more complex equation (2), when modifying coefficient C_1 (figure 6). Modifying coefficient C_2 resulted in very different predicted heat transfer rates when comparing

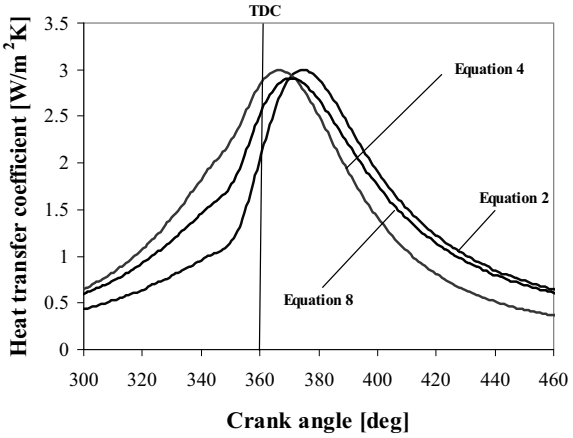


Figure 7. Calculated heat transfer coefficients using calibrated equations, with C_2 modified.

the three equations (figure 7). Again, correlations (2) and (8) both under-predict heat losses during compression and combustion, while over-predicting heat transfer during expansion, compared to equation (4).

Correlation (4) was the model that required the least calibration. This is the reason why all presented values in figures 5, 6 and 7 are similar for this equation. Calculated heat flux throughout the entire load range (figure 8), is comparable to measured values given in the literature.

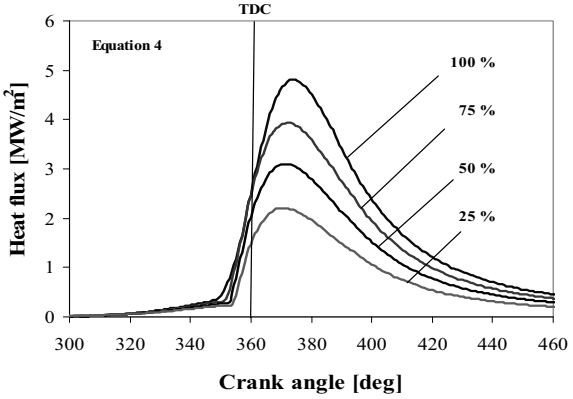


Figure 8. Calculated heat flux with un-calibrated equation 4, at 25 %, 50 %, 75 % and 100 % load.

4. Conclusions

A numerical study was performed to evaluate required calibrations for different heat transfer models applied to SI engines. Main combustion parameters were calculated using a Wiebe heat release model. Calculated fuel conversion efficiency was compared to measured values in order to validate the predicted in-cylinder pressure trace.

Three different correlations of convective heat transfer coefficients were compared to fit the calculated in-cylinder pressure traces. Models that quantify fluid motion inside the cylinder require the least amount of calibration, while simple correlations need extensive modifications of prescribed coefficients.

Acknowledgement

This work was partially supported by the the strategic grant POSDRU/89/1.5/S/57649, Project ID 57649 (PERFORM-ERA), co-financed by the European Social Fund – Investing in People, within the Sectoral Operational Programme Human Resources Development 2007-2013.

References

[1] Abu-Nada, E., Al-Hinti, I., Al-Sarkhi, A., B. Akash, B., Thermodynamic modeling of spark-ignition engine: Effect of temperature dependent specific heats, *International Communications in Heat and Mass Transfer*, **33**, 1264, 2006.

[2] Mohammadi, A., Yaghoubi, M., Rashidi, M., Analysis of local convective heat transfer in a spark ignition engine, *International Communications in Heat and Mass Transfer*, **35**, 215, 2008.

[3] Wu Y. Y., Chen, B. C, Hsieh, F. C., Ke, C. T, Heat transfer model for small-scale spark-ignition engines, *International Journal of Heat and Mass Transfer*, **52**, 1875, 2009.

[4] Soyhan, H. S., Yasar, H., Walmsley, H., Head, B., Kalghatgi G. T., Sorusbay C., Evaluation of heat transfer correlations for HCCI engine modeling, *Applied Thermal Engineering*, **29**, 541, 2009.

[5] Grünwald, B., *Theory, calculation and design of automotive engines (original title in Romanian)*, Editura didactică şi pedagogică Bucureşti, România, 1980.

[6] Heywood, J. B., *Internal combustion engine fundamentals*, McGraw Hill series in Mechanical Engineering, 1988.

[7] Zeng, P., Prucka, R. G., Filipi, Z. S., Assanis, D. N., Reconstructing Cylinder Pressure of a Spark Ignition Engine for Heat Transfer and Heat Release Analyses, *Proceedings of ASME Internal Combustion Engine Division 2004 Fall Technical Conference, October 24-27, Long Beach, California, USA*, 2004.

[8] Katsumata, M., Kuroda, Y., Ohata, A., Development of an Engine Torque Estimation Model: Integration of Physical and Statistical Combustion Model, *SAE World Congress & Exhibition, April 2007, Detroit, MI, USA*, SAE Paper No. 2007-01-1302.

[9] Shehata, M. S., Cylinder pressure, performance parameters, heat release, specific heats ratio and duration of combustion for spark ignition engine, *Energy*, **35**, 4710, 2010.

[10] Zeng, P., Assanis, D. N., Cylinder Pressure Reconstruction and its Application to Heat Transfer Analysis, *SAE 2004 World Congress & Exhibition, March 2004, Detroit, MI, USA*, SAE Paper No. 2004-01-0922.

[11] Irimescu, A., Fuel conversion efficiency of a port injection engine fueled with gasoline–isobutanol blends, *Energy*, **36**, 3030, 2011.

AEROSOL LAYERS INVESTIGATION BY LIDAR SYSTEMS, SATELLITE IMAGES AND TRAJECTORY MODELS

Ion VETRES, Ioana IONEL, Malan BASSIM

Mechanical Faculty, Politehnica University*, Timisoara, Romania*
e-mail: vetres.i@gmail.com

Abstract. Lidar data helps us to investigate and identify the type and height for layers of aerosols and dust. Satellite image gives us a better view of the phenomenon that created that layer as well as its dynamics in Earth's atmosphere. Trajectory modeling gives us additional information about a layer's height evolution in time.

Keywords: Lidar, Satellite data, trajectory

1. Introduction

In the last decades it has become more and more obvious, that mankind is endangering the habitability of its own biosphere. Most of the potential risks for our environment are produced by human activities and are mediated through the chemistry and physics of the atmosphere:

- air pollution resulting from industrial combustion and biomass burning;
- changes in the oxidation capacity of the lower atmosphere due to anthropogenic and changing biogenic emissions;
- global warming as a consequence of the increasing emissions for greenhouse gases;
- acidic precipitation;
- changes in precipitation and cloud coverage;
- climatic impact of changes in land use (e.g. tropical deforestation).

Another very important source of aerosol and dust are volcanic eruption that put huge quantities of ash, SO_2 and dust.

We hear very often the word "aerosol", but what is it?

Aerosols are a minor component of the atmosphere, a trace constituent, but their role is amplified by their ubiquity and interaction with the atmospheric radiation. Typical sizes of aerosol vary from 10^{-4} μm to tens of micrometers. They can be found in concentrations ranging from about 10^{7} to 10^{-6} cm^{-3}, depending upon their size, origin, and location. The study of the atmospheric aerosols is important for a variety of reasons, from which we will consider the following:

- Aerosols influence the climate directly and indirectly by altering the radiative energy transfer through their optical properties;
- By serving as cloud condensation nuclei, they influence cloud - microphysical processes and therefore the development of clouds and precipitation which are important for weather and climate prediction and earth's hydrological cycle;

Aerosols influence air, environmental pollution and often cause severe health-hazardous problems in human and any other animals [1].

2. Experimental

As a consequence of the changes in the climate and the strong pollution problems, atmospheric science was intensively subsidized to develop new observational platforms, for modeling the future behavior of the atmosphere, to understand the historic development of climate, to monitor anthropogenic and natural emissions as well as to collect knowledge for policy makers to facilitate their decisions. The Lidar observation system and satellite technology has evolved and not only for military purpose but also for air pollution analysis. The knowledge of aerosols is important for surveillance from air or satellite. To get better signals for all communication and observation through the troposphere, the knowledge of aerosols is important. If the aerosol distribution in the atmosphere is known, the researchers believe that predictions of mist can be done. This means, that an airport can receive information of when mist is coming, and send out warnings in case no airplanes should land or take off. Also on the sea, the knowledge of mist in advance can improve the daily life for transport companies. It can also be used as a detector in warning systems for bush fires, industrial smoke or smog since these are made of aerosols in most of their composition.

Lidar is an instrument for active remote sensing of various atmospheric variables. Lidar can be used to observe atmospheric trace gases, aerosols and clouds. There is a lack of knowledge about the distribution of these gases in the atmosphere and lidar measurements can contribute to increase the knowledge.

The lidar provides measurements of atmospheric components in the troposphere with high spatial and temporal resolution at day and night.

Molecules and aerosols are responsible for scattering and absorption of the incident light. Scattering by molecules include elastic and inelastic scattering processes whereas aerosols usually cause only elastic scattering. A telescope collects the backscattered light which then can be analyzed in a polychromator by one or several detectors. The height information is derived from the detection time taking into account that the laser pulse travels with the speed of light through the atmosphere.

Optical remote sensing has been extensively used to study the atmospheric aerosol pollutants. These techniques fall into two categories: active and passive remote sensing techniques. Remote sensors can be classified into three different types on the basis of the used platform: ground-based, airborne, and satellite borne [2].

For this paper there were used Lidar measurements, Range Corrected Signal image, that were made in Magurele, near Bucharest.

3. Results and disscusion

The measurements were made in 22.07.2008 and are shown in Figure 1.

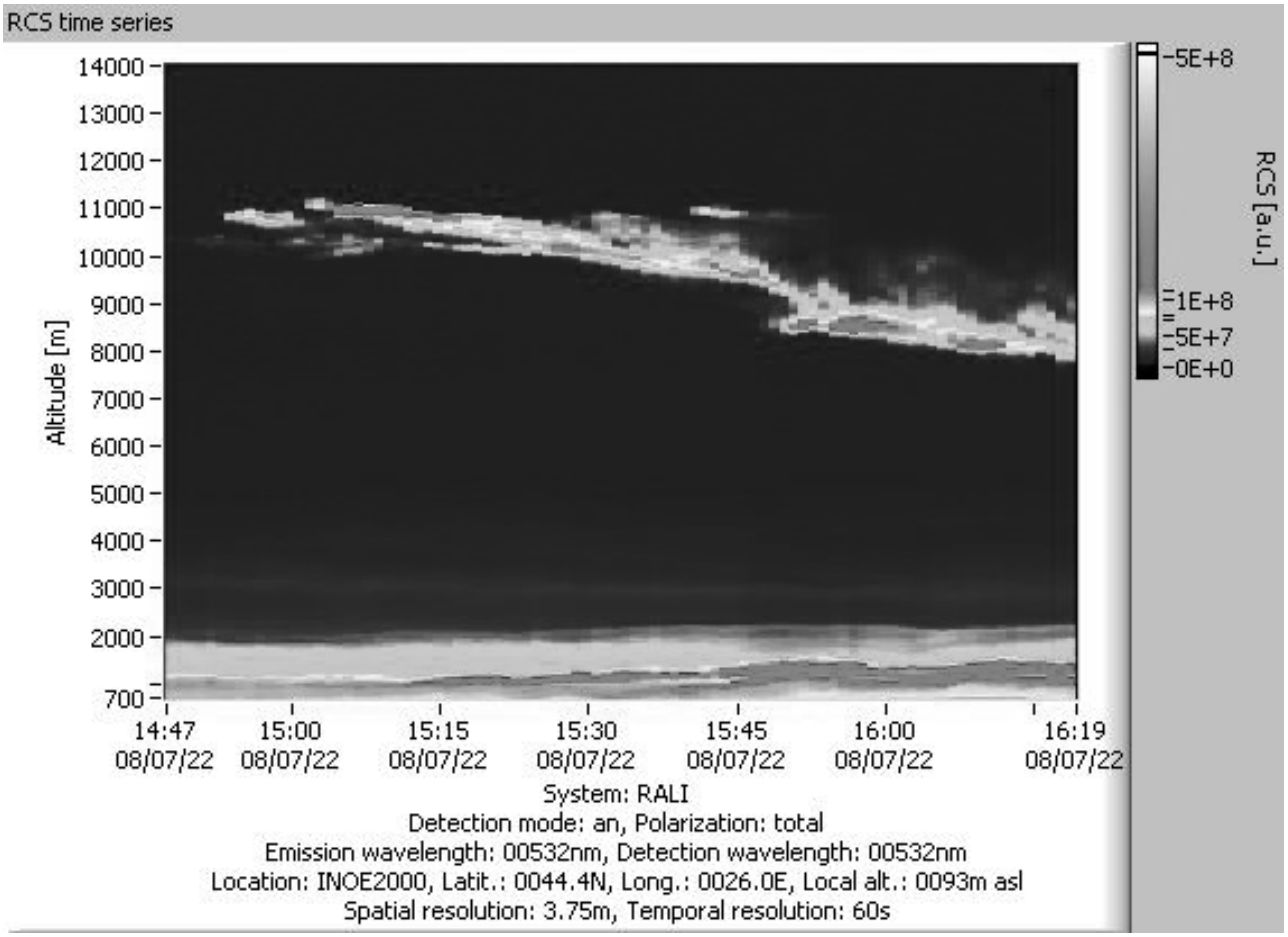


Figure 1 RCS signal from LIDAR data in 22.07.2008 at INOE location

We can clearly see the aerosol intrusion and also the height of the layer. With the Lidar measurement there can be investigated the height and aerosol characteristics, but very important is the source and the dynamics for the layers of aerosols. In the case of volcanic eruptions where layers of ash and dust are formed, those kinds of clouds are very dangerous for aircraft because the engine will be damaged.

With the help of trajectory-models the dynamics of aerosols clouds can be investigated.

In the paper are used HYSPLIT model (collaboration between NOAA-National Oceanic and Atmospheric Administration and the Bureau of Meteorology from Australia). Meteorological data are used in the models to track the trajectory of the aerosol particles. In the HYSPLIT – "Hybrid Single Particle Lagrangian Integrated Trajectory" – model, a fixed number of particles are advected about the model domain by the main wind field and a turbulent component [3].

For this analyze, 9000 m, 10000 m and 11000 m altitude was used. These values were chosen from the RCS image analysis and are presented in Figure 2. The back-trajectories for the particles are calculated for 6 days period, 48 hours calculation time, specified in the input of the model.

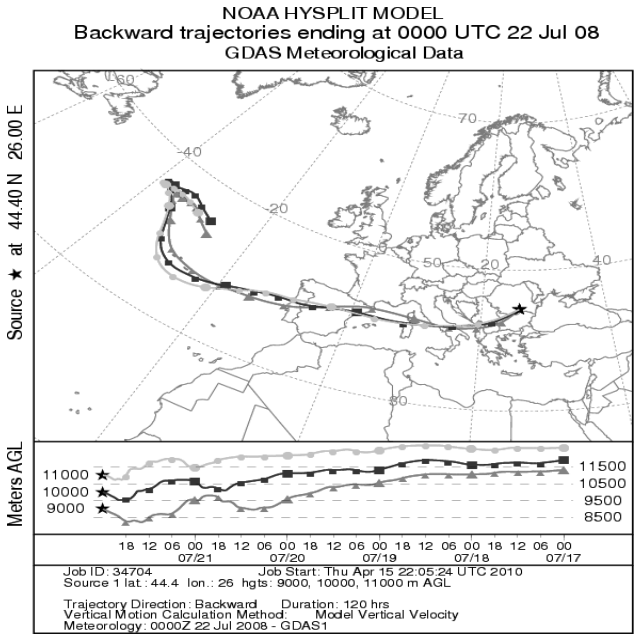


Figure 2 Backward trajectories from NOAA HYSPLIT MODEL for 22 July 2008 [3]

The air masses that are over Magurele-Bucharest in the 22 of July came from the over the ocean at high altitude, over 10000 m, passing several countries from Europe and there is no indication of anthropogenic pollution mixed in from lower latitudes.

Satellite data can give us additional information related to the air masses and aerosols layers [4], [5]. For this specific evaluation of the Lidar measurements, satellite data from NASA/GSFC - TOMS integrated in NAAPS/TOMS model, for the 22 July 2008 is represented in Figure 3. For a better visualization of the trajectory also a satellite data from 19.07.2008 it is presented in Figure 4.

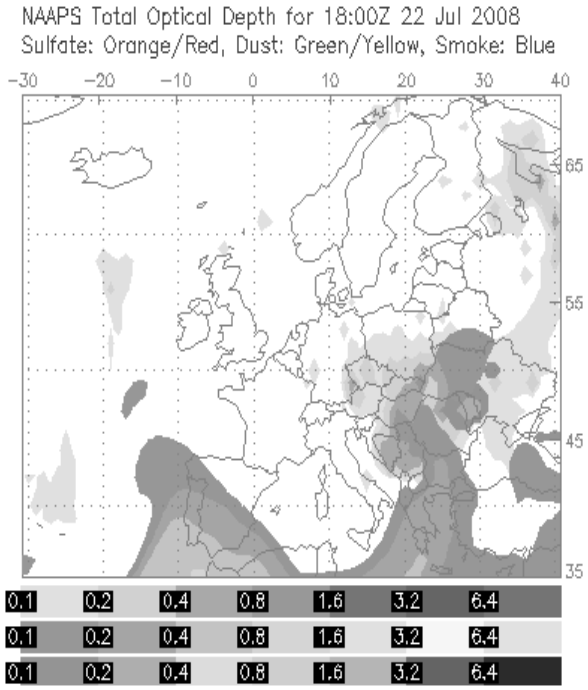


Figure 3 NAAPS/TOMS measurements (Navy Aerosol Analysis and Prediction System) from 22 July 2008 obtained from satellite data and integrated in global model [6]

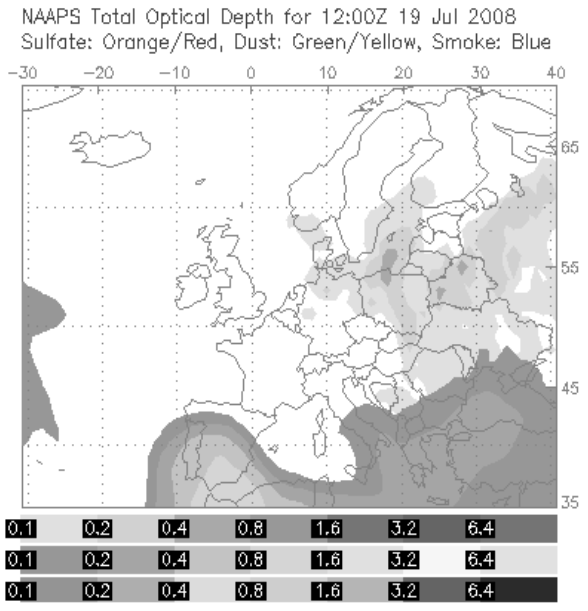


Figure 4 NAAPS/TOMS measurements (Navy Aerosol Analysis and Prediction System) from 19 July 2008 obtained from satellite data and integrated in global model [6]

From what it can be seen, the predominant pollutant that is over the investigated area is dust (green/yellow colours), but also a big concentration of sulphates.

4. Conclusions

If we superpose the satellite images with the back-trajectory model we can observe that the dust mass coincide with the layers detected by the LIDAR and represented in the Figure 2 and 3. The use of remotely sensed data and satellite investigation for the mapping of pollutants over a city brings a better spatialisation of the phenomena under study.

The digital analysis of satellite images proved to be a valuable tool for accurate detection of environmental pollution.

This method can be automated, because with today's technology we have access to satellite images in real time and thus can detect aerosol masses, ash clouds or other pollutants.

According to the obtained results one can conclude that satellite image proved to be one of the most important tools for global environmental monitoring

Current weather models are becoming better every day and so we have access to wind profiles and turbulence. They may be linked to satellite imagery and it can be obtained a very good warning system about dust or aerosol clouds, which are dangerous for aircraft, while realising also predictions regarding the evolution in real time of the air masses.

ACKNOWLEDGMENT

This work was partially supported by the strategic grant POSDRU 6/1.5/S/13, (2008) of the Ministry of Labour, Family and Social Protection, Romania, co-financed by the European Social Fund – Investing in People.

The authors gratefully acknowledge the NOAA Air Resources Laboratory (ARL) for the provision of the HYSPLIT transport and dispersion model and/or READY website (http://www.arl.noaa.gov/ready.php) used in this publication.

References

[1] Kondratyev L., Ivlev L., Krapivin V., Varotsos C., *Atmospheric Aerosol Properties Formation,* Springer, 2006

[2] Weitkamp, C.,*Lidar Range-Resolved Optical Remote Sensing of the Atmosphere*, Springer, 2005.

[3] Draxler, R. R. and Rolph, G. D., 2003: HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (http://www.arl.noaa.gov/ready/hysplit4.html), NOAA Air Resources Laboratory, Silver Spring, MD

[4] Engel-Cox, J., Hoff, R., Haymet, A., 2004a. Recommendations on the use of satellite remote-sensing data for urban air quality. Journal of the Air and Waste Management Association 54, 1360–1371.

[5] Kaufman, Y. J., Tanre D., Boucher O., 2002, A satellite view of aerosols in the climate system, Nature, vol.419

[6] http://www.nrlmry.navy.mil/aerosol/#satelliteanalyses

HUNTING PARK IN THE BANAT OF TIMISOARA COUNTY UNDER CYNEGETIC BIODIVERSITY, ZOO-TECHNICAL AND ECONOMIC ASPECTS

Marcel MATIUTI[*], Carmen-Luminita MATIUTI[**]

[*] *Faculty of Veterinary Medicine, Timisoara, Romania*
e-mail: matiutimarcel@yahoo.com
[**] *Technical College Azur Timisoara, Romania*

Abstract. The Economy of Game entails all the activities done in order to improve – quantitatively and qualitatively – the animal population, to know exactly each wild animal species in terms of behaviour, habitat, selection, complementary nurturing, preservation. The term of economy, which refers to preserving the cynegetic biodiversity and the agro-sylvan-cynegetic equilibrium in nature. The Hunting Center in Sarlota is situated at a distance of 45 km of Timisoara (in the Banat county, Western Romania) and has as a goal the preservation of the local cynegetic biodiversity. This area is a hunting place and a place where certain game breeds can be raised semi-intensively, such as the wild boar (Sus scrofa ferus), red deer (Cervus elaphus), fallow deer (Dama dama), roe deer (Capreolus capreolus) and mouflon (Ovis aries musimon). In this area one can also take pictures and videotape. Especially given the fact that lots of professional hunters come here from Germany and Austria, the cynegetic tourism can provide the are with a lot of income.Supplementary feeding has been done through concentrated fodder based on recipes given by the nutritionists from the Faculty of Veterinary Medicine Timisoara (Banat). The results of this experiment prove that the quality of the tested trophies has improved. The chemical analysis shows are improvement in the authors composition in comparison with standard results. This shows that complementary feeding is a necessity throughout the year.

Keywords: cynegetic, biodiversity, zoogenetic, game economy

1. Introduction

Unlike other countries in Western Europe, which managed to bring to extinction a large number of wild animal species through bad management, Romania still has a great venatorial potential. Nevertheless, the exact number of wild species on Romanian territory remains to be determined, as well as the interaction between species pertaining to a certain ecosystem. The extinction of a certain species may lead to a state of unbalance in the ecosystem and to the apparition of another species, a fact which usually has negative effects [1].

When trying to preserve the gene banks, one usually employs two methods: the *in-situ* and the *ex-situ* ones. The in-situ method refers to taking immediate and necessary measures in order to protect the living animals in an environment which is as similar as possible to their natural one, or even their natural habitat if this is possible. The ex-situ method uses conservation *in vivo*, where, unlike the former method, animals are kept in a different habitat than their natural one, as well as conservation *in vitro*, which means preserving seminal cells, embryos or tissues [2].

2. Materials and Methods

In what wild animals are concerned, it is preferable to use the in-situ preservation, thus keeping them in their natural habitat. Wild species are protected from leaping into extinction by means of repopulating those areas which used to be their natural habitat or by populating closed spaces like hunting parks and zoos. Still, there are lots of species which go extinct because these measures are taken too late.

Romania, although having been criticized by many, has managed to preserve a large number of mammals and wild birds, which constitute the National Genetic Patrimony. Wild animals such as bears, wolves, wild boars, goats, the chamois (*Rupicapra rupicapra)*, the lynx, the black grouse have long disappeared from many European countries but can still be found in Romania. In 2002, at the Faculties of Veterinary Medicine from Timisoara a new discipline was founded by Eng. Matiuti Marcel, Ph.D: The Economy of the Game. This subject had the aim to bring forth knowledge about the cynegetic biodiversity in Romania and basic notion were to be taught, such as dealing with game, its selection, behaviour and preservation and also the role of the veterinarian in the cynegetic field. The subject was intended for the third year students of the Faculty of Veterinary Medicine, as an

optional course. The students' interest in this domain was unexpectedly great and the course caught the attention of other students from senior years and even from other faculties in the Banat University of Agricultural Sciences and Veterinary Medicine Timisoara.

Between November 2003 – october 2010 numerous studies on were conducted on the behaviour of the fallow deer and the mouflon. The observation of the animals wasn't always easy, on the contrary, and many observations were made with the help of binoculars. There were a lot of diagrams which showed the behaviour of the animals (etograms) and the data was statistically interpreted. Certain basic forms of behaviour were studied: water and food consumption, urinating and defecating, sexual behaviour, behaviour which expresses various sensations (fear, pain, well being), rest patterns, social interaction, exploration willingness, combative behaviour, playfulness, non-aggressive behaviour [3].

3. Results and disscusion

In general, in Banat there are many species (covered in fur or feathers) which are constitute perfect game for hunters or perfect subjects for those who "hunt" by camera. The pedo-climatic conditions are excellent for a vigorous and healthy game, with trophies which win awards at various exhibitions in foreign countries. It is not an exaggeration to claim that Romania is truly a hunter's paradise. The facilities existent in almost any area in what hunting is concerned attracts hunters from all over the world.

Due to various reasons, which are mainly financial ones but also reasons regarding scientific research, social, legislative, ecological ones, Romania has to plan the so-called Hunting Centres, which include Hunting Parks and other areas where game is bred intensively or semi-intensively. In these spaces, game is closely observed, accurately evaluated and monitored especially in what the mating habits are concerned. Here evaluations such as scientific research, behavioral studies, etograms, animal handling or health checking are easily done. These park centers ensures an "in situ" animal preservation of those species which had been almost extinct and now are being reintroduced in Romania's fauna. For example, the Fallow deer is known to be bred in these kinds of places because outside it would produce much damage to crops. The Mouflon used to be found in the 1970s in the Macinului Mountains or very rarely in other parks in Romania, but now it is bred in the Hunting Center of Sarlota in over 120 specimens.

There is also an ecological side to the whole matter, namely that the animals kept in the centers are fed ecologically, no chemicals are added to their nutrition, chemicals which in everyday agriculture seems to occur more often than not.

Pouching is reduced in these enclosed parks as well as packs of stray dogs or shepherds' dogs. The latter are known to be quite numerous at the sheep cots and they don't get proper feeding so they attack any wild animal that they can find, especially young animals.

Situated at 40 km NE of Timisoara, the hunting center of Sarlota offers a spectacular view for those who want to take photos or observe the nature with the help of a pair of binoculars and of course 3000 ha of forest out of which 1200 ha enclosed for those who seek adventure and want to actually hunt. The main game is represented by Fallow deer and Mouflon.

The Hunting Center Pischia is situated at 25 km NE of Timisoara. It owns 700 ha and the main species encountered here are the Red Deer and the Wild Boar. Its facilities are similar to those in Sarlota.

In the area around the parks there are other species such as the European pine marten (Martes martes), the fox (Vulpes vulpes) the jackal (Canis aureus), the wolf (Canis lupus), the wild cat (Felis silvestris), the European badger (Meles meles). Species such as the mink (Lutreola lutreola) and the ermine (Mustela erminea) were spotted very rarely, for example in 2010 in Sannicolau area.

Keeping animals in hunting centers proves to be a profitable business on the long run. The amount of investment one has to make in the case of a hunting center is much smaller than one made for a domestic animal breeding farm. As it happens, usually there are terrains near the parks which are used agriculturally.

In most cases, the parks are surrounded by a wire fence. The wires go horizontally and vertically, the resulting squares (popularly named "eyes") being wider in the upper part. The fences go down in the ground as deep as 40 cm and they are bent in the lower part so that animals cannot dig and escape. The fence's height is of 2,30 m in order not to be jumped over by deer. Also, it has to be very well stretched. The cost of the fence is another issue, the one for Sarlota having been bought from Austria because in Romania prices are quite high in this particular case. Barbed wire is strictly forbidden [4].

It is extremely important that the clusters of trees in the park be made of different species of trees. The foresters recommend that there shouldn't be only one type of trees in the forest because that wouldn't provide good conditions for a cynegetic biodiversity. Between clumps of trees in the forest there must be some clearance, some opening in which spontaneous flora can grow or other plants can be grown, such as turnips or the Jerusalem artichoke (topinambur) for wild boars. Between the forest and the park there usually is a stripe of land of about 200-300m cultivated in order for the animals not to leave the area.

3.1. Hunting tradition, establishments and installations

If decades ago a hunting lodge meant a simple wooden construction similar in shape to the local houses in the area, nowadays there are hunting houses which have a special architecture, imitating the former hunting houses of Transylvanian noblemen. These so-called hunting houses have lots of rooms and many facilities, even luxury items. Since hunting is considered nowadays to be a luxury sport, prices are no lower than that. Hunters who come in such a hunting park are ensured with the necessary means of

transport and guides. Before the hunting session begins, the hunters are taken to those places where specimens with spectacular trophies are seen to roam, this depending on the price they are willing to pay.

Hunting traditions in Banat are almost lost. At the County Association of Hunters and Fishermen they still maintain the "hunter's baptism", which is a ritual dating back in the Antiquity, done in the name of Diana (Artemis) the Goddess. The apprentice is whipped with a stick so that he doesn't forget that a wrong shot is worse than this punishment.

The hunting traditions which come from Central Europe are kept when a big hunting session is organized or when the foresters hunt. These include giving the game a "last helping of food" or paying the "last homage". After the hunting session is over a "hunting display" is done, a smaller one for the smaller animals and a bigger one for the bigger animals. Sometimes hunters blow the so-called hunting horn or sing together specific songs.

At the end of each hunting session (or even at the beginning as well if it's a cold day) the hunters eat together what is called a hunter's meal and which must be very rich.

In Romania the hunter's day is celebrated in 20th September, on St. Eustasius day, the Saint who is believed to have seen a bright cross with Jesus Christ crucified on it between the antlers of a deer which he was hunting.

There are also special enclosures which camouflage the hunters and these can be placed on ground as well as high above the ground. There are roads and special hunting paths which allow the hunter to approach the game as close as possible.

3.2. Games complementary feeding

Complementary feeding is necessary due to the large number of animals in the Hunting Center. Some specialists recommend that animals be fed complementary only during winter months when food in naturally reduced, but specialists from the Wild Animal Biology Institute in Budapest say that the animals should be fed complementary throughout the year and this is because it is the only way to obtain qualitative trophies in a place with a high density of animals.

Supplementary feeding in Sarlota and Pischia Hunter Center has been done through concentrated fodder based on recipes given by the nutritionists from the Faculty of Veterinary Medicine in Timisoara.

Prof. Crainiceanu E. and Eng. Dr. Matiuti Marcel, Ph.D. have elaborated specific fodder recipes for the mouflons (which had the optimal quantity of proteins, fats, energy, vitamins and minerals) to which certain anti-parasites substances were then added. This was done because there was a high occurrence of internal and external parasites in the animals at the center, due to their increased number [5].

In order to ensure efficiency in a hunting park, there needs to be observation towers. These have to be tall enough so that the animals cannot see the person who is observing them. Besides the concentrated fodder, the animals have been given good quality hay. The food was regularly tested as well.

In winter the feeding was made with a mixture of concentrated fodder which also had hay and ensilage in it. The mouflons were seen to come to the feeding spots in the morning at 4:35-5:30 and 7:20-7:45 and in the evening at 17:30-18:20 and 20:00-20:30. It was impossible, however to determine the exact amount of fodder eaten because from the same spots other animals ate as well (the fallow deer and the roe deer). Then the observations were carried out during the day as well, when the animals were seen coming to feed themselves quite often, in a short period of time.

Out of the whole time they spent near the observation point, the mouflons could be seen to do the following: approx. 23,00 % they spent eating and approx. 23,00% they stood still, paying much attention to any noise. Normal noises from the woods didn't scare them. There was one time, however, when they were seen running very fast and the next day the researchers found trails of wolves' paws near the fence of the reservation. Three days later the wolf was hunted down and killed. Some other time the mouflons were born away from the feeding spot by a wild boar. In the whole group of mouflons there is a hierarchy. In females, it depends on their age. In males, on their strength: 0,2% licked the salt in the "salt spots"; 13,30% were moving; 7% drink water; 8% fought each other; 3% scratched by the trees, by the fallen branches or by some black oil painted beams placed there on purpose; 0,50% defecated or urinated and 10,00% explored the surroundings.

They ruminated in intervals of about 12 minutes. At young specimens there has been noticed a playful behaviour in 30% of the time, while simulating fights or sexual activity.

In all this time of 4,5 years of observing mouflons, a general conclusion can be drawn and that is that the animals have adapted well in the Hunting Center of Sarlota. The main objective in the mouflon's acclimatization at Sarlota is, in the first period, its numerical increase. In 2010 there were 125 specimens.

Between 2008- 2010 the new board of the Sylvic Directorate in the Timis County was no longer interested in the hunting center, but only in exploiting the wood in the forest. As a result, the collaboration with the Faculty of Veterinary Medicine was interrupted, as well as the complementary feeding of the game, with the exception of small quantities of corn which were eaten mainly by wild boars. No treatments against parasites were conducted and the health observation was pretty scarce. No animal selection was made either. Therefore, the result was that the hunting was not as qualitative as it used to be. Moreover, in 2010 an invasion of mites was signaled. In a fairly short amount of time there were discovered 6 dead specimens of mouflons, out of which one was killed by poachers and 5 died from massive mites infestation.

In 2010, at the Hunting Center of Sarlota, on the 1200 ha there existed the following numbers of animals: 120 mouflons, 630 fallow deer, 32 red deer and 85 wild boars.

Around the center there were signaled wolf specimens, which seem to come and go and out of which 3 specimens were hunted between November 2010 – January 2011.

It is worth mentioning the fact that in Sarlota there seems to be an increasing number of muskrat.

Since the quality in the mouflon hunting at Sarlota has decreased, specialized hunters prefer to go to other countries. The same is true for the fallow deer. Only for the wild boars there seems to still be a preference, but these hunters are not necessarily interested in quality.

Given the austerity of the situation, the board of the Sylvic Directorate of the Timis County has rekindled the connection with the specialists from the Faculty of Veterinary Medicine in Timisoara in January 2011 in order to come up with some viable solutions.

3.3. The observation of complementary feeding in the case of the Fallow Deer

Game selection is being done either by exchange o biological material from other areas, or by the so-called "gun-selection" which means killing those specimens which have obvious external defects, very feeble constitution, underdeveloped horns.

In order to examine the external defects in the Fallow deer, an experiment was carried out at the Hunting Center of Sarlota in 2003 in what concerns its complementary feeding. The park in Sarlota was inaugurated in 1904 and in 1905 the first specimens of fallow deer were brought in from other regions of the Austro-Hungarian Empire. The external defects, as well as the low quality of the horns (the trophies) seemed to have occurred due to the fact that over the years the fallow deer population mated only between themselves, no other specimens (or very few) were brought from the outside to improve their quality. Complementary feeding of the fallow deer was done according to recipes elaborated by specialists at the Faculty of Veterinary Medicine in Timisoara, Prof. Eugeniu Crainiceanu and Eng. Matiuti Marcel,Ph.D.

All around the Sarlota forest a stripe of land wide of about 100-250 m was cultivated with cereals and/or with vegetables. This was done in order to attract the animals towards the woods and for them not to leave the park.

A mineral and vitamin combination was introduced in the daily ratios, a combination which has macro and micro elements of a 3,5% concentration.

Over the course of a year the corn was deposited in a granary and 21 open mangers were built plus other several places were salt was put for the animals to lick. Thus, the animals got used to these places of feeding. It is worthwhile mentioning that the animals should be given balls of salt directly from the saline and not the so-called packs of vitamin-salt or other products which contain chemical additives because these will have a negative effect on the game. Some workers from Romsilva have experimentally given the animals a type of products which contained chemicals, NaCl and mushroom flavoured additives, which proved to have a bad influence on deer and mouflons, especially on their reproduction.

Hides have been built on high poles, situated near the complementary feeding areas, so that the game could be kept under surveillance.

In order for this type of feeding to happen simple wooden mangers are built. Also, in this area hunting is forbidden because the animals must feel safe around the persons who bring in the food. For wild boars a concrete platform is enough (here corn cobs are put) and for pheasants and partridges there are simple enclosures of wood which protects them and their food from wind or snow (these species are known to be very "patriotic" and migrant). For deer there needs to be a place where salt balls are put, besides the manger for fodder.

3.4. The effects of complementary feeding on quality of tropheum

When the selection was made (by hunting) between 15th November – 15th December 2003, 22 pairs of antlers were obtained which didn't have a great value as trophies and which were chemically tested. The results were compared to the ones from a year before and also to the field terminology and research. The following chemical composition was determined: 92 % dry substance and 8% water. Out of the total dry subtance, 87% was calcium phosphate, 6% calcium carbonate, 3.10% calcium floride (limestone flux), 2,80% magnesium phosphate, 1% zinc, copper and other elements.

The composition obtained this year comes close to the standard one given in the reasearch domain and it differs from the one tested the year before, when calcium occurred in lower percentage.

The tested antlers showed a very small amount (5%) of specimens that had some kind of deformity or signs of underdevelopment.

The results of this experiment prove that the quality of the tested trophies has improved. The chemical analysis shows an improvement in the antlers' composition in comparison with standard results. This shows that complementary feeding is a necessity throughout the year.

The areas must be kept as natural as possible. For example, drainage is forbidden in certain places because those animals covered in fur need these muddy spots in order to get rid of parasites. Some beams covered in black oil can be put here and there for the animals to rub their fur against them so that they get rid of parasites as well. Taking after a Serbian and Croatian model, the hunting parks are designed to have some enclosures for intensive breeding so that the number of specimens of a certain species increases. As in the case of wild boars, males are kept throughout the year in a forested area while females and piglets are kept in another area. During autumn some swine are exported to other countries and 5-6 males of great reproduction value (4-6 years old) are being taken to the reproduction place. During hunting period young boars which are not destined for reproduction are hunted. Another step in the wild boar's intensive breeding is separate

breeding of the young population. A project in this area was to be initiated but the often changes in board at the Sylvic Directorate of Timis County made it impossible.

There are studies made on the wild boar, such as *The Wild Boar's Monography* by Selaru Neculai, Ph.D. which is his Ph.D. thesis. The same is *Schwarzwild*, a report from 1990 by Heinz Meynhardt who observed the wild boar's characteristics in a hunting park in Germany. He also managed to record the characteristic sounds made by wild boars and to interpret them so as to understand whether they were made out of fear, pain, pleasure, discomfort, etc. Interestingly, the animals "accepted" him in their territory and thus he was able to study them more carefully.

Each hunting park should have a veterinarian because the high density of animals leads to multiple diseases especially in what parasites are concerned. There should be some kind of mobile laboratory for the various tests run on sick animals.

Hunting parks can be designed also by private investors if they have the necessary land and forest. One has to know the specific legislation and to get in touch with the specialists from ROMSILVA. It might be useful, however, for these persons to read an exceptional book before they get started, since many of them don't have the necessary knowledge and expertise in the field: "De la chasse et de ses a-cotes" by Marcel Roucate, a surgeon by profession. In this book the author explains quite wonderfully what it means to be a hunter. This implies a hunting ethic, meaning that one does not kill for pleasure and give the game a chance to escape. Just as in chess, a good hunter must foresee the opponent's next move and most importantly, "without the game, there's nothing; hunting is a sport where the brain works together with the muscles and there's no place for greed".

The hunting parks ensure a relaxing climate for the animals there, as well as good shelter. Some activities such as forest or agricultural work disturb the game especially during the mating season or when they are young. Repeated hunting sessions in the same area have negative effects so this is carefully avoided in parks. Here the animals are protected from predators such as the wolf, the jackal or stray dogs. Man can improve the natural conditions offered to these animals by planting different trees whose fruits and seeds offer yet another complementary source of food and by assuring water, ideally in a natural source.

These parks which are true reservations of cynegetic gene banks should overlap with other protected areas such as natural reservations. In this way the transformation of a too large part of Romania into a reservation of the entire Europe can be avoided. Often there appear articles (such as the ones in the Euronatur magazine) where authors from other countries but from Romania as well plead for reservations as wide as possible, taking after the African model. But this thing would be a mistake, especially because it would bring about negative economic consequences. In other countries there are numerous hunting parks. For instance, Hungary has 47 parks, and the biggest one is the one from Visegrad, spreading on 200 ha.

In Romania there are half the number than the one in Hungary, but the total surface is much bigger, like the park in Sarlota (1200 ha) and the one in Pischia (700 ha).

In order for these parks to improve, the general public should understand their importance and the authorities should provide a clear legislation.

While some think that only wood exploitation is important, the E.U. is giving strict laws and regulations on just how much wood one can exploit. It is known that during the last 15 years a huge surface suffered deforestation in Romania and even though reforestation already began, it will take many years for the trees to grow. Contrastingly, hunting can bring income and new jobs, including to people working in hotels.

In what follows we will enumerate a number of hunting centers and mention their surface, the game found there and the places of accommodation for those who want to hunt there. One of the most renowned hunting parks in Croatia is that of Snjevica, situated East of the Rijeka-Zagreb highway.

4. Conclusions

- undoubtedly, Banat is one region which still has many different species in quite large numbers.

- the farmers must be encouraged to reduce the level of pollution (triggered by the chemicals they used) and to turn to an organic agriculture, especially since there is a very small number of properties which don't exceed 10 ha.
- there are some large areas where nothing is being cultivated and this has negative effects on the game
- the deforestation must be stopped, especially in the case where former properties have been retrocede to their owners. These people, however, once they got their land back, started to cut down trees either for an immediate income or because they were afraid of being stolen from.
- poaching and excessive hunting must be reduced considerably. Some poachers hunt the animals because they live in extreme poverty and don't have enough food for their families but there are many others who hunt illegally for pleasure, such as young men who like the adrenalin of hunting animals with their powerful SUV cars. In other cases, there are clerks who disobey any kind of legislation.
- the aggressive tourism must be diminished, and here there is a problem of civilization and culture because some people leave "mountains" of trash behind them after spending a relaxing day out in the woods.
- one of the biggest problems is that there are many persons who build their holiday houses on forbidden land such as in National Parks.
- the stray dogs packs causes massive losses especially in young game. There are often the times when trucks full of dogs from the so-called Dog Centers come near the forest and they release the dogs here. In 2010 there was an extreme case in the Carpathian Mountains near Cozia where almost 100 dogs coming from a Dog Center were

unloaded from a truck and left there near the woods. Most of the dogs were skinny, hungry and sick.

- another problem is represented by the shepherds' dogs. For instance, in an area near the Hunting Center in Sarlota, there are shepherds who own about 10-12 dogs, which is much more than they need. These dogs are often poorly fed, do not have a collar so they attack the other animals. Moreover, some tourists who come to the hunting center bring along dogs which they leave there afterwards.
- it would be very beneficial for Romsilva if it collaborated with the Faculty of Veterinary Medicine and with the Faculty of Animal Husbandry but as it often happens, these decisions are made based on political colours by the Sylciv Directorate board.
- people need to be informed about the importance of preserving the natural environment and the cynegetic patrimony.
- research must be continued in order to identify the species which are on the verge of extinction
- the Romanian legislation must be harmonized with the European one. For example, in the case of the migrant feathered game which is hunted in some cases while the birds are in their period of mating or when chicks still depend on their mothers.

References

[1] Matiuți M., D. Dronca, Researches regarding complementary nutrition with sesame grouts at fallow deer (Dama Dama), Facultatea de Zootehnie Bucureşti, A 32-a sesiune de comunicări Ştiinţifice BALNIMALCOM, 36, (2003)

[2] Matiuți M., Biodiversitatea protejată a animalelor sălbatice, Revista Diana nr. 2 aprilie – iunie, Ed. Full Print Banat SRL, Timişoara, 30-31, (2007)

[3] Matiuți M., Crăiniceanu E., Carmen Matiuți, Dronca D., Quality improvement of follow deer horns, Sesiunea Internaţională de Comunicări Ştiinţifice Facultatea de Zootehnie 16-18 nov. Bucureşti, Ed. Granada, 105-108, (2005)

[4] Matiuți M., Crăiniceanu E., Măcinic I., Dronca D., Study regarding the cervidae evolution between 1995-2006 in the Criş forest area, The 35-th International Session Scientific Communications The Scientific papers of the Faculty of Animal Science Bucureşti, Ed. Granada, 403-408, (2006)

[5] Matiuți M., Crăiniceanu E., D. Dronca, Carmen Matiuți, The effect of the complementary feeding at Dama Dama, Sesiunea anuală de comunicări Ştiinţifice "Realizări şi perspective europene în creşterea animalelor", Iaşi 22-23 aprilie, 89, (2005)

[6] Cotta V., Bodea M., Vanatul Romaniei, Ed. Agrosilvica, Bucuresti, (1969)

[7] Frevert W., Das jagdliche Brauchtum, Franckh-Kosmos Verlags Gmbh, Stuttgart, (2001)

[8] Hespeler B., Vor un d nach dem Schuss, BLV Verlagsgesellschaft mbH, Munchen, (2002)

[9] Matiuți M., Researches concerning of the two population of the red fox (Vulpes vulpes) from the hunting grounds Tomeşti (Timiş), Faculty of Animal Science Bucharest Abstracts of the 31-th annual session scientific communication, 80, (2002)

[10] Matiuți M., Liliana Cărpinişan, M. Căsălean, Evaluation of cervidae population from Timiş country between 2001-2002, USAMVB Timişoara Lucrări Ştiinţifice Medicină Veterinară, Timişoara, vol. XXXVI, 603-605, (2003)

[11] Matiuți M., D. Dronca, Cercetări privind populaţia efectivelor de vânat mic la Secuieni, Simpozion Ştiinţific Internaţional 70 ani ai Universităţii Agrare de Stat din Moldova 7-8 oct. Chişinău, 208, (2003)

[12] Matiuți M., D. Dronca, Evaluarea efectivelor de vânat mare în zona Secuieni, Simpozion Ştiinţific Internaţional 70 ani ai Universităţii Agrare de Stat din Moldova 7-8 oct. Chişinău, 209, (2003)

[13] Matiuți M., E. Crăiniceanu, Mouflon behavior in a hunting park, USAMVB Timişoara Lucrări Ştiinţifice Medicină Veterinară, Timişoara, vol. XXXVII, 884-886, (2004)

[14] Matiuți M., Crăiniceanu E., Cercetări privind furajarea complementară a vânatului, Universitatea Agrară de Stat din Moldova Simpozion internaţional "30 ani de învăţământ superior medical veterinar din Republica Moldova, Chişinău 1-2 oct, 66-67, (2004)

[15] Matiuți M., Mistreţul – un senior al pădurii, USAMVB Timişoara Revista Agricultura Banatului nr. 9-10, 15, (2002)

[16] Matiuți M., Constiutirea unui teren de vânătoare, o afacere rentabilă, USAMVB Timişoara Revista Agricultura Banatului nr. 1-2, 17, (2003)

[17] Matiuți M., Muflonul, USAMVB Timişoara Revista Agricultura Banatului 4-5, 19, (2004)

[18] Matiuți M., Cerbul comun (Cervus elaphus), USAMVB Timişoara Revista Agricultura Banatului nr. 9-10, 19, (2004)

[19] Matiuți M., Cum se organizează un parc de vânătoare?, Revista de Zootehnie şi Medicină Veterinară nr. 12 AGRIS Editura Revistelor Agricole, Bucuresti, 27-29, (2004)

[20] Matiuți M., De ce trebuie să existe parcurile de vânătoare, Revista Diana nr. 4 octombrie –decembrie, Ed. Full Print Banat SRL, Timişoara, 22-23, (2006)

[21] Matiuți M., Parcul de vânătoare, Revista Diana nr. 1 ianuarie –martie, Ed. Full Print Banat SRL, Timişoara, 4-5, (2007)

[22] Menzel K., Alters-ansprache beim Schalenwild, Franckh-Kosmos Verlags Gmbh, Stuttgart, (2002)

[23] Meynhardt H., Mein Leben unter Wildschwein, Neuman Verlag, Leipzig, (1990)

[26] Wagenknecht E., Rotwild, Nimrod Verlag, Suderburg, (2000)

[24] Roucaute M., De la chasse et de ses a-cotes, Coutille, Paris, (1983)

[25] Selaru N., Mistreţul, Editura SALUT, Bucuresti, (1995)

[26] Wagenknecht E., Rotwild, Nimrod Verlag, Suderburg, (2000)

REMOTE SENSING MEASUREMENT TECNIQUE FOR SO_2 EMISSIONS

Catalin NISULESCU, Ioana IONEL, Delia CALINOIU

Politehnica University of Timisoara, Faculty of Mechanical Engineering , Mihai Viteazu Blv, NB 1, 300022, Timisoara, Romania
Phone: +40/56/403746; e-mail: cnisulescu@mec.upt.ro

Abstract. Protecting and preserving the environment is a global problem of mankind. The paper focuses on the SO2 pollutant, especially. It presents the results obtained by remote sensing with an UV camera and the comparison with results obtained with an on line measuring technique accomplished by a Testo 350 XL instrument working with chemical cells. The SO_2 camera is a novel device for the remote sensing of power plant emissions using solar radiation scattered in the atmosphere as a light source for the measurements.

Keywords: UV camera, pollutant plume, remote sensing, SO_2

1. Introduction

Remote sensing is the acquisition of information about an object or phenomenon, without making physical contact with the object. In modern usage, the term generally refers to the use of aerial sensor technologies to detect and classify objects on Earth (both on the surface, and in the atmosphere and oceans) by means of propagated signals (e.g. electromagnetic radiation emitted from aircraft or satellites).

There are two main types of remote sensing: passive remote sensing and active remote sensing. Passive sensors detect natural radiation that is emitted or reflected by the object or surrounding area being observed. Reflected sunlight is the most common source of radiation measured by passive sensors. Examples of passive remote sensors include film photography, infrared, charge-coupled devices, and radiometers. Active collection, on the other hand, emits energy in order to scan objects and areas whereupon a sensor then detects and measures the radiation that is reflected or backscattered from the target.

Radiometers and photometers are the most common instrument in use, collecting reflected and emitted radiation in a wide range of frequencies. The most common are visible and infrared sensors, followed by microwave, gamma ray and rarely, ultraviolet. They may also be used to detect the emission spectra of various chemicals, providing data on chemical concentrations in the atmosphere.

The oxidation of sulfur fuel, mostly (95 %) is converted through combustion into SO_2. Discharged into the atmosphere, sulfur dioxide (SO_2) reacts at a rate of (1-2) $^0/_{00}$/h with oxygen under the action of solar ultraviolet radiation, creating sulfur dioxide (SO_3) [1]. Sulphur dioxide (SO_2) is a toxic substance that attracts attention by its odor and irritating action on mucous membranes, causing muscle spasm and contraction of upper airway.

In high concentrations, SO_2 causes irritation and burning sensation of respiratory and conjunctive mucous membranes, cough, difficulty breathing, spasm of glottis, choking. The presence of sulfur oxides in the environment is marked both by direct damage to plants and by altering water and soil composition. SO_2. Thus, in higher concentrations, destroy chlorophyll in leaves, action by amplifying the synergism with NO_2 [3].

SO_2 is widely monitored at power plant. A number of measurement techniques exist, but ever since the first application of the correlation spectrometer has been developed theoretical description of functionality, applications, and limitations of SO_2 cameras, remote sensing techniques have become more and more established. The method is based on measuring the ultra-violet (UV) absorption of SO_2 in a

narrow wavelength window around 310 nm by employing a band-pass interference filter and a 2 dimensional UV-sensitive CCD detector.

The effect of aerosol scattering can in part be compensated by additionally measuring the incident radiation around 325 nm, where the absorption of SO_2 is about 30 times weaker, thus rendering the method applicable to optically thin plumes. For plumes with high aerosol optical densities, collocation of an additional moderate resolution spectrometer is desirable to enable a correction of radiative transfer effects.

$$CH_3 - SH + 3O_2 \rightarrow SO_2 + CO_2 + 2H_2O \quad (1)$$

During the incomplete combustion with lack of oxygen elementary sulphur and hydrogen sulphide (H_2S) can form, at high temperatures.

$$CH_3 - SH + 0.5O_2 \rightarrow H_2S + HCHO \quad (2)$$

$$2H_2S + O_2 \rightarrow 2H_2O + 2S \quad (3)$$

Hydrogen sulphide (H_2S) can occur during the combustion process of low quality coals like lignite or into the piston engines exhaust gases after catalytic reduction if the engine works at high load and low air-fuel ratio.

During the combustion and in exhaust channels the SO_2 can be oxidized to SO_3 who will form with water content of flue gases sulphuric acid H_2SO_4. The SO2 conversion to SO3 is increased in the presence of vanadium of iron oxides at temperatures over 800 ºC.

Evacuated into the atmosphere SO_2 reacts in proportion of (1 – 2) ‰/hour with oxygen, under the presence of ultraviolet radiation (uvr) and will form SO_3.

$$2SO_2 + O_2 + uvr \rightarrow 2SO_3 \quad (4)$$

Afterwards, the SO_3 will react with water vapors from the atmosphere to form sulphuric acid H_2SO_4. In periods of fog or days with high humidity the transformation rate of SO_3 to H_2SO_4 can be up to 15 %.

$$SO_3 + H_2O \rightarrow H_2SO_4 \quad (5)$$

This study gives a theoretical basis for the pertinent aspects of working with SO_2 camera systems, including the measurement principle, instrument design, data evaluation and technical applicability. As the dynamic process governing the propagation and dispersal of pollutant plumes in the atmosphere occur on significantly shorter time scales (order of seconds), a simpler and faster means of recording 2-D images of gases is desirable. The large amounts of SO_2 present in power plant plumes and the fact that SO_2 is by far the most dominant absorber around 300 nm, however, make high spectral resolution measurements

In this case, the maximum transmittance is centered at 309 nm, a region in which the SO_2 absorption-cross-section σ(λ) is prominent. Also shown in blue is an example spectrum of incident scattered solar radiation $I_S(\lambda)$ [2].

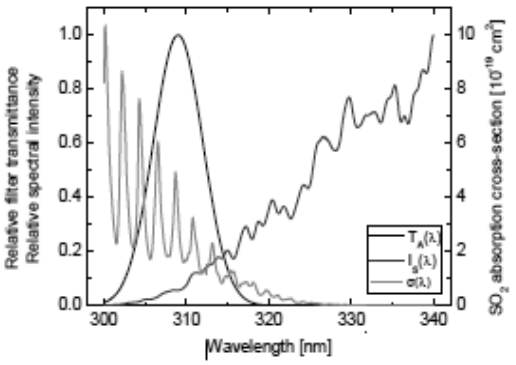


Figure 1. Example of the spectral transmittance T(λ)

Here, this concept is first dealt with in a theoretical approach. Certain problems are identified, and methods for improving both the accuracy and technical implementation of the technique are described. Finally, some examples of the discussed methods and applications are shown.

2. Instrument description

In its simplest form, a SO_2 camera is solely composed of a UV sensitive camera and a single spectral band-pass filter allowing only radiation in a narrow wavelength interval encompassing significant SO_2 absorption structures to enter the camera optics. Figure 1 shows an example of the transmittance curve $T_A(\lambda)$ of such a band-pass filter along with the absorption cross-section σ(λ) of SO_2. For each pixel, the intensity signal collected through this filter is compared to a background intensity, either measured in a region in which no plume is present or interpolated from values acquired on either side of the plume. In the absence of SO_2, the wavelength-dependent light intensity $I_{0,A}(\lambda)$ arriving at each pixel of the 2-D camera CCD is given by the intensity of scattered solar radiation $I_S(\lambda)$ arriving at the instrument (see Figure 1), the filter transmittance $T_A(\lambda)$, and the quantum efficiency Q(λ) of the detector:

$$I_{0,A}(\lambda) = I_S(\lambda) \cdot T_A(\lambda) \cdot Q(\lambda) \quad (6)$$

If SO_2 is present in the optical path of the incident radiation, the spectral intensity is

attenuated according to the Beer - Lambert-Bouguer law:

$$I_A(\lambda) = I_{0,A}(\lambda) \cdot \exp(-\sigma(\lambda) \cdot S(\lambda)) \quad (7)$$

Figure 2. View of the stack and emission plum from the measurement site

$\sigma(\lambda)$ is the absorption cross-section of SO_2 and $S(\lambda)$ is its column density, or the integral of the SO_2 concentration along the effective light path L (ideally the line of sight through the plume).

$$S(x) = \int_L c(x)dx \quad (8)$$

Unfortunately, the effective light path L can deviate substantially from the line of sight through the plume. Especially in cases where power plant plumes contain large amounts of SO_2 or scattering aerosols or are viewed from a large distance, the effective light path may be significantly shorter or longer than a straight line through the area of interest. Radiation entering the field of view between the plume and the instrument shortens the effective light path, while multiple scattering inside the plume elongates it. In fact, the absorption of radiation by SO_2 in pollutant plumes is often times sufficiently strong in itself to influence the effective light path [1].

An advanced optical system was designed specifically for the SO_2 camera in an attempt to reduce the illumination angle dependent calibration issues described in schematic of this design. The optical system is composed of two lens groups between which the band-pass interference filter is located. An adjustable aperture is centered in the focal point of the first lens group. The band-pass interference filter is positioned behind this image so that dust or in homogeneities on the filter are not in focus. Behind the filter, a second group of lenses is used to project the virtual image onto the detector. The position of this lens group in relation to the detector and the virtual image can be varied such that the image is exactly scaled to fit the detector. If e.g. a 1 to 1 reproduction of the virtual image is wanted, the second lens group is placed at twice its focal length f2 from the virtual image and the detector is likewise positioned at 2 × f2 from the lens group. The great advantage of this setup over the simple setups and shown in is that the angle of incidence λ on the band pass filter no longer varies for individual pixel positions on the detector. Although a range of illumination angles is realized, this range is identical for all pixels, thus leading to an identical effective filter transmission curve.

When selecting the band-pass interference filters for use in the SO_2 camera, several aspects must be considered. Both, the spectral position of the filter transmittance window as well as its width will determine the light throughput of the optical system. This can only be considered an approximation, as very narrow band-pass interference filters tend to have lower maximum transmittances than wider filters, but actual transmittances vary, so this study may represent a somewhat optimistic estimate for narrow filters. Nevertheless, it gives some guidance on how to choose optimal filter parameters.

A view of the SO_2 camera prototype is shown in figure 2, during on line monitoring. A back-thinned CCD camera was chosen as a detector. Plumes such as the one represented and analyzed are continuous emitted as a consequence of ongoing combustion processes at this vent.

3 Measurement concept

The SO_2 camera was tested in several measurement campaigns at power plants in Romania. The concept of measurement is simple. A UV camera is connected to a laptop via USB port and supplied. Once the connection is established a command is give in order to cool camera to -20ºC for eliminating electronic noise. According with meteorological conditions the user can modify exposure time, filters used for measurements, number of measurements, etc.

First a dark measurement is accomplished. After that calibration procedure is did using two SO_2 cells with known concentration and finally background image is did with clear sky [5].

After preliminary settings were accomplished, the results were processed and analyzed.

Figure 3. Example of pollutant plume achieved via UV camera

The SO_2 concentration measured with UV camera is almost the same with the concentration obtained with a Testo 350 XL working according the amperometry principle [6], [8] that indicates a mean value of around 135 ppm.

4. Conclusions

The UV camera is a remote sensing instrument for SO_2 measurements and it is considered that it will became a very good tool for on line measurement especially for the fact that it can be accomplished from a considerable distance, and introduced into an automatic survey system, not having contact with the stack flow. Remote sensing technique will became the future option for conventional measurement.

[7] gives similar conclusions, but for other pair of techniques and pollutant specie.

The dispersion modeling theory can also be enriched by this novel technique

Acknowledgments

This work was partially supported by the strategic grant POSDRU/88/1.5/S/50783, Project ID50783 (2009), co-financed by the European Social Fund-Investing in People, within the Sectoral Operational Program Human Resources Development 2007-2013. Also the authors wish to acknowledge Norway Grants for RADO contract STVES 115266 (http://inoe.inoe.ro/RADO).

References

[1] ***, www.cyanogen.com

[2] Kern C., Kick F., Lubcke P., Vogel L., Wohrback M., Platt U., Theoretical description of functionality, applications, and limitations of SO_2 cameras for the remote sensing of volcanic plumes

[3] ***: Typische Konzentrationen von Spurenstoffen în der Troposphäre. Anorganische Verbindungen, Kommission Reinhaltung der Luft im VDI und DIN, 1992.

[4] Nisulescu C., Ionel I., Calinoiu D., Vetres I., Air pollution monitoring in a town nearly power plant, Advances in Biology, Bioengineering and Environment, ISBN: 978-960-474-261-5, p.181-185, 2010

[5] Radulescu R, Belegante L, Stebel K, Prata F, Preliminary results of SO2 measurements in SW romania using UVGasCam cameras, Proceedings of Optoelectronics Techniques for Environmental Monitoring, ISSN 20066 -8651

[6]***, www.mediu.ro

[7] Environmental Technologies, ISBN 978-3-902613-10-3 Publisher I-Tech Education and Publishing, Publishing date January 2008

[8] Francisc Popescu, Ionel Ioana, Air Quality, ISBN 978-953-7619-X-X, published by Sciyo, 2010, http://www.sciyo.com.

BIO-ENERGY AND THE AIR QUALITY

Ioana IONEL, Francisc POPESCU, Nicolae LONTIS, Dorin LELEA, Virgil STOICA

POLITEHNICA University of Timisoara, Facultatea de Mecanica,
Bv. M Viteazu, 1, 300222, Timisoara, Romania, Tel +40 256 403670, Fax +40 256403669, ioana.ionel@mec.upt.ro

Abstract: This article refers to a novel approach concerning the dependence of environmental air quality from the implementation of renewable energy resources, especially bio-energy. Basically the most tempting bio-energy form for Romania is the biomass (CO_2 neutral fuel), and short rotation coppice (plantation, forestry), but also biogas and bio-fuels (second generation fuels) are temting. Most benefit is consisting in: diversity, natural continuous resource, climate adaptable, CO_2 neutral, technology to process and clean up the exhaust gases are already developed, should only be adapted and retrofitted, etc. Not at least the independence of clean anergy regions and the possibility of local economic and social growth, by implementing state of art developments in rural and less developed areas are to be mentioned. SRC/SRF might be a solution, assuring as independent or in co-combustion the basic fuel for a cogeneration, system, also the regional development, income and independence (economic and energetic). Other technologies such as biogas production, co-combustion of waste non fossil originated fuels, especially in cogeneration or tri-generation, reducing the losses and working with as most as efficient thermodynamic cycles and conditions, avoiding or reducing losses, economy of energy consumption/capita represent the future.

Keywords: bio-energy, cogeneration, short rotation forestry (SRF), energy crops, air quality, bio-fuels.

1. Facts about bio-energy

Environmental policy in the European Union and its neighbors has delivered substantial improvements to the state of the environment. However, major environmental challenges remain which will have significant consequences for Europe if left unaddressed.

Bio-energy is renewable energy made available from materials derived from biological sources and includes biomass, the biological material used as a bio-fuel, as well as the social, economic, scientific and technical fields associated with using biological sources for energy. Bio-energy has its origin in C and H of non fossil origin. For example plants, agricultural residues, short rotation coppice, municipal waste, etc are possible examples. Main advantages of the bio-energy as resource are:

- CO_2 neutral or lean energy sources,
- Assuring continuity and independence of the local economy,
- Supporting progress and development in the region,
- Offering security of the nation or territory from point of view of energy supply.

Biomass currently accounts for 2/3 of renewable energy in Europe and bio energy will play a key role in achieving the ambitious targets approved by the renewable energy. Therefore, the future development of bio-energy will be crucial to reach the RES and GHG reduction targets set to all EU member states. According to the new EU Directive on renewable, "biomass" describes the biodegradable fraction of products, wastes and residues of biological origin from agriculture (including vegetable and animal substances), forestry and related industries, including fisheries and aquaculture, as well as the biodegradable fraction from industrial and municipal wastes. Biomass includes a broad variety of raw materials such as wood, agricultural crops, byproducts of wood processing, agricultural and forestry industry products, manure and the organic fraction of waste streams. Forest and wood-based industries, as well as dedicated short plantation coppices (SRC/SRF) produce wood, which is the largest source of solid biomass. Over the last years bio-energy was - in absolute terms - the fastest growing Renewable Energy Source (RES) in the European Union. The contribution of biomass to the energy supply in terms of gross inland energy consumption increased from 53 in 2000 to 105 Mtoe in 2008. Bio-energy covers more than sixty percent of all RES (Figure 1).

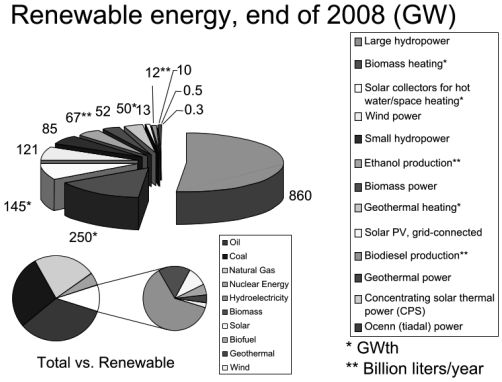


Figure 1: 2008 worldwide renewable-energy sources. *Source: REN21* - Renewable Global Status Report 2009 [1]

The renewable energy and the bio-energy among it is necessary to cover the gap that is presently developing between consume and production, and will affect very soon on global level the stability on the Earth, as energy resources are crucial for development and life standards.

The continuous growth of the economy, at global level, due to the improving of the industrial and consume energy per capita, not mentioning the tremendous augmentation of the population in the world, especially in developing countries. Not at least it is important to state that the classic energy resources (fossil energy, nuclear power, water, wind, solar, fuel cells, photovoltaic, etc.) are strictly reaching their end in the next decades, are not secure or as secure as one desires, are time and space depended (not continuous), are too expensive for the moment, etc.

Not at least the classic traditional up to now utilized resources are emitting also pollutants and gases relevant for the climate change (ozone depletion, global warming, etc.). Bio-energy must at least preserve the present situation, adding to the existing energy resource effective offer a general one, that is continuous, spread all over the world, assures serenity and is renewable.

2. RES in Romania

Romania is currently struggling to implement a clear legal framework that gives RES energy a definitive advantage versus the conventional energy sources. Law 220/2008 was adopted by the Romanian parliament and received with enthusiasm by the RES specialists. They all agree that this law will make RES projects feasible because of its green energy promotion system but the energy regulatory authority is delaying its approval and publication of its implementation methodology. Currently, in Romania, RES is promoted by G.D. 1892/2004 modified by G.D. 958/2005. According to these G.D., RES projects benefit of one green certificate for 1MWh provided to the grid. Law 220/2008 states the following number of green certificates (GC) that will be issued for RES electricity:

- 1 GC for 1MWh produced and sold to the grid by a upgraded hydroelectric plant of max 10 MW installed power;
- 1 GC for 2MWh produced and sold to the grid by a hydroelectric plant of max 10 MW installed power;
- GC for 1MWh produced and sold to the grid by a hydroelectric plant of max 1MW installed power;
- GC for 1MWh produced and sold to the grid by an onshore wind plant;
- GC for 1MWh produced and sold to the grid by a biomass plant;
- GC for 1MWh produced and sold to the grid by a solar system plant.

RES energy producers are awarded at a mean price of 42 Euro for 1MWh. Starting 2008 up to 2014, the price decided for one green certificate ranges between 27 and 55 Euro.

Certain requirements are absolute minimum conditions for investments and represent clear obstacles if not met. Some examples are [9]:

(a) Political and social stability, investor's rights (such as Stable legislative and judicial environment with regard to investments including protection of investments and the avoidance of retroactive changes). A trustworthy policy with regard to retroactive changes is highly critical because clean energy project investments come along with high initial investments and the inability to adjust cash flows during the lifespan of a project. Also according an allowance for foreign investors to take company stakes larger than 50% and to secure land titles is in debate.

(b) Stable economy/taxation, e.g. (i) Moderate actual and expected inflation (especially for long-term assets), (ii) Moderate taxation, allowing an adequate return for the investor, specifically in comparison to countries with comparable investment opportunities, (iii) Leading to stable foreign exchange rates (in case of investments in a currency other than the Romanian currency).

(c) Infrastructure, e.g. (i) reliable access to investment site (roads), availability of reliable electricity infrastructure, access to grid, and (ii) local expertise in constructing and running a clean energy project, do not always exist.

(d) Municipality and local support, e.g.: willingness of local authorities and citizens to make clean energy projects happen that actively are supporting and enabling the permission process.

(e) Negotiation and contract ethics, e.g.: finalization of negotiation process within an adequate time frame, as well as reliable contractual partners, sticking to what has been agreed upon.

(f) Clear requirements for used clean energy equipment, e.g.: Technical obligations, defined ex ante rules for the respective installation, their financial impact and relevant accounting procedures.

3. Facts about atmospheric pollution

Atmospheric pollution is indubitable the result of humans' activity (industry, transport, household, intensive agriculture and livestock farming etc.) that act supplementary to the natural pollution (fires, volcanoes, natural chemical processes in soil, water and air, etc.). Air quality is determined by measurements, numerical simulation and physical modeling Many key climate indicators are already moving beyond the patterns of natural variability within which contemporary societies and economies have developed and thrived. The main consequences of climate change expected in Europe include an increased risk of coastal and river floods, droughts, loss of biodiversity, threats to human health, and damage to economic sectors such as energy, forestry, agriculture, and tourism. Atmospheric pollution is a major problem facing all nations of the world. Rapid urban and industrial growth has resulted in vast quantities of potentially harmful waste products being released into the atmosphere. The atmosphere is the largest imaginable chemical reactor in which pollutants may be converted into more harmful or harmless substances. Societies have been reluctant to accept, or have simply failed to recognise the limitations of the cleaning properties of the atmosphere and self-adaptation of the ecosystem Planet, with no remnant damages or preventing a non-equilibrium status. The

consequences has been that air pollution has affected the health and wellbeing of people, has caused widespread damage to vegetation, crops, wildlife, materials, buildings and climate, and has resulted in depletion of the scarce natural resources needed for long-term economic development.

The chemical pollution of the atmosphere is a consequence of the chemical compounds input, over the natural air constituents and is of natural and artificial origin. However, the natural chemical pollution sources like volcanoes eruption, natural decomposition of organic substances or fire (naturally occurred) are not of major concern as they are part of natural environment equilibrium. However, the anthropogenic chemical pollution is of major concern as their sources are increasing in number and concentration with the increase of global human population and our continuously increase of energy demand. The anthropogenic chemical pollution has no borders and no matter where the pollutants are released into the atmosphere will have an impact over global environment. The most relevant sources are the incineration of fossil fuels to produce energy (heat and electricity), major industrial processes (like metallurgy industry or cement/construction industry) and transportation. One classifies the anthropogenic chemical pollution sources into two major groups: stationary and mobile sources.

The four major groups of gaseous air pollutants by historical importance, concentration, and overall effects on plants and animals (including people), are sulfur dioxide (SO_2), oxides of nitrogen (NO_x: NO, NO_2), Carbon dioxide (CO_2) and ozone (O_3). Sulfur dioxide and nitric oxide (NO) are primary pollutants – they are emitted directly from sources. We shall start by looking at the main sources of these and other primary gases, and also consider some of the methods of control that can be used to reduce emissions and concentrations when required. The most important groups of anthropogenic air pollution sources are defined by industrial processed, residential heating systems, transportation (terrestrial, naval and aerial) and agricultural systems. The majority of the pollutants are the direct result of the combustion or co-combustion [13] process in large Clausius Rankine (or more sophisticated cycles) power plants and /or piston engines [12, 17], so that the first steps to reduce the pollutants concentration from atmosphere is to control and reduce the emissions from these source groups.

In Figure 2 a short and simplified relation between fuel, combustion, combustion products (pollutants) and air quality is given.

For a given pollutant, there may be a number of measurement methods, each having its own advantages or disadvantages in terms of performance, reliability and cost-effectiveness. Broad classification can be made into direct-reading (usually automatic) methods and indirect (usually manual) methods. Direct measurement techniques are those where the air is sampled and the quantification stage of the pollutant analysis is performed *in-situ* virtually instantaneously. Most direct-reading analyzers provide a continuous readout of the pollutant concentration or have a relatively short sample time-average period. Indirect measurement techniques are those where the air is sampled for a fixed time and the pollutant is captured, by for example evacuated flask, cryogenic trapping, absorption in a liquid or adsorption onto a solid resin. The analysis is then carried out on the pollutant in this form or after further pretreatment of the sample. Table 1 gives a review of major methods, most of them standardized at EU level.

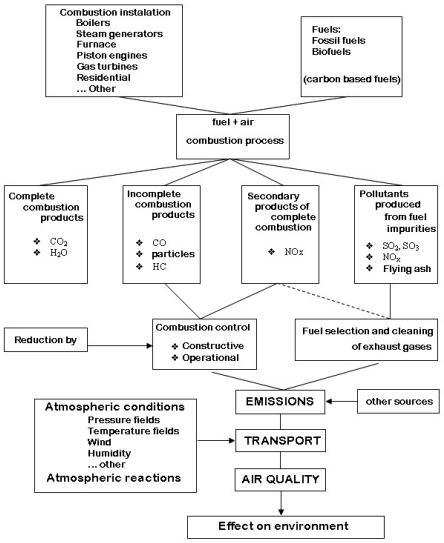


Figure 2: Sources and products of anthropogenic pollution.

Table 1: Common direct-reading measurement methods for gases

Method	CO	SO_2	NO_x	O_3	Organics
NDIR	•				
NDUV		•			
UV fluorescence		•			
Chemiluminescence			•		
Flame photometric		•			
FID, PID					•
DOAS		•	•	•	•
DIAL		•	•	•	•
FTIR					•
UV absorption				•	

An important part of the measurement process is the sampling line. The way how to suck the sample into the container (to the analysers) can already influence the measurement. Therefore national standards have been developed for the sampling of gaseous samples and particulate matter. The intake line has to be designed in a way that rain or snow can not enter the sampling system and sedimentation does not take part. Chemical reactions and deposition on the walls have to be avoided. This requires short tubes, the time between inlet and analyser must not exceed 10 s. The whole manifold system has to be built using chemically inert materials (i.e. Borosilicate glass or Polytetrafluorethen (PTFE)).

One outlines that measuring air quality is not simple at all, it necessities calibrated instruments, applying attested relevant standardised methods, clear

management procedures, skilled personnel and a lot of work, including also the calculus of results and errors. Avoiding subjective mistakes (suck system of the probe, location of the instrument, lack of calibration, etc.) are subject of special attention, as they may influence in great amount the final values for reporting the air quality parameters.

The four major groups of gaseous air pollutants by historical importance, concentration, and overall effects on plants and animals (including people), are sulphur dioxide (SO_2), oxides of nitrogen (NO_x: NO, NO_2), Carbon dioxide (CO_2) and ozone (O_3). Figure 3 shows a scheme of a set-up of such a measuring station. The measuring gas suction hoods and different meteorological measuring instruments are installed on a 10 m high altitude. The management and working methods are respecting the international standards SR EN ISO/CEI 17025:2005 (General features and competences), according to the fundamentals and definitions imposed by SR EN ISO 9000:2006. In addition to the instruments for the specific measurement of pollutants there are numerous other instruments for the recording of meteorological parameters such as wind direction and wind speed, temperatures, global radiation, duration of rain and bedewing, amount of rain etc., as well as an electronic controlled computer, to record, calculate and memorise the values. Some measuring stations work with direct data transmission to a central computing station.

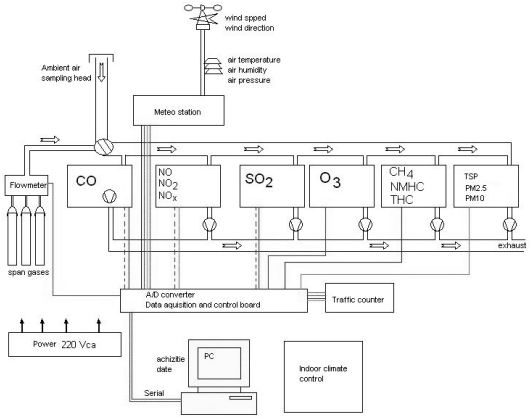


Figure 3: Set-up of the sampling system of an automatic air quality station (owned by UPT) with air probe suction through tubes and with calibration gas switching [www.mediu.ro]

Notable are the remote sensing instruments that are offering complementary information, and also relevant data concerning thermodynamic parameters (concentration, temperature inversion, at different levels, etc.) over the free atmosphere. Examples are found on the on line platform www://energieregen.mec.upt.ro, in form of a LIDAR instrument [11], sun photometer, UV cameras, etc. UPT is working presently on European level, been part of several grids:

- Rolinet - Retea **Ro**mana de sisteme **Li**dar - http://inoe.inoe.ro/ROLINET
- RADO - **R**omanian **A**tmospheric 3**D** **O**bservatory - http://rado.inoe.ro/RO/RADO.html
- AERONET - (**AE**rosol **RO**botic **NET**work) - http://aeronet.gsfc.nasa.gov
- EARLINET- **Eur**opean Aerosol Research **Li**dar **Net**work - http://www.earlinet.org/

If for the pollutants special strategy for reducing them (primary during combusting, and secondary as flue gas cleaning up technologies) the climate change relevant gases such as CO_2 and other greenhouse gases are affecting globally the future of the Planet. Different standards of life are based on different emission levels/capita. Industrialisation and life standard pay or should pay the price!

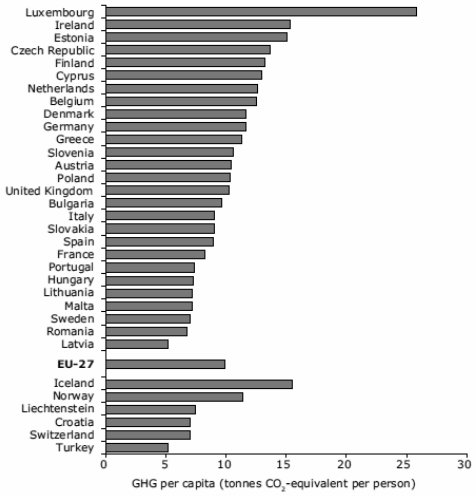


Figure 4: Greenhouse gas emissions as tones CO_2 - equivalent per person by country in 2008 (Source IEE)

Figure 4 gives the overall trends concerning CO_2 that are influenced by the fact that, in many cases, emissions from large point sources have been reduced, while at the same time emissions from some mobile and/or diffuse sources, especially those transport-related, have increased substantially.

4. Vision for the bio-energy utilization

Europe's unsustainable use of heat, by 2003, according to the results of the ECOHEATCOOL project [3[, is demonstrated in figures and facts, attesting: data concerning why the overall picture of Europe's unsustainable use of heat is striking. The reasons are: (i) From primary energy supply to energy end use more than half of total European primary energy input is wasted; (ii) Most of this waste occurs in the form of heat; (iii) Around 60 % of total energy end-use takes place in the form of heat. Data are based on Ecoheatcool, covering EU 27, Iceland, Norway, Switzerland, Croatia and Turkey. District heating (DH) and District cooling (DC) theory based on the fundamental idea of using local heat, cold and fuel sources that under normal circumstances would be lost or remain unused. Another essential feature is that it provides a flexible infrastructure able to integrate a wide range of (renewable) energy sources. Heating and cooling are responsible for more than 50 % of total final energy consumption in the European Union (see Figure 5). Huge heat losses appear in the European energy balance.

From the annual energy supply in EU-25, EFTA and applicant countries, (by 2005), around one third is lost in conversion processes in power plants, oil refineries, and industrial processes.

Parts of these losses can be retrieved and distributed by DH and DC, delivering simple, reliable and comfortable heating and cooling in urban buildings and therefore supporting Europe's potential for higher energy efficiency. Presently, with approximately 86 % of heat deriving from a combination of recovered heat, renewable energy and waste resources, modern district heating and cooling come very close to fulfilling its fundamental idea in practice.

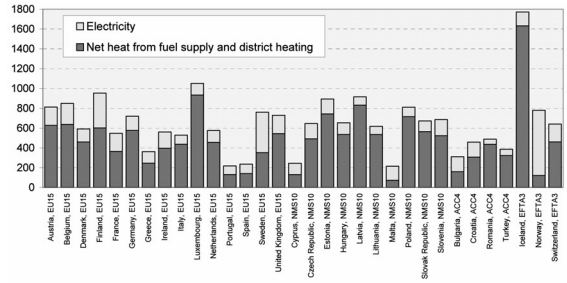


Figure 5: Residential end use of net heat and electricity, MJ/m^2 [4]

Since heating causes most of the energy consumption in buildings in most of Eastern Europe countries, the introduction of a low carbon fuel for heating can significantly affect their region's emissions. New dedicated energy crops for energy production would enable the EU to diversify its energy sources, provide an income to European farmers and reduce CO_2 emissions, at least, theoretically by the figure of its input.

Figure 5 indicates the electricity and net heat from fuel supply and district heating, for several countries. It is obvious that the extreme examples are motivated but geography and natural on spot available resources, but also a factor is the research and applied development for renewable resources, and tendencies in this area. Based on the output of heat and cold market reports, and on the evaluation of possibilities for DHC across Europe, the recommendations will cover aspects such as:

- Development of new district heating and cooling schemes across Europe,
- Upgrading/benchmarking of existing district heating schemes across Europe,
- Promotion of CHP and the use of clean fuels in urban areas,
- Fuelling the CHP with bio-fuels as main or support combustion material,
- Increasing the share of renewable energy sources in the heat market, by all ways (not at least legislative initiatives),
- The use of waste incineration for local heating,
- The use of industrial waste heat.

Other possibilities are to organize the cycle for energy production on most modern and efficient thermodynamic cycles [7]. Thus two ways are indicated for the future:

1. Synthetic gasoline and diesel via gasification of lignocellulosic biomass with downstream synthesis and upgrading (Biomass to Liquids – BTL),
2. Integrated gasification and combined cycle (IGCC) power plant/ IGCC CHP.

Synthetic gasoline and diesel ("biomass-to-liquid" -BTL) can be produced via gasification of lignocellulosic biomass such as wood and straw with downstream synthesis and upgrading. BTL is also considered as so-called "2nd generation bio-fuel". The technology has been under development for several years. BTL plants are still an issue of research and development. Lignocellulosic biomass such as wood chips and straw can be used as feedstock. At first a mixture of hydrogen (H_2) and carbon monoxide (CO) is generated via gasification. After clean-up the product gas stream is sent to the Fischer-Tropsch (FT) synthesis stage [9, 10]. Lignocellulosic biomass can be used for the generation of electricity via an integrated gasification combined cycle (IGCC) process. The IGCC offers higher electrical efficiency than conventional steam turbine processes. Solid biomass fuelled IGCCs are still an issue of research and development. Instead of converting the product gas stream leaving a gasification plant to BTL, the product gas (mainly CO and H_2) can be used for heat and electricity generation. In contrast to BTL plants air instead of pure oxygen can be used as gasification agent and thus avoid the requirement of an air separation plant. In case of allothermal gasification however, (steam is used as gasification agent) air separation is not required at all.

There are *three types of plants* that are suitable to produce solid bio-fuels for the biomass dedicated boiler:

- annual plant species - planted and harvested every year - such as cereals, hemp, or kenaf;
- perennial species – planted once usually every 12 - 25 years and harvested annually - such as Miscanthus, reed canary grass and other reeds;
- short rotation coppice (SRC) – planted once usually every 20-30 years and harvested every 2 to 8 years - such as willow, poplar, black locust or paulownia with a perennial harvest rhythm.

In Figure 6 one gives the proposed configuration for combined production of heat & cold energy and electricity. DH (District Heating) is combined with DC (District Cooling) offer.

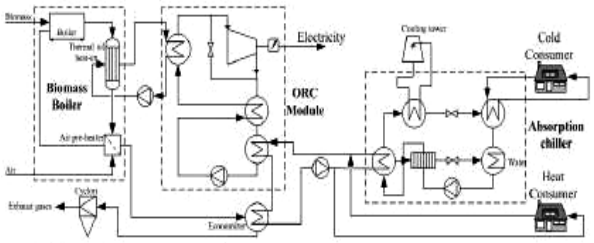


Figure 6: Scheme of the thermodynamic flow for a DH&DC tri-generation system with bio-energy input[5]

The vision is absolutely necessary to be implemented in the next years, as the global climate change, makes electricity and heat absolutely changing

in the offer and market necessity, not speaking about the price of the energy unit, and its C footprint.

Figure 7 indicates an example of a process that is a solution for generating hydrocarbons from biomass, in a synthetic way, by using a synthesis technology. The advantage is a good quality of fuel, according to the input material.

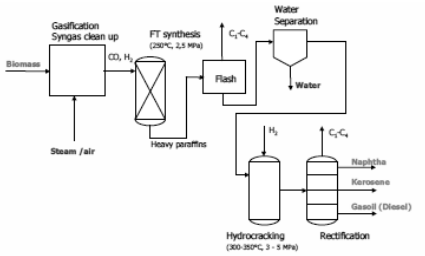


Figure 7: Simplified process scheme of the production of synthetic hydrocarbons via gasification and downstream Fischer-Tropsch (FT) synthesis [7]

Biogas [12] can be derived from the cultivation of energy crops. A biomass yield of 10 t - According to EAA 2006 - (wheat whole plant) to 17.5 t (double cropping, optimal) of dry substance per ha and year can be expected in the EU. The gross methane (CH_4) yield amounts to about 270 Nm³ per t of dry substance in case of wheat whole plant and 312 Nm³/(t of dry substance) in case of maize whole plant (which is used together with another plant for double cropping). The energy supply for the biogas and upgrading plant requires about 20% of the biogas formed in the fermenter. If 10% (~10.5 Mio. ha) of the arable land in the EU (~105 Mio. ha) would be used for the cultivation of energy crops for biogas generation, about 820 to 1,650 PJ of upgraded biogas could be generated per year from energy crops [10].

An alternative to the FT synthesis is the generation of synthetic transportation fuels via methanol route. The generation of synthesis gas via gasification is followed by a methanol synthesis step. The methanol is converted to synthetic transportation fuel (gasoline, diesel) via the so-called MtSynfuels process. The advantage of the MtSynfuels process compared to the FT synthesis is that the naphtha can be used directly as a fuel for Otto engines without any further upgrading [10]. Bio-diesel is a very known and used alternative fuel that has been introduced, for its environmental benefits, but also price value. Bio-fuels are direct fuelled, as main combustor, but also may switch to co-combustion alternatives, supporting a fossil fuel conversion, in a clean chain [12, 13, 17].

Table 2 gives comparative characteristics of different bio energy sources from crops [6]. In general, the C3 assimilation path is adapted to operate under low temperature (15-20 °C) whereas C4 metabolic pathway species are more efficient converters in high light level and high temperature situations. short rotation forestry suitable for energy production under temperate climate is mostly C3 species – willow, poplar, etc. Generally, the C4 crops such as Miscanthus are more suitable for arable lands whereas C3 crops can be grown on marginal land. In order to make the crop growing process environmentally friendly, a transportation distance should be as short as possible and should preferably not exceed 40 km.

Table 2: Comparative characteristics of different bio energy sources from energy crops [6].

Crops	Dry mass (DM) yield	Lower heating value	Energy production per ha	Water content of harvest
	t DM/(ha year)	MJ/kg DM	GJ/ha	%
Straw	2-4	17	35-70	14.5
Miscanthus	8-32	17.5	140-560	15
Hemp	10-18	16.8	170-300	na
Willow	8-15	18.5	280-315	53
Poplar	9-16	18.7	170-300	49
Giant reed	15-35	16.3	245-570	50
Reed canary grass	6-12	16.3	100-130	13
Switch grass	9-18	17	na	15
Black locust	5-10	19.5	100-200	35
Wood	3-5	18.7	74.5	50

Calorific value, ash content of the harvested plant and ash properties such as ash melting point as well as moisture content at harvest are of a crucial importance for energy production. Dry mass (DM) yield and the heating value of the crops are the most important factors in determining the energy source potentials for solid fuels. Therefore, it should be noted that dry mass yield largely depends on soil and climate conditions whereas the water content depends on the time of harvest. The largest areas of energy crops can be found in the UK (mainly Miscanthus and willow), Sweden (willow, reed canary grass), Finland (reed canary grass), Germany (Miscanthus, willow, etc), Spain and Italy (Miscanthus, poplar).

5. Bio-Heat as an effective solution

The markets for bioenergy products like current/power, heat and biofuels developed dynamically during the last decade. Market expansion and especially large scale application of RE is only possible if all existing biomass resources are used and additional potentials are activated to increase the basis for non-fossil fuels. Short-Rotation-Coppice is one of the most promising sources for sustainable wooden biomass production. Former research projects showed a high potential and interest for the SRC-topic in the whole agricultural sector, but due to uncertain regulatory framework and an enormous lack of adequate (end-user oriented) information, investments in this sector are still small and the development of a free market is inhibited. Bio-energy input supported by CO_2 capture technologies at the end of the flue gas circuit turns the global technology into a negative CO_2 technology [18].

The BIO-HEAT project will build on those successful projects mainly by using results and avoid

duplication of the work already performed by some of the BIO-HEAT partners. In projects such as BIOPROS, already economic, ecological and technical feasibility studies of Short Rotation Plantations for different local conditions and market requirements were performed and this know-how was transferred to the SME members (farmers, biomass processors, engineers, decisions makers) for the promotion of this way of biomass production. BIO-HEAT aims at triggering a long list of regional activities, running for their own without funding, only through investments of regional actors. BIO-HEAT will inform and connect those stakeholders about advantages/disadvantages of a new concept that will change the future development of the community. One possible outcome of the training and networking efforts could be to retrofit a local system or create a success story by designing a new biomass co-firing system. Long term aim of BIO-HEAT is to turn the technology and concept of SRC into one of the major suppliers of RE biomass for district heating in Eastern Europe. The objective is that SRC will be able to be effective not only in demonstration projects, but also in market application and be considered as a trustable, long term sustainable development for the independent energy delivery on the basis of biomass. It is anticipated that the countries addressed will be able to enter the international market of biomass, establishing agreements for the supply of wood chips or pellets with neighboring countries. The target groups for training and dissemination activities are stakeholders of the whole of SRC and DH systems as well external experts like community authorities, politicians and young students to offer opportunities for RE jobs (Figure 8).

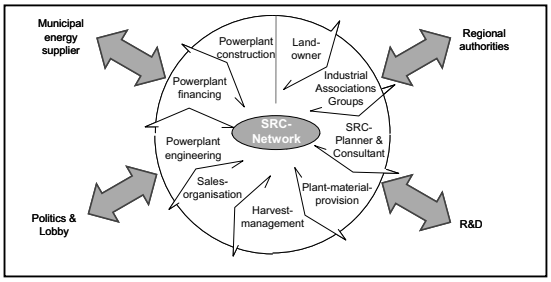


Figure 8: Bio-energy chain for a clean business in energy production

As it results, the actions foreseen in the work plan are aimed towards strengthening the competitiveness. In detail the key actors on the "productive" side are the biomass producers (farmers and forestry), biomass suppliers, consultants as well the following logistic, handling and processing chain, owner and facilitators of heating plants. The involvement of these groups in the project is ensured through the participation of the Industrial Association Groups (IAGs) in the consortium. BIO-HEAT´s IAGs are also strongly linked to the policy, R&D-sector, regional authorities from communities and to energy and environment authorities who represent the other group of relevant key-stakeholder and therewith a target group for project activities.

Examples of several applications and advantages are given in [12, 13, 17], meaning biogas production from waste bio-energy and cogeneration with co-combustion of bio-energy.

6. Conclusion

Following research gaps that need to be addressed, especially with the rapid growth of the bio-fuel industry have been identified: (1) advanced research to improve processing efficiency, product quality and air quality; (2) development of machinery for harvesting, transport and post-processing operations for both small- and large-scale feedstock plantations; (3) breeding and improvement of current feedstock varieties; and (4) development of germ-plasm for bio-fuels feedstock.

By using modern instruments as well as emission factors for modeling the air quality of tomorrow used to derive estimates of pollutant emissions based on the amount of fuel and energy (including bio-energy) consumed during an industrial activity it is possible to generate a sustainable world and keep the pollution level and greenhouse gases under control. Until man kind exists always keen solution for energy resources such as bio-energy will be technologically improved and applied for the next generation benefit. No split between land use for energy source and for food is realistic, if political will be involved actively. Air quality and thus life standards are in circulated exchange with the energy resources used, bio-energy is part of them, assuring continuity, sustainability, independence, variety, social and economic development as well.

The best biomass crops for energy production is one that can be harvested dry and has a perennial growth habit (no need for annual planting or tillage) to minimize cultivation costs.

Energy plants can convert solar energy efficiently. The best biomass crops for energy production is one that can be harvested dry and has a perennial growth habit (no need for annual planting or tillage) to minimize cultivation costs. Low input of fertilizers and other chemicals when growing these plants helps to reduce the environmental impact as well as to improve energy efficiency. SRC is one of the most promising sources for sustainable wooden biomass production. They are rarely used in Eastern-Europe, although there is a constantly expanding bio-energy sector and more rural areas with agricultural focus than in Western-Europe. Encouraging sustainable production is part of the European Commission objectives in creating a friendly environment for businesses. Cutting net costs through energy savings enhances European industrial competitiveness. Nonetheless, a number of barriers need to be overcome in order to tap the full potential of energy savings with net economic benefits in the industrial sector.

Bio-energy is available and can be transformed by today already tailored or still under development technologies into final energy (electricity and heat), to support the sustainable development of the society.

A smart energy exchange network (expected in the EU vision by 2030), allowing for optimal resource allocation between the multiple low carbon energy sources feeding into the system and various temperature

demands of customers, as well fully carbon neutral energy solutions through regional, integrated networks (expected by 2050) are basically depending also on the EU strategy and vision for DHC and their applications.

SRC/SRF may play a role in the complex mixed energy resource offer, assuring local (rural) sustainable development, regional economic and energetic independence, new jobs' creation for under graduated people, financial and environmental beneficial results, complex associations grids between land owners and energy production, etc

Cogeneration [16, 17] for the DH offer may be based on local bio-energy resulting from SRC/SRP, bringing thus economic, environmental, social, and independence advantages, not speaking about new jobs in the local community. An energy (low C footprint) society and region does have such solutions in mind, for progressing, and especially in countries where deforestation and bad economics and management destroyed the ancient forests might step to such solution, for individual but also global benefits! The SRC/SRP offers multiple possibilities, not only to be used as solid fuel, but also in a compact enhanced fuel, such as biogas or bio-fuels for internal engines combustion. As result, the amount of fossil originated CO_2 is drastic reduced, by the figure of biomass implementation, as input.

7. Literature

[1] *REN21* - Renewables Global Status Report, http://www.ren21.net/Portals/97/documents/, (2009).

[2] ***, District Heating Cooling – A vision towards 2020 – 2050, DHC+ Technology Platform material, May Brussels, http://www.dhcplus.eu/Documentation.html, (2009).

[3] Ecoheatcool, IEEE project, http://www.euroheat.org/ Files/ Filer/ecoheatcool/index.htm, (2008).

[4] ***Source Chalmers University, ECOHEATCOOL project WP1, http://www.euroheat.org/Files/Filer/ecoheatcool/documents/Leaflet.pdf, (2008).

[5] X. Feng, Y.N. Cai, L.L. Qian, A new performance criterion for cogeneration system, Energy Conversion and Management, Vol. 39(15), pag. 1607-1609, (1998).

[6] *** AEBIOM, New dedicated energy crops fro solid biofuels, www.aebiom.org

[7] *** Assessment of potential and promotion of new generation of renewable technologies, ITRE, En, PE440.278, (2010).

[8] Altmann et al. "EU Energy Efficiency Policy – Achievements and Outlook", Brussels, (2010).

[9] *** Investing in low-carbon energy technology in the EU, IP/A/ITRE/2009-15, En, Workshop Report 26 Aprilie, Brussels, (2009).

[10] Assessment of Potential and Promotion of New Generation of Renewable Technologies, IP/A/ITRE/ST/2009-11 & 12, PE 440, (2009).

[11] I. Vetres and all, LIDAR system implementation and development for novel Romanian systems, OPTOELECTRONICS AND ADVANCED MATERIALS – RAPID COMMUNICATIONS Vol. 4, No. 8, August 2010, pag. 1074 – 1077.

[12] Cioablă Adrian Eugen, Ionel Ioana, Popescu Francisc, Study connected with wood residues behaviour during anaerobic fermentation process, Environmental Engineering and Management Journal , Vol 9, Nr. 10, ISSN 1582-9596, 2010, pag. 1411-1416.

[13] Popescu, F; Lontis, N; Ionel, I., Improving the air quality in urban areas applying cogeneration with biofuels. Case study, PROCEEDINGS OF THE 3RD INTERNATIONAL CONFERENCE ON ENERGY AND DEVELOPMENT-ENVIRONMENT - BIOMEDICINE (EDEB'09)77-81 2009, DEC 29-30, 2009, Pag. 78 – 81.

[14] C. Nisulescu, Delia Calinoiu, A. Timofte, Andreea Boscornea, Camelia Talianu, Diurnal variation of particulate matter in the proximity of Rovinari fossil-fuel power plant, Environmental Engineering and Management Journal, Ed. Ecoyone, Iasi, January 2011, Vol. 10, No. 1, pag. 99 – 107.

[15] C. Nisulescu, Ioana Ionel, Delia Calinoiu, I. Vetres, Air pollution monitoring in a town nearly power plant, Advances in Biology, Bioengineering and Environment, Ed. WSEAS Press, Vouliagmeni, Athens, Greece, December 29-31, 2010, pag. 181-185.

[16] Delia Calinoiu, Ioana Ionel, Solar energy power systems as renewable energy technique of the future - Journal of Optoelectronics and Advanced Materials, Vol. 12, no.5, May 2010, pag. 1220-1225.

[17] Ionel, I; Popescu, F; Lontis, N; Tordai, GT; Russ, W., Co-combustion of fossil fuel with bio-fuel in small cogeneration systems, between necessity and achievements, SSE '09: PROCEEDINGS OF THE 11TH WSEAS INTERNATIONAL CONFERENCE ON SUSTAINABILITY IN SCIENCE ENGINEERING352-357 2009, 11th WSEAS International Conference on Sustainablility in Science Engineering (SSE 09), MAY 27-29, 2009, pag. 352 - 357.

[18] D. Cebrucean, Ioana Ionel, T. Panait, NOVEL TECHNOLOGY OF COAL BIOMASS CO-COMBUSTION WITH CO_2 CAPTURE, JOURNAL OF ENVIRONMENTAL PROTECTION AND ECOLOGY vol.11, nr. 1, pag. 284-293, 2010.

8. Acknowledgement

This work is a part of a larger project on Bio-Heat (Promotion of Short Rotation Coppice for District Heating Systems in Eastern Europe, Contract N°: IEE/09/890/SI2.558326, financed by Intelligent Energy Europe), Bio-Heat (Promotion of Short Rotation Coppice for District Heating Systems in Eastern Europe, Contract Nr. IEE/09/890/SI2.558326, financed by Intelligent Energy Europe), http://bio-heat.eu/en/home.html, as well supported by the national research project EPOC (Energy for a clean city, http://mec.upt.ro/epoc/, financed by the Romanian Ministry of Research and Education). By this way the author expresses appreciations versus the partners in the mentioned projects, as well.

The author acknowledges the constant support of the ***Alexander von Humboldt Foundation***, in respect to instruments' and books donation, as research basis.

Warm thanks addressed to all my actual and former PhD students that performed with skill and devotement pioneer engineering in the UPT laboratories, making this presentation possible!

BIOLOGY, MEDICINE

BIOLOGIE, MEDICINĂ

NANOROBOTICS IN MEDICINE

Ilie POPA[1)], Magdalena Adina CIOBANU[2)]
[1)]University of Pitesti, Street Targul din Vale, No. 1, Pitesti, Arges, 110040, Romania,
E-mail: ilie.popa@upit.ro, ci.popa@yahoo.com
[2)] Fundeni Hospital Cardiology Center, Bucharest, Romania
E-mail: adinaciobanu21@yahoo.com

Abstract. This paper present actual stage of medical nanorobot architecture based on important discoveries in nanotechnology, integrated circuit patents, and some publications, directly or indirectly related to one of the most challenging new fields of science: molecular machines. It is also describe how medicine can benefit from the joint development of nanodevices which are derived, and which integrate techniques, from artificial intelligence, nanotechnology, and embedded sensors. Teleoperated surgical procedures, early disease diagnosis, and pervasive patient monitoring are some possible applications of nanorobots, reflecting progress along a roadmap for the gradual and practical development of nanorobots. To illustrate the described nanorobot architecture, the most important applications of nanorobots for diabetes using real clinical data are presented. Theoretical and practical analysis of system integration is one important aspect for supporting the rapid development in the emerging field of nanotechnology. This provides useful directions for further research and development of medical nanorobotics and suggests a time frame in which nanorobots may be expected to be available for common utilization in therapeutic and medical procedures.

Keywords: nanorobot, nanomedicine, nanomachine, nonosurgery, cell repair, telemetry.

1. Introduction

Nanorobotics represent a peculiar case of robotics and refers, on one hand, to nanometric displacements of some parts of the robots of larger or smaller robots, but, however, the scale for this displacements is confined at least to millimeter and, on the other hand, to the fact that the ensemble of robots incorporates robots with nanometric dimensions, of less than $1mm^3$. Obviously, robots from the first category are not „real" nanorobots, while those belonging to the second category are no doubt this kind of robots. The nanometrical displacements or even the nanometric technologic achievements are part of the field that nowadays is called nanotechnology. Certainly, the first logical step is that of producing robots that are part of the first category, and formerly, by using the acquired experience in the field, second type of robots be produced (those really belonging to the "nanometric" class). Nanorobots are generally considered to comprise a wide area of much reduced dimension machines or devices capable of executing certain works that require the presence of human beings in inaccessible places, because of the dimensions involved in the processes.

Still, nanorobots that fall under the volume of 1 mm^3 are not being produced, but projects and research work are much more advanced. This is why, nowadays, projects involving robots capable of passing through capillary blood vessels are taken into account.

The Figure 1 depicts nanorobots conceived by Svidinenco Yuriy, Tim Fonseca and Rocky Rawstern from the Institute for Molecular Manufactoring (IMM) USA to be used in medicine [1].

The sphere shape offers a lot of advantages and this is why Tim Fonseca has decided to choose this design for its works. Still, in order to dislodge in certain environmental conditions or to protect their nice pieces in other conditions, the robots require retractile flyers. This example depicts 6 of these retractable flyers. The nanorobot also features 6 protuberances that could be extended or retracted, although the author does not mention these functions as possible. They could be arms or manipulators for various interventions.

2. Nanorobot applications in medical field

The use of nanorobots may advance biomedical intervention with minimally invasive surgeries [2], help patients who need constant body function monitoring, and improve treatment efficiency through early diagnosis of possibly serious diseases [3]. Implantable devices in medicine have been used for continuous patient data acquisition. Patient monitoring can help in preparing for neurosurgery [4], early stage diagnostic reports to fight cancer [5], and blood pressure control for cardiology problems [6]. The same approach is quite useful in monitoring patients with diabetes [7].

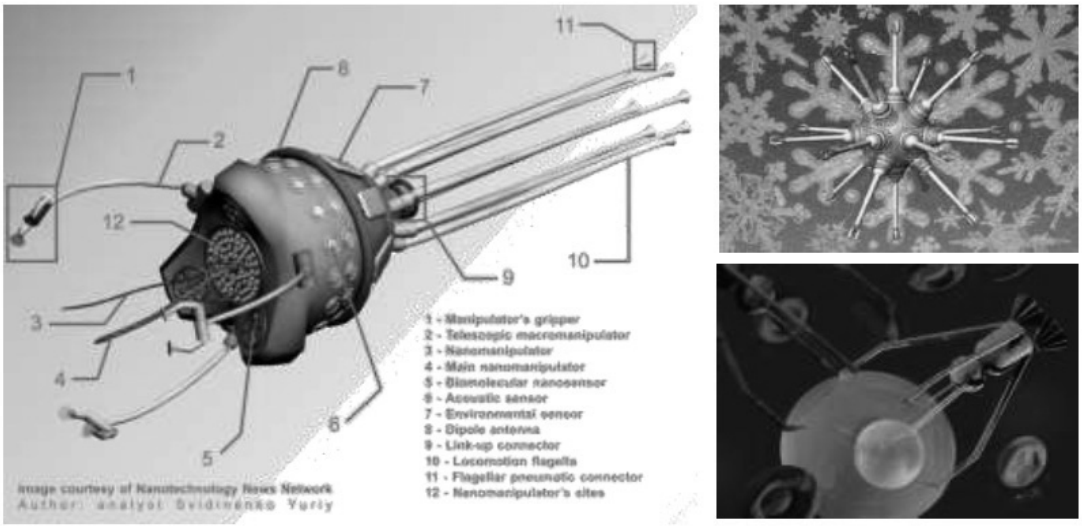


Figure 1. Nanorobot from the Institute for Molecular Manufactoring (USA)

Medical complications can arise due to diabetes problems. Nanorobots use sensors to detect glucose levels in bloodstream. To visualize how stages of the actual technologies can be used to medicine, based on current discoveries, publications, and patents, was implemented a system simulation of nanorobots monitoring blood glucose levels (Figure 2). For example, a variation of 30mg/dl can be adopted as a displacement range (Figure 3). The nanorobot can sends a signal to the mobile phone at every observed critical level.

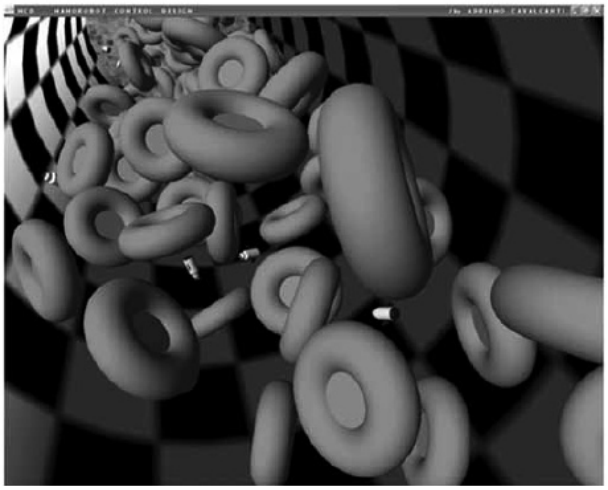


Figure 2. Monitoring blood glucose levels

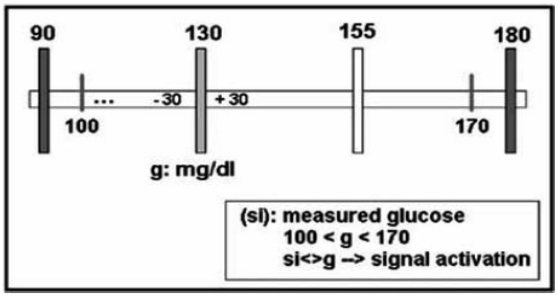


Figure 3. Accepted Blood Glucose Levels (BGLs).

Actual advances in wireless technologies, nano-electronics devices, and their use in the implementation of nanorobots applied to diabetes can illustrate what upcoming technologies can enable in terms of medicine applications.

3. Nanorobot Architecture

The main parameters used for the medical nanorobot architecture and its control activation, as well as the required technology background that may lead to manufacturing hardware for molecular machines.

3.1. Manufacturing Technology

The ability to manufacture nanorobots may result from current trends and new methodologies in fabrication, computation, transducers and manipulation. The hardware architecture for a medical nanorobot must include the necessary devices for monitoring the most important aspects of its operational workspace: the human body.

Teams of nanorobots may cooperate to perform predefined complex tasks in medical procedures. To reach this aim, data processing, energy supply, and data transmission capabilities can be addressed through embedded integrated circuits, using advances in technologies derived from nanotechnology and VLSI design [8].

3.2. Chemical Sensor

Manufacturing silicon-based chemical and motion sensor arrays using a two-level system architecture hierarchy has been successfully conducted in the last 15 years. Applications range from automotive and chemical industry with detection of air to water element pattern recognition through embedded software programming, and biomedical uses. CMOS-based sensors using nanowires as material for circuit assembly can achieve maximal efficiency for applications regarding chemical changes, enabling new medical applications [9].

Factors like low energy consumption and high-sensitivity are among some of the advantages of nanosensors. Nanosensor manufacturing array processes can use electrofluidic alignment to achieve integrated CMOS circuit assembly as multi-element systems [10].

To further advance manufacturing techniques, Silicon-On-Insulator (SOI) technology has been used to assemble high-performance logic sub 90nm circuits [11].

3.3. Energy Supply

The most effective way to keep the nanorobot operating continuously is to establish the use of a continuous available source of power. For a medical nanorobot, the device must keep working inside the human body, sometimes for long periods, and must have easy access to clean and controllable energy to maintain efficient operation.

Some possibilities to power the nanorobot can be provided from ambient energy [2].

Electromagnetic radiation from light is an option for energy generation in determined open workspaces [12] but not for *in vivo* medical nanorobotics, especially since lighting conditions in different kinds of workspaces could sharply change depending on the application.

Kinetic energy can be generated from the bloodstream due to motion interaction with designed devices embedded with the nanorobot [13].

Most recently, remote inductive powering has been used both for RFID (Radio Frequency Identification Device) and biomedical implanted devices to supply power on the order of milliwatts [14]. To operate nanorobots, a low frequency energy source may be enough. The use of CMOS for active telemetry and power supply is the most effective and secure way to ensure energy as long as necessary to keep the nanorobot in operation. The energy received can be also saved in ranges of ~1μW while the nanorobot stays in inactive modes, just becoming active when signal patterns require it to do so. For communication, sending RF signals ~1mW is required. A practical way to achieve easy implementation of this architecture will obtain both energy and data transfer capabilities for nanorobots by employing mobile phone in such process [15].

3.4. Data Transmission

The application of devices and sensors implanted inside the human body to transmit data about the health of patients can provide great advantages in continuous medical monitoring [7]. Most recently, the use of RFID for *in vivo* data collecting and transmission was successfully tested for electroencephalograms [4]. For communication in liquid workspaces, depending on the application, acoustic, light, RF, and chemical signals may be considered as possible choices for communication and data transmission [16].

Acoustic communication is more appropriate for longer distance communication and detection with low energy consumption as compared to light communication approaches [17]. Although, optical communication permits faster rates of data transmission, its energy demand makes it not ideal for nanorobots [2].

Work with RFID has been developed as an integrated circuit device for medicine [14, 18]. Using integrated sensors for data transfer is the better answer to read and write data in implanted devices. For the nanorobot active sonar communication frequencies may reach up to 20μW/8Hz at resonance rates with 3V supply [17].

For example, every two hours the nanorobot keeps the sensor activated 2 minutes and transmits the BGL measurements directly to the mobile phone (Figure 4).

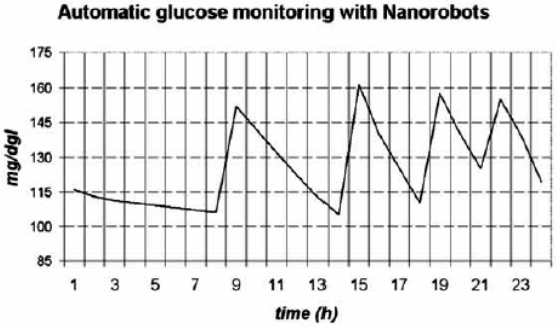


Figure 4. A monitoring example.

More widely accepted and usual than an RF CMOS transponder, mobile phones can be extremely practical and useful as sensors for acquiring wireless data transmission from medical nanorobots implanted inside the patient's body. The nanorobot will emit signals to send an alarm in case the patient urgently needs medications prescribed by his doctor. It uses electromagnetic radio waves to command and detect the current status of nanorobots inside the patient. Frequencies ranging from 1 to 20MHz can be successfully used for biomedical applications without any damage [18].

4. Current and Future Developments

4.1. Nanosurgery

Liquid containing gold-coated nanoshells have been developed. Fusion of two pieces of tissue into one has been achieved by use of this liquid. The two pieces of tissue are put together touching each other, then the liquid is dribbled and infrared laser is traced along the seam, the two pieces "weld" together and the process is termed as "Tissue Welding" which is going to replace the suturing of wounds. This will also solve the problem of restitching the artery when it gets cut during surgery or a heart/kidney transplant. The "tissue welder" would cause perfect seal of the cut artery [19].

4.2. Molecular Nanomedicine -Nanorobots

Molecular nanomedicine envisages the development of machines (molecular assemblers, nanorobots) which could function at a molecular or atomic scale e.g. computational gene introduced into the system can carry out the job of a missing or defective gene. A nanorobot will

be between 0.5-3 micrometers in size, the size of a particle which can pass through the capillary. Carbon is the primary element used to build these nanorobots due to inherent strength and other characteristics of some forms of carbon. These devices injected into a human body would work in a specific organ or a tissue mass [20].

4.3. Cell Repair

Cell biology has revealed that basic operations of cell repair are carried out at molecular level. Nanomachines that are able to enter the cells, sense differences from healthy one and make modifications of faulty structure [21].

4.4. Diagnostics

What is being seen as a major breakthrough in detection of carcinomas and other deadly diseases, the researchers at University of Toronto, Canada, have developed an inexpensive and small ultra sensitive microchip for detection of various malignant and benign tumors as well as severe infectious diseases like HIV and H1N1. This is going to revolution the field of diagnostics. Diagnostic nanomedicine could be employed to monitor the internal chemistry of the body. The nanorobots equipped with wireless sensors and transmitters could freely move in lymph and blood to detect imbalances and send warning signals. Nanomachines can be planted in brain to monitor the pulse and brain-wave activity.

4.5. Recent Advances

Landscape phage fusion protein-mediated targeting of nanomedicines enhancing the prostate tumor cell association and cytotoxic effecency of anticancer drugs, Self assembled lipid nanomedicines for SiRNA tumor targeting anticancer drugs have been introduced recently [22,23]. Effective uptake and distribution of fullerenes (a potent inhibitors of mast cell mediated allergies/ inflammation) in human mast cells is now possible by nanomedicine [24].

5. Conclusions

Nanomedicine is going to have a potential impact on the society. It will drastically improve patient's quality of life, reduce societal and economic costs associated with healthcare, will offer early detection of pathologic conditions, reduce the severity of disease and result in improved clinical outcome for the patient.

Nanorobots may provide useful tools in biomedical instrumentation. Successful nanorobotic systems must be able to respond efficiently in real time to changing aspects of microenvironments not previously examined from a control perspective.

References

1. Mircea Copoț, *et al*. *Achievements and perspectives in the field of nanorobotics* The Romanian Review Precision Mechanics, Optics & Mechatronics, 2009 (19), No. 36.
2. Freitas Jr RA, *Nanomedicine, Vol. I: Basic Capabilities*, Landes Bioscience, 1999, http://www.nanomedicine.com/NMI.htm.
3. Martel S., *et al*. *Adapting MRI Systems to Propel and Guide Microdevices in the Human Blood Circulatory System*, 26th Annual Int'l Conf. of the IEEE Engineering in Medicine and Biology Society, p. 1044-1047, Sept. 2004.
4. Sauer C, *et al*. *Power Harvesting and Telemetry in CMOS for Implanted Devices*, IEEE Trans Circ Sys 2005; 52: 2605-2613.
5. Cavalcanti A, Hogg T, Shirinzadeh B, Liaw HC. *Nanorobot Communication Techniques: A Comprehensive Tutorial*, IEEE ICARCV Int'l Conf. on Control, Automation, Robotics and Vision, Grand Hyatt, Singapore, Dec. 2006.
6. Yamamoto H., et al. *Transcardiac Gradient of Soluble Adhesion Molecules Predicts Progression of Coronary Artery Disease*, Int'l J of Cardiology, 84(2-3): 249-257, Aug. 2002.
7. Sumino T, *et al. Preliminary study of calibration-free continuous glucose monitoring with microdialysis technique.* Proc Int'l Conf of the IEEE Engineering inMedicine and Biology Society, Vol. 20, No 4, pp. 1775-1778, 1998.
8. Srivastava N, Banerjee K, *Performance analysis of carbon nanotube interconnects for VLSI applications*, IEEE/ACM ICCAD Int'l Conf. on Computer-Aided Design, pp. 383-390, Nov. 2005.
9. Zhang MJ, et al. *Interactive DNA sequence and structure design for DNA nanoapplications*, IEEE Trans Nanobiosci 2004; 3(4). p.286-292.
10. Xu W, *et al. Design of a Nanosensor Array Architecture,* ACM Proceedings of the 14th ACM Great Lakes symposium on VLSI, Boston, Massachusetts, USA, Apr. 2004.
11. Mitra S, *et. al*. Evaluation of ESD characteristics for 65 nm SOI technology. *IEEE Int'l SOI Conf* 2005; 21-23.
12. Liu W, Wyk JDV, Odendaal WG. *Design and evaluation of integrated electromagnetic power passives with vertical surface interconnections.* 9th IEEE Applied Power Electronics Conf Exposition 2004; 2: 958-963.
13. Roundy S, *et. al*. *Energy scavenging for wireless sensor networks with special focus on vibrations*, Springer 2006.
14. Vavik, G. M.: US20056946989 (**2005**).
15. Ahuja SP, Myers JR. *A survey on wireless grid computing*. J Supercomputing 2006; 37(1): 3-21.
16. Cavalcanti A. *Assembly automation with evolutionary nanorobots and sensor-based control applied to nanomedicine*. IEEE Trans Nanotechnol 2003: 2: 82-87
17. Horiuchi TK, Cummings RE. A Time-Series Novelty Detection Chip for Sonar Int'l J Robotics and Automation, ACTA Press, 2004.
18. Sauer C, *et al*. "Power harvesting and telemetry in CMOS for implanted devices"IEEE Trans Circ Sys 2005;52(12) 2605-13.
19. Bergman RM, "Innovations in biomaterials: Achievements and Opportunities". *MRS Bull* 2005; 30 : 540.
20. Gelain F, *et al*. *Systemic studies of a self assembling peptide nanofiber scaffold with other scaffolds*. J Nanosci Nanotechnol *2007;* 7: 424-34.
21. Alivisatos AP. *The use of nanocrystals in biological detection*. Nat biotechnol 2004*;* 22: 47-52.
22. Jayanna PK, *et al*. *Landscape Phage Fusion Protein-mediated targeting of nanomedicines enhances their prostate tumor cell association and cytotoxic efficency.* Nanomedicine 2010Feb,4.
23. Tseng YC, Huang L. *Self Assembled Lipid nanomedicines for Si RNA Tumor targeting.* J Biomed Nanotechnol 2009; 5(4) p.351-63.
24. Dellinger A, *et al*. *Uptake and distribution of fullerenes in human mast cells*, Nanomedicine 2010 Feb, 4.

BIOMECHANICAL AND CLINICAL CONSIDERATIONS OF OPENBITE TREATMENT IN ADULTS

Camelia SZUHANEK
Faculty of Dental Medicine, "Victor Babes" University of Medicine and Pharmacy, Timisoara,
e-mail: camelia_fleser@yahoo.com

Abstract. Anterior openbite is historically considered a challenging malocclusion to treat, and its correction is prone to relapse. Treatment mechanics usually consists of posterior molar intrusion and extrusion or eruption of anterior teeth This study was undertaken in order to present the biomechanical options and some clinical treated cases of open bite in adults.

Keywords: orthodontic treatment, biomechanics, adult patients, openbite.

1.Introduction

Anterior openbite is historically considered a challenging malocclusion to treat, and its correction is prone to relapse[1,2,3]. An anterior open bite is a definite lack of contact, in the vertical direction, between the incisal edges of the maxillary and mandibular anterior teeth The severity varies, from an almost edge-to-edge relationship to a severe handicapping open bite.

The etiology is complex, potentially involving skeletal, dental, respiratory, neurologic, or habitual factors[4].

This study was undertaken in order to present the biomechanical options and clinical treated cases of openbite in adults.

2.Treatment options

Treatment is dependent on the age of the patient, his/her concerns and expectations, and the aetiology of the malocclusion.

Mizrahil[5] described four modalities of treatment:

1. myofunctional therapy;
2. orthodontic mechanotherapy (using fixed or removable appliances);
3. surgical therapy;
4. combination of two or more of the above.

Treatment mechanics usually consists of posterior molar intrusion and extrusion or eruption of anterior teeth(fig.1). Intermaxillary vertical elastics are usually indicated in the frontal area.

The biomechanical treatment objectives are (Saito, [6]:

1. correction of the anterior open bite and establishment of ideal frontal relations by retracting and tipping the maxillary and mandibular incisors lingually,
2. obtaining the Class I occlusal relationship by upright of the mandibular occlusal plane,
3. limiting of the mandibular clockwise rotation and increment of anterior lower face height due to extrusion of the posterior teeth,
4. correction of a discrepancy between the facial and dental midlines
5. reduction of the protruding lower lip by incisor retraction and bite closure.

Many treatment modalities such as habit-breaking appliances, high-pull headgears, chin caps, vertical elastics, multiloop edgewise arch wire (MEAW) appliances, tongue reduction,and surgical correction are used to treat open bite malocclusions[7].

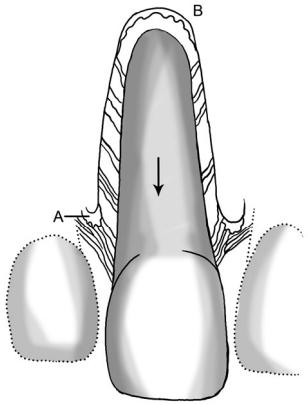


Figure 1. Extrusive movements of the incisors are required during openbite closure.

First or second four premolar extractions can be also helpful in order to achieve the bite closure. Posterior intrusion can be obtained nowadays with the help of orthodontic implants, which provide an excellent extradental anchorage.

Surgical correction represents an indication in severe skeletal cases. A combination of fixed-appliance orthodontics and orthognathic surgery may be required to treat skeletal openbites..

3.Case reports

Case 1

This 23 years old male patient with large openbite was treated nonsurgically, using only fixed Roth .022" brackets, the normal sequence of archwires and frontal elastics(fig.2). Treatment time was 16 months. The patient showed excellent cooperation with wearing the frontal rectangular elastics. Vacuum-formed retainers were used in order to mantain the posttreatment result.

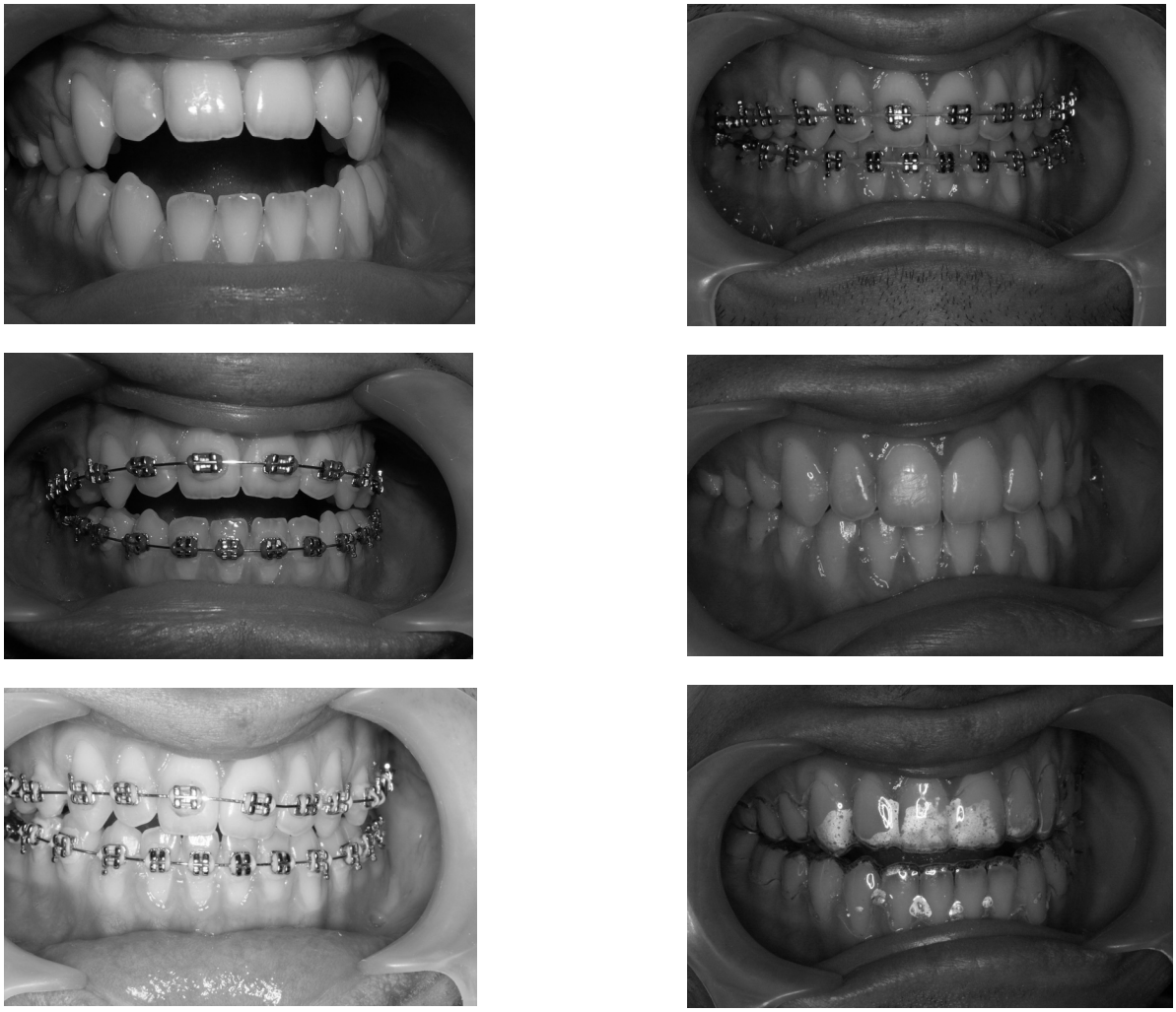


Figure 2. Clinical case. 23 years old male patient with large openbite. Initial situation, the sequence of wires and the final result.

Case 2

This 22 years old female patient(fig.3) presented to the orthodontic clinic requesting correction of the anterior openbite. Anamnesis revealed abnormal myofunctional behaviour, including thumb sucking and tongue thrusting habits during childhood, which have led to a 4 mm frontal inocclusion.

The treatment plan consisted of tongue position re-education and fixed orthodontics. Special archwires, such as reverse curve nitinol, were used in order to achieve posterior intrusion and frontal overlap. Stability was provided by using fixed retainers and a positioner that maintained the occlusion and the tongue in normal parameters.

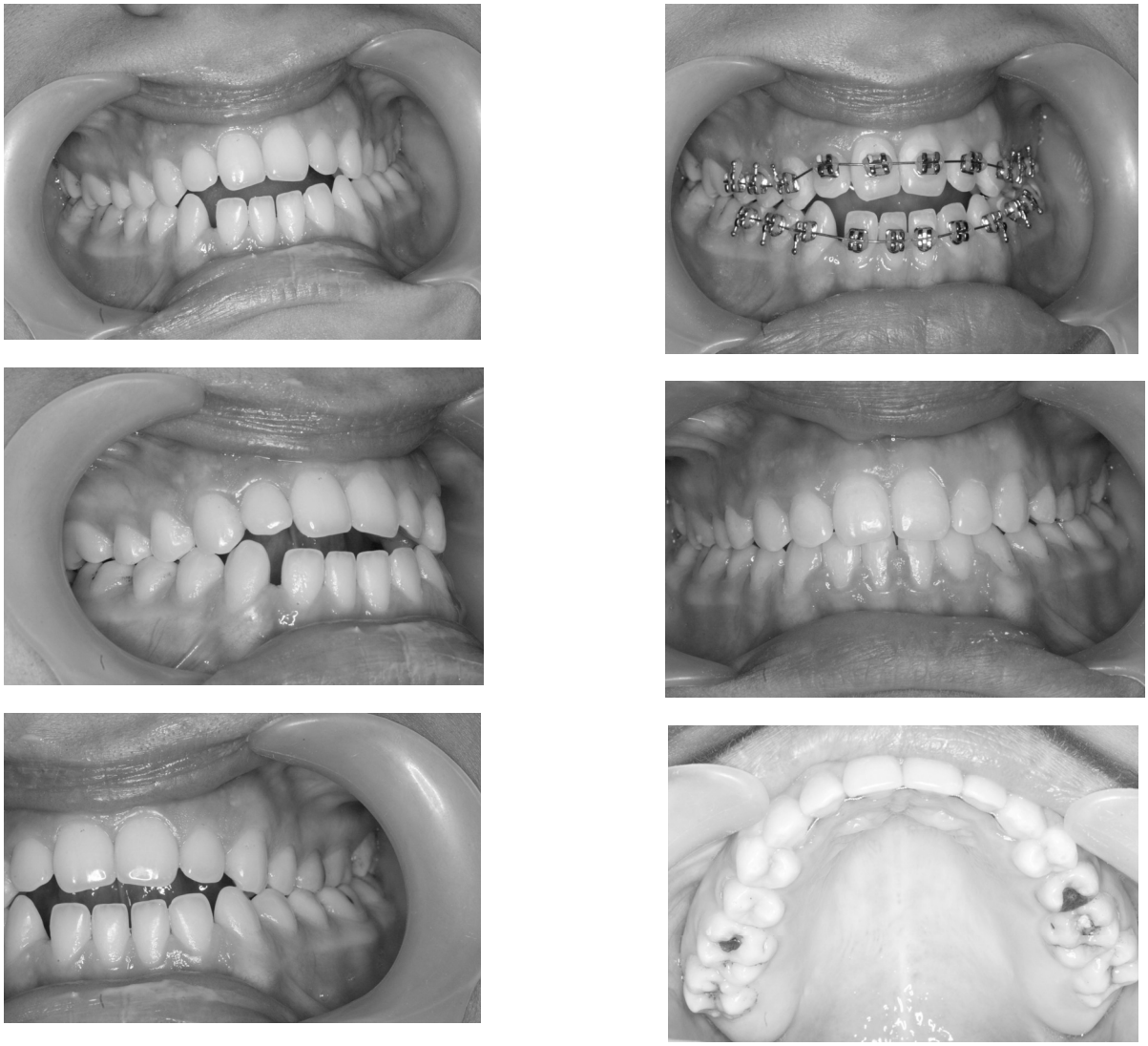


Figure 3. Clinical case, 22 years old female patient with openbite caused by abnormal functional habits. Fixed appliances were used in order to close the openbite. Posttreatment stability was provided by using fixed retainers and a positioned.

3.Disscusion

Most orthodontists can obtain positive openbite closure with orthodontic or surgical interventions, but retaining the vertical correction can be very challenging once the appliances are removed. Stability of the corrected tooth positions and the final occlusion depend on control of the possible factors related to relapse of the anterior open bite.

As reported previously, the major primary factors in the dental equilibrium appear to be the resting tongue and lip pressures. Prediction of the response to treatment and the stability of the outcome is generally unreliable.

Conclusions

Openbite represents one of the most challenging malloclusion to treat. Habit re-education, fixed orthodontic appliances and long term retention are highly recommended.

Acknowledgement: This work was supported by CNCSIS–UEFISCSU, project number PNII – IDEI 1738/2008-2011.

References

1. Burford D, Noar J., H.: *The causes, diagnosis and treatment of anterior open bite***.** Dent Update. 2003;30:235–241
2. Sugawara J., Baik U., B., Umemori M., Takahashi I., Nagasaka H., Kawamura H., et al.: *Treatment and posttreatment dentoalveolar changes following intrusion of mandibular molars with application of a skeletal anchorage system (SAS) for open bite correction.* Int J Adult Orthod Orthognath Surg. *2002;17:243–253*
3. Ng C.,S., Wong W., K., Hägg U.: *Orthodontic treatment of anterior open bite***.** Int J. Paediatr Dent. *2008;18:78–83.*
4. Lentini-Oliveira D., A., Carvalho F., R., Ye Q., et al. *Orthodontic and orthopaedic treatment for anterior open bite in children***.** Cochrane Database Syst Rev. 2007;Apr 18;(2):CD005515.
5. Mizrahi E.: *A review of anterior open bite.* Br J. Orthod 1978; **5:** 21–27.
6. Isao Saito, Masaki Yamaki, Kooji Hanada: *Nonsurgical Treatment of Adult Open Bite Using Edgewise Appliance Combined with High-Pull Headgear and Class III Elastics*. The Angle Orthodontist: March 2005, Vol. 75, No. 2, pp. 277-283.
7. Szuhanek Camelia, Glavan Florica, Jianu R.: *Biomecanica ortodontica*, Ed.Orizonturi Universitare 2009, ISBN 978-973-638- 435-6.

BIOMECHANICAL ANALYSIS OF TWO ORTHODONTIC CLOSING SPACES METHODS

Anghel CERNESCU[*], Camelia SZUHANEK[**], Nicolae FAUR*, Traian FLESER*
[*] Politehnica University of Timisoara
[**]University of Medicine and Pharmacy "Victor Babes" Timisoara

Abstract. Bone remodeling laws have been used to simulate the movement of a lower retracted canine in a premolar extraction case. The purpose of this article is to discuss a method that allows the simulation of more complex tooth movements. A 3-dimensional finite element method was used to simulate the orthodontic tooth movement (retraction) of a canine and the associated movement of the anchor teeth. Absorption and apposition of the alveolar bone were produced in proportion to the stress of the surrounding bone. Two loading cases were analysed in this simulation. The canine was retracted by a 1.4N force with 0.6 mm square wire and were analysed the stress and strain state in surrounding bone of the teeth. Simple assumptions were used in this calculation to simulate orthodontic tooth movements. The calculated results were reasonable in mechanical considerations. This method might enable one to estimate various tooth movements clinically. However, precise comparisons between calculated and clinical results, and the improvement of the calculation model, are left for a future study.

Keywords: orthodontic force, absorption bone, tooth movement, FEM analysis, stress state, strain state.

1. Introduction

When an orthodontic force is applied to a tooth, stresses and strains are produced in the periodontal ligament (PDL) and the surrounding bone. Absorption of alveolar bone occurs in a region of compressive stress, whereas apposition of the alveolar bone occurs in a region of tensile stress. By this bone remodeling action, the teeth move. To plan tooth movement, a clinician must understand the force to be applied to the tooth and the stress distribution in the surrounding bone.

Many calculations have been carried out by using the finite element method on the stress distribution in the PDL. These results show that the moment to force (M/F) ratio controls the pattern of tooth movement, [1,2], ie, tipping or bodily movement. These results have been used for appliance design [3,4]. Some trials have been done to estimate long-time orthodontic tooth movement considering absorption and apposition of the alveolar bone.

In these methods, applying bone remodeling laws, the movements of a three teeth were simulated.

We have proposed a 3-dimensional (3D) finite element model for calculating orthodontic teeth movements. The change in orthodontic forces of the teeth movements can be calculated as a coupled problem of teeth and appliance.

Bone remodeling is a well-known phenomenon in orthopedics. However, the biological mechanism of bone remodeling has not been clarified. We considered only orthodontic tooth movement. The reassessment of many experiments shows that, with orthodontic force up to about 2 N, the rate of tooth movement is increased by an increase in the force. The orthodontic force corresponds to the stress in the PDL and surrounding bone, and tooth movement corresponds to the absorption of alveolar bone. Then, the bone absorption depends on the stress. By using the simplest relationship, the rate of bone absorption was assumed to be proportional to the mean stress in the PDL.

2. Materials and method

2.1. *Geometric modelling*

The algorithm of the research included obtaining a geometrical model of dental and periodontal structures.

A three-dimensional model was used for this FEM analysis obtained by 3D scanning of a real teeth and human mandible bone with a 3D laser scanner, Roland, model LPX 1200. The scanned images were reconstructed by reverse engineering techniques, fig. 1.

A steel wire, with 0.6x0.6 mm cross-sectional dimensions was used as anchorage of molar, premolar and canine teeth. Wire bending such as a gable bend and brackets were not used for this model. The teeth were directly connected with the steel wire.

2.2. *The mechanical properties of model components*

The bone of mandible is assumed to have an outer shell of dense compact bone, enclosing a core of porous cellular, cancellous or trabecular bone.

The mechanical behaviour of cancellous bone is typical of a cellular material.

Following mechanical properties were used in this analysis, for mandible bone, [5]:

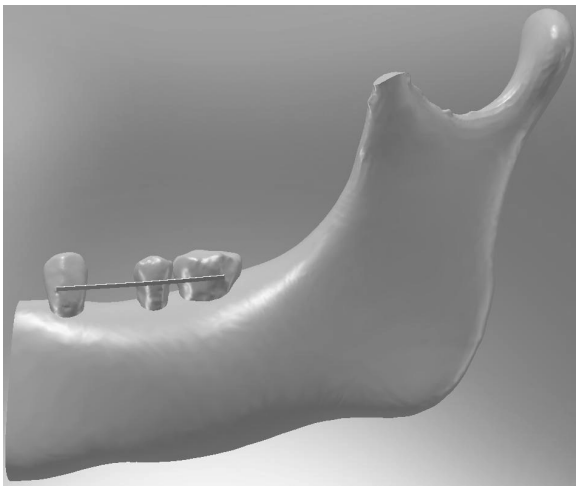


Figure1. The geometric model used for FEM analysis

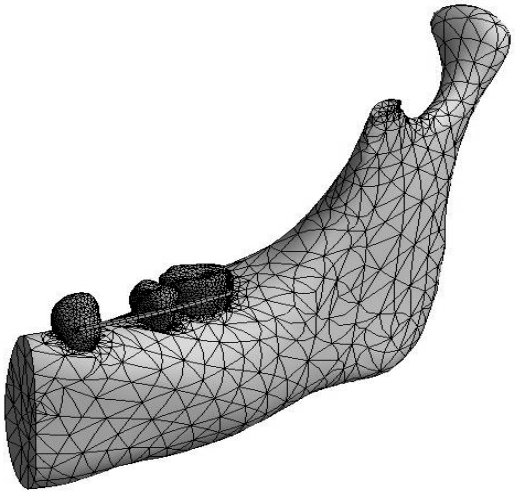


Figure 2. The meshed model used in FEM analysis

- Young's modulus: longitudinal – E_1 = 17000 MPa
  radial – E_2 = 11500 MPa
  transversal – E_3 = 11500 MPa
- Shear modulus: $G_{12} = G_{13} = G_{23}$ = 3300 MPa
- Poisson's ratio: $\nu_{12} = \nu_{13} = \nu_{32}$ = 0.41
- Compressive strength: along - σ_{ys} = 193 MPa
  normal – σ_{ys} = 133 MPa
- Tensile yield strength: along - $\sigma_{ys}^{T} = 148MPa$
  normal - $\sigma_{ys}^{T} = 49MPa$

Since the purpose of the paper is to determine the movement of the teeth and not the deformation of the tooth itself, it assumed that the teeth are dense compact bone and have a rigid behaviour. Also, the steel wire have a Young's modulus, $E = 2 \cdot 10^5$ MPa, and Poisson's ratio, $\nu = 0.3$.

2.3. *The FEM analysis of the tooth movement*

For numerical simulations of tooth movement, the geometrical model was imported in a FEM software package, Ansys v11.

The model was meshed in a 4-node linear tetrahedral elements, C3D4, using 310962 elements with 59090 nodes, fig. 2.

There were analysed two loading cases. In the first loading case, the canine was retracted by a 1.4 N force and the steel wire made a bonded connection between canine, premolar and molar, fig. 3. In the second loading case, the steel wire was removed and was considered that the force which retracts the canine (1.4 N) is supplemented with about 60% on molar (0.8 N) and 40% on premolar (0.56 N), fig. 4.

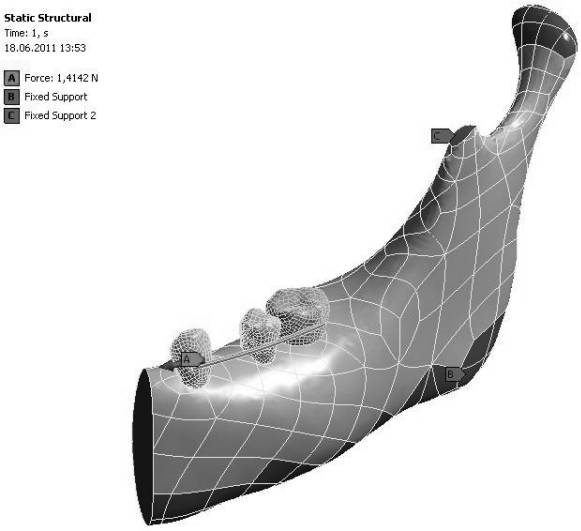


Figure 3. The first loading case of FEM analysis

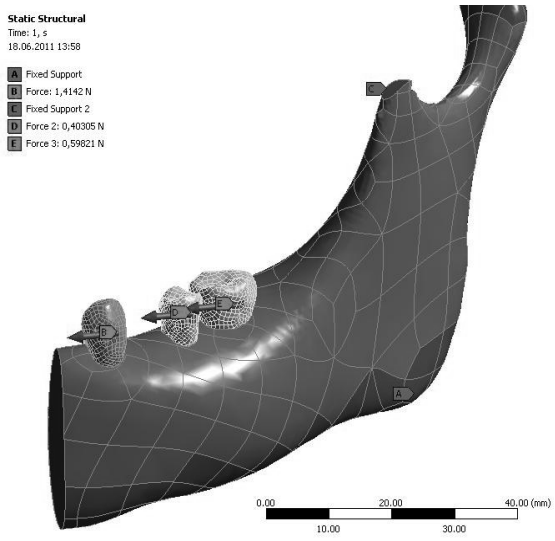


Figure 4. The second loading case of FEM analysis

3. Results and discussions

For both loading cases were analysed the stress and strain states in alveoli teeth, fig. 7-10.

The compressive stress-strain relation of cancellous bone shows three familiar regimes of behaviour. The small, strain, linear-elastic response of low-density, near-isotropic cancellous bone derives from elastic bending of the cell walls (Pugh et al, 1973; Stone, 1983; Gibson, 1985). Axial or membrane stresses may be present too, but the deformations resulting from these are small compared to those from bending. The linear-elastic regime ends when the cells begin to collapse. The rod- or plate-like cell walls in low-density bone have a high slenderness ratio (the ratio of the length of a column to its thickness) and fail by elastic buckling, both in wet and dry conditions. At higher densities the slenderness ratio is lower and buckling is more difficult; then it is found that wet specimens microcrack while dry ones fracture in a brittle manner (Townsend, 1975a; Gibson, 1985). Progressive compressive collapse gives the long, horizontal plateau of the stress-strain relation, fig. 5. Which continues until opposing cell walls meet and touch, causing the stress to rise steeply, fig. 5.

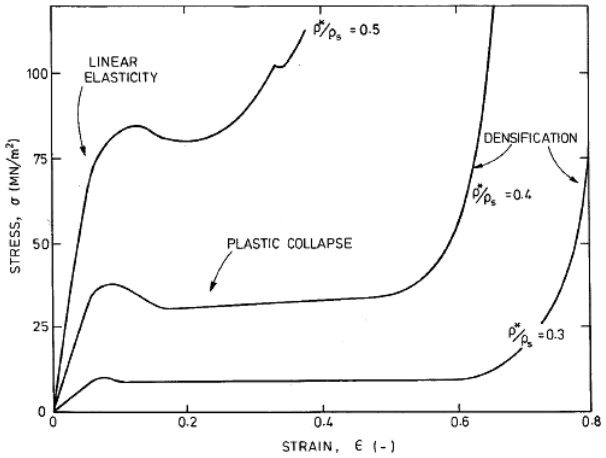


Figure 5. Compresives stress-strain curves for several relative densities of wet cancellous bone (after Hayes and Carter, 1976)

In the tensile stress-strain relation for wet cancellous bone, the initial linear-elastic portion of the curve results from the elastic bending or extension of the trabeculae, as in compression. At strain of about 1 % the stress-strain curve becomes non-linear as the trabeculae start to deform irreversibly and crack. Beyound the peak, the stress-strain curve falls gradually as the trabeculae progressively fail by tearing and fracturing (Carter, 1980), fig. 6.

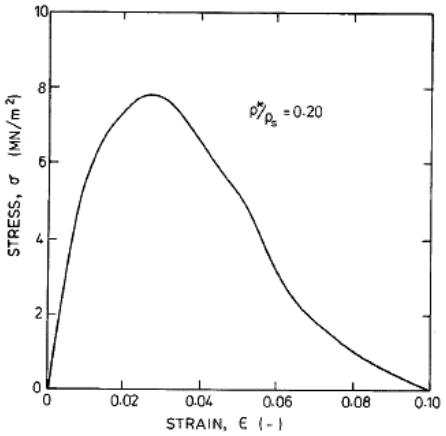


Figure 6. Tensile stress-strain curves for wet cancellous bone (after Carter et al, 1980)

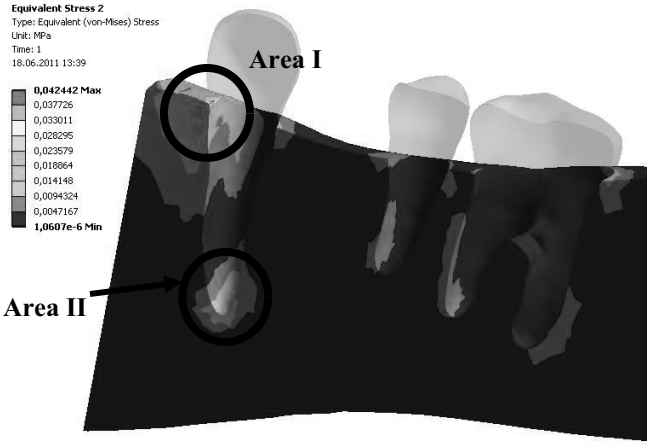


Figure 7. The Equivalent von Mises stress distribution, for loading case I

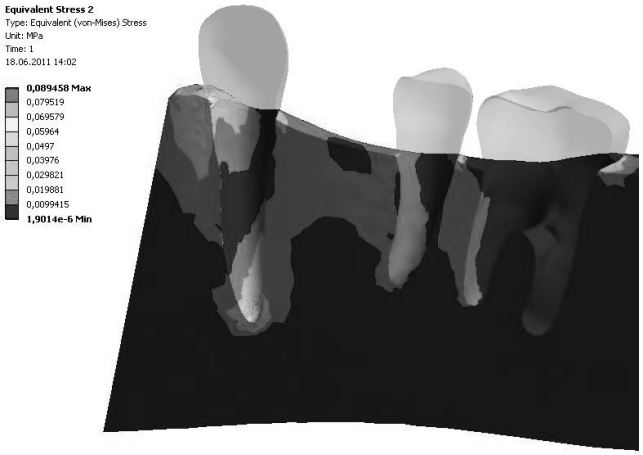


Figure 8. The Equivalent von Mises stress distribution, for loading case II

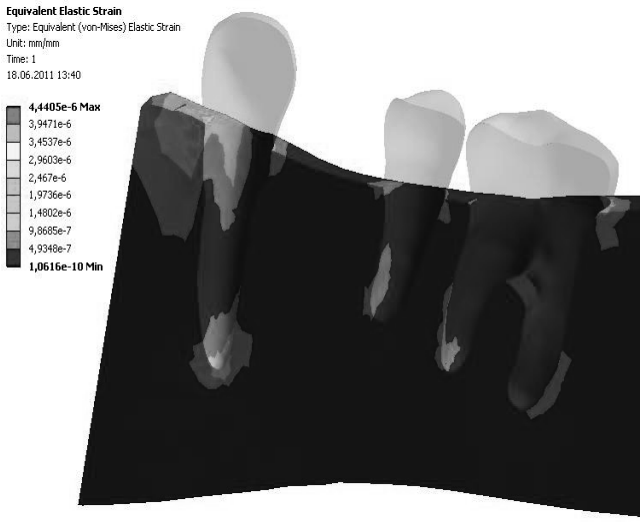


Figure 9. The Equivalent von Mises strain distribution, for loading case I

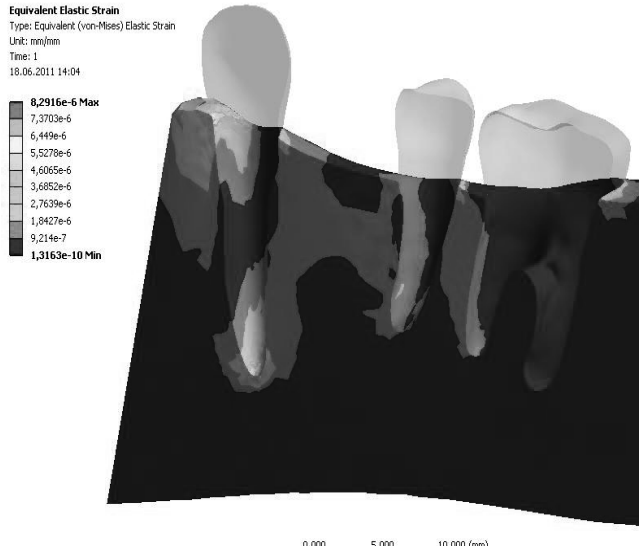


Figure 10. The Equivalent von Mises strain distribution, for loading case II

For both analysed cases the stress and strain states are included in the first regime of compression behaviour (fig. 5) of alveoli bone, fig. 7-10. Which means that the cell walls of the alveoli bone are elastic compressed and is not produced a progressive collapse of the cells.

Surrounding of canine it can be observed two areas with elastic compressed cells of alveoli bone and higher values of stress and strain.

In the case two, where the applied force on canine is supplemented with force applied on molar and premolar, the stress and strain states are about double than case I, but the cells behaviour of the alveoli bone are still in elastic compression.

For further analysis is necessary to evaluate the loading capacity of the surrounding bone of the teeth before its cells have permanent deformations or collapse.

4. Conclusions

Although the simplest assumptions were used in this calculation, actual orthodontic tooth movement could be simulated. The calculated results were reasonable in mechanical considerations.

The magnitude of two loading cases are not produced an absorption of alveolar bone in a region of compressive stress, but the analysis can be helpfull to understand how can be done this process and which are the alveoli areas were can occurs maximum absortion of the bone.

Also, it can observe a tendency of canine tipping (bevelling) when the orthodontic force is applied.

Acknowledgements

This study was supported by CNCSIS - UEFISCSU, project number **PNII-IDEI code 1738/2008** and by the project **PERFORM ERA ID-57649, CONTRACT POSDRU/89/1.5/S/57649.**

References

1. Tanne K, Sakuda M, Burstone CJ. *Three– dimensional finite element analysis for stress in the periodontal tissue by orthodontic forces.* Am J Orthod Dentofacial Orthop 1987;92:499-505;
2. Tanne K, Koenig HA, Burstone CJ. Moment to force ratios and the center of rotation. Am J Orthod Dentofacial Orthop 1988;94:426-31;
3. Bruce SH, William AS, Michael D. *Auxiliary springs in continuous arch treatment: Part 1. An analytical study employing the finite-element method.* Am J Orthod Dentofacial Orthop 1990; 98:387-97.;
4. Raboud DW, Faulkner MF, Lipsett AW, Haberstock DL. *Threedimensional effects in retraction appliance design.* Am J Orthod Dentofacial Orthop 1997;112:378-92;
5. L.J. Gibson, M.F. Ashby. *Cellular solids. Structure and properties. Second edition.* Cambridge University Press, ISBN 052149560, 1997;
6. Hayes W.C., Carter D.R. J. Biomed. Mat. Res., Symposium, 7, 537, 1976;
7. Pugh J.W. et al. J. Biomech, 6, 475, 1973a;
8. Carter D.R., Schwab G.H., Spengler D.M. Acta Orthopaed. Scand., 51, 733, 1980;
9. Gibson L.J. J. Biomech., 18, 317, 1985;
10. Stone J.L., Beaupre G.S., Hayes W.C. J. Biomech., 16, 743, 1983;
11. Townsend P.R., Rose R.M., Radin E.L. J. Biomech., 8, 199, 1875a.

THE NECESSITY OF GENE BANKS IN ORDER TO PROTECT THE BREEDS CREATED ON ROMANIAN TERRITORY

Marcel MATIUTI[*], Carmen-Luminita MATIUTI[**]

[*] *Faculty of Veterinary Medicine, Timisoara, Romania*
matiutimarcel@yahoo.com
[**] *Technical College Azur Timisoara, Romania*

Abstract. It has to be said that by losing the local breeds of animals, the local communities will find it harder and harder to protect their culture and their traditional lifestyle. The extinction of the breeds can have a negative effect upon the environment in numerous underpriviledged areas, for example in the area of the Banat Plain or the mountain area where the number of animals has decreased drastically. The traditional breeds are important for the beauty of the landscape, for keeping under control the vegetation and for the durability of the ecosystems, by preventing the decrease of the biological diversity entailed. On a mountain pasture there is nothing more lovely than seeing some beautiful specimens of taurines such as the Brown of Maramures, Transylvanian Pinzgau, Transylvanian Pustertaler or Romanian Spotted. Some breeds have genetic features which allow them to survive in various production environments, even if subjected to stress such as diseases or draught. The existence of a large number of breeds allows the breeders and the researchers to have a great diversity for gene selection. This diversity is esential for enduring the effects of climate changes, various diseases and for meeting the demands of more and more consumers, especially since there is this opportunity of the animals being raised in an organinc farm, due to the increasing demand for bio products. Without a serious inventory of the zoogenetic resources, the human health and the durability of the products could well be compromised. For these reasen it is necessary founded Gene Bank and Farm Animal DNA Bank, preferably near Timisoara in Banat.

Keywords: biodiversity, zoogenetic resources, gene bank

1. Introduction

It is a general accepted fact that the genetic diversity in the case of farm animals is endangered and that urgent actions are required. The genetic erozion can be diminished thorugh the ex-situ and in-situ methods of conservation organized at a regional, national and even international level [18]. These methods must be conducted through programmes supported by adequate politic son behalf of the authorities in charge.

2. Materials and Methods

Identification of the animal breeds and populations was somehow difficult to do because of various reasons: official documents do not always reflect the reality; there are breeders who cannot say the difference between breed and population, or who do not care about it; some households in the mountain area, where there are still animals from threatened breeds are difficult to reach because of the relief.

Some of the rustic breeds from the Banat of Temeswar or from Transylvania are economically behind other specialised breeds. These rustic breeds are, in exchange, well adapted to the areas and they have genes that endow them with particular disease-resistance.

Here are the rustic breeds from the Banat of Temeswar or from Transylvania:

- cattle breeds and populations – Mountain Cattle Banat ecotype, Risca, Grey Cattle Transylvanian type (can be found only in the Serbian Banat and rarely in the couvarture in the Sub-Carpathians), Romanian Spotted, Transylvanian Pinzgauer, Black Pinzgau, Brown of Maramures, Pustertaler of Transylvania;
- sheep breeds and populations: Transylvanian Merino, Ratka of Banat, Curly Sheep of Banat, Tsigai Banat type, Spanca, Stogosa, and Tsurcana Banat ecotype;
- goat breeds and populations: White of Banat, Carpathian Breed;
- equine breeds and populations: Nonius the Banat type, Draft Horse of Banat, Mountain Horse of Banat:
- pig breeds and populations: Mangalitza, Bazna, Black of Strei, White of Banat;
- poultry breeds and populations: Transylvanian Naked Neck, Banat Goose, Danubian Frisante.

This pilot programme will have to associate itself with other organizations which have been militating for many years for preserving these breeds, organizations such as: the SAVE Foundation from Switzerland, DAGENE or SLE Belgium. In Romania the Transylvanian Rare Breeds

Association was formed in 2009 in order to preserve the traditional breeds and populations as well as some wild animal species. Eng.Dr. Marcel Matiuti is the founder member and the president of this association. In its database, the Association helds a large amount of information, photographs and videos regarding the Romanian breeds and populations, the areas of their habitat, body development dates, production, reproduction and selection information.

DAGENE (Danubian Countries Alliance for Conservation of Genes in Animal Species) is an Association created at the initiative of Prof. Bodo Imre from the University of Veterinary Medicine of Budapest. The purpose of this non-profit Association ist o identify, monitorise and conserve the traditional breeds and populations of domestic animals from the danubian countries. Other eurocaucasian countries joined DAGENE, therefore, today the Association has members from Germany to Gruzia. The Association has as members individual persons as much as profit-based Assocuation from the countries above. The members are: prestigious teachers from Universities and Faculties from France, animal husbandry engineers, veterinarian, agronomist engineers and also chemistry engineers, IT specialists, sylvicultural engineers and technicians. DAGENE is in excellent colaboration with SAVE Foundation (**S**afeguard for **A**gricultural **V**arieties in **E**urope) and Monitoring Institut of London through its large Data Base concerning native breeds and populations of domestic animals and those traditionally raised in these countries. Also, they colaborate for organising sciebtific sessions. DAGENE is included in FAO Programs that have the purpose to protect the doemstic animals breeds and populations. The members of the Associations annualy present yhe situations of the breeds and populations, the ways of preserving the zootechnical Heritage of each country, which from the world's zootechnical Heritage. During 15th-17th of April 2010, with the ocasion of the International Biodiversity Year, DAGENE in colaboration with the Roumanian Academy, organised the Annual Meeting at the Conference Centre in Brazi, ned Raul cu Mori from Hunedoara Area, Roumania. The topic of the Meeting was „Biodiversity is live – Agrobiodiversity is our life". The Meeting is very important for the evolution of DAGENE. During this Meeting, after the participants presented their scientifical studies, preselections for the new leader of DAGENE took place, as Prof. Bodo Imre retired duet o his age. The participants chose as President a high-reputation manager Prof. Dr. Pal Hajas who is the FAO coordinator for Hungary. The new directing Committee has as members: Pal Hajas (Hungary) president; Andras Gaspardy (Hungary) executive secretary; Beate Berger (Austria); Ante Ivancovic (Croatia); Srdjan Stojanovic (Serbia); Marcel Matiuti (Romania). The new diresting Committee has the purpose to develope the activity of DAGENE in other East-European and Central-European countries. Another purpose ist o elaborate scientific ways of implementing guide lines for the presevation of eurocaucasian livestock biodiversity.

3. Results and disscusion

The traditional breeds and populations are seriously affected not only quantitatively but also qualitatively. The lost genetic material is lost forever. This is why we have to identify the animals which are of a traditional breed by phenotypic appreciation and through DNA tests.

Breeders of these animals will have to fill in some questionnaires in order to collect as much information as possible about these animals.

Some farms in which specimens of traditional breeds and populations will be raised are to be organized. From these farms genetic material will be delivered to other breeders who want to raise those types of breeds.

The animals' health will be monitores by specialists, this including taking samples for DNA thorugh the Typi-fix method of Prof. Brem G., from University of Veterinary Medicine Vien, for certain genetically transmitter diseases. In certain areas where those particular breeds had gone extinct a try to repopulate the zone will be made.

If the number of specimens of a breed is too little, thus the extinction being envisioned, genetic material will be brought – alive or cryopreserved - belonging to breeds similar to those raised in Romania (it can be brought from Easter or Central Europe). The genetic material exchange between regions or countries can be a valuable mechanism for the development of the breed stocks. This exchange tends to get higher and higher, considering the development of the biotechnologies and the climate changes [1]. The breeders who want to raise a certain breed of animals are often times deterred from doing so administrative obstacles. This is the reason why the organization of these breeding farms is neessary, as well as the existence of a gene bank which should ensure the breeds wanted by the breeders. It is extremely important for the in-situ preservation of the local breeds to be promoted by applying various strategies. In order to apply them i tis necessary that we elaborate a guiding line which is what this pilot programme wished to be. The existence of genetic diversity leads to the creation of new breeds for the years to come. For example, the future Bovaria cattle breed is a creation of the geneticians from the Wageningen University. There are already companies of animal breeding for different species where specialists create new breeds, adapted to future climate changes, by using the major biotechnological conglomerates and the biological material from the gene banks. For the future certain programmes are already taken into account, which will provide the clone stock, in the way in which genetic modification is being studied in order to obtain Robusta taurines (at the same university). It is also very important that in the near or distant future new diseases will come to surface which will be hard to treat [2].

The quicker this project is implemented , the more it will contribute to the salvation of certain traditional breeds

and populations through its power in decision making. The state authorities are to maintain these measures, checking whether the existent laws are consistent with these ideas.

It is important that the population be moved by the existance of the animal genetic diversity. All these actions will be adequately backed up by practical knowledge and an adequate regulations [4].

The main cause that leads to the decrease of the number of items belonging to the breeds mentioned above is, generally, the wrong opinion that these breeds are overrated economically by breeds modernly perfected and improved. Unfortunately, a negative propaganda in this direction is also made by the so called specialists in the field. The peasants from Transylvania and Banat without any financial support from the state institutions, under the pressure of the negative information regarding giving up the raise of these breeds, keep giving up raising these animals. Another cause is the lack of some associations for raising animals that can be of real help for the people. Some present associations favour only a limited number of members for the purpose of getting European funds. There are cases when in such an association the traditional local breeds have disappeared from the registers and replaced with pure breeds of import and rewritten in the registers as local breeds. These items are also exhibited in fairs and exhibitions of animals as being the creation of those specific people. The evidence regarding the number of animals, their productions or the breed they belong to are very brief, inexact giving the chance for different interpretations [5-7].

Another important problem that leads to the decrease of the traditional breeds from Transylvania is also the wrong interpretation of some state clerks regarding the raising of these breeds. Those who raise these animals are forced to give up the traditional ways of raising these animals and adapt them to very modern technologies resembling the superspecialized breeds [8-10].

Visits to ther countries where these preserving systems are already implemented will be made. This project's impact will be upon the breeders, the animal products processors, the specialists in Agronomy, Animal Husbandry, Veterinary Medicine and upon the students. This type of project will help the rural communities to develop economically and to keep their identity. By raising animals the level of poverty will be reduced in comparison to the level existent nowadays in many regions of Romania. The breeds and populations must be checked, monitored even if this requires a lengthier period of time. The ex-situ preservation in the gene banks is necessary as a last resort.

The farms where traditional breeds and populations will be raised will function according to strict sanitary-veterinarian rules, keeping in mind that the animals come from different areas of the country or even from import.

Figure 1. Transylvanian Pinzgauer. Orig.

Figure 2. Grey cattle.

It has to be said that by losing the local breeds of animals, the local communities will find it harder and harder to protect their culture and their traditional lifestyle. The extinction of the breeds can have a negative effect upon the environment in numerous underpriviledged areas, for example in the area of the Banat Plain or the mountain area where the number of animals has decreased drastically. The traditional breeds are important for the beauty of the landscape, for keeping under control the vegetation and for the durability of the ecosystems, by preventing the decrease of the biological diversity entailed. On a mountain pasture there is nothing more lovely than seeing some beautiful specimens of taurines such as the Brown of Maramures, Transylvanian Pinzgau, Transylvanian Pustertaler or Romanian Spotted [10].

Preliminary economic estimation regarding the working costs of these farms will have to be made. In order to populate the farms a plan will have to be elaborated, which should indicate the regions those animals are taken from, the personnel needed to care care of them, the animals' mobility,

the way in which the products obtained will be capitalized, the permanent sanitary-veterinarian control.

The breeders who want to raise traditional breeds will be offered training courses which will be organized by university specialists through university extension [12], [16].

A good marketing is crucial for a good preservation of the traditional breeds and populations. It is necessary that this marketing be connected at a regional, national and European level to various possible interested institutions [17].

This pilot programme is fully correspondence with the solutions adopte dat the First International FAO Congress which took place in Interlaken (Switzerland) in September 2007.

4. Conclusions

This project's goal is that of identifying the traditional breeds and populations of domestic animals, their habitat, the way they are raised (maintenance, feeding, reproduction), the evaluation of the number of specimens from the point of view of health, the owner's motivation of raising them and the way in which the products obtained are capitalized.

At this moment Romania does not have a gene bank yet (with the exception of some modest stocks of biological material) for these breeds and populations. It is because if this that the biological material for farms that capitalize on raising taurines, swine,hens and even sheep comes from the import. Gene Bank is not a easy project. For these reasen it is necessary founded Gene Bank and Farm Animal DNA Bank, preferably near Timisoara in Banat.

References

[1] Broxham Eli, 2009 ELBARN Guidelines, SAVE Foundation Konstantz

[2] Ivankovic M., 2008 *Analysis of applicability of Acces and Benfit-Sharing (ABS) principales on Animal Genetic Resouces (AnGR)*, Wageningen University

[3] Rouane J., 2006 *The Role of Biotechnology in exploring and protecting agricultural genetic resources*, FAO Roma

[4] Matiuti M., 2010 "*Die eingebohrenen Tierrassen aus Transilvanien (Siebenburgen) und die Klimaveranderungen*" Nova Acta Leopoldina Neue Folge, Band 108. no. 374, 147-148

[5] Matiuti M., Matiu□i Carmen, 2010 "*Native Sheep breeds from Banat*", Annual Meeting DAGENE Hateg, electronic libr.

[6] Matiuti M., Alexandru T. Bogdan, 2010 "*The adaptation of the Fleckvieh cows to the climate and the nutrition in the West of the country*", Simpozion Internațional Fac. Zootehnie şi Biotehnol. Timisoara, vol. 43 (1) , 76-78

[7] Matiuti M., A. T. Bogdan, E. Crainiceanu, Carmen Matiuti, 2010 „*Research regarding the hybrids resulted from the domestic pig and the wild boar"*, Simpozion Internațional Fac. Zootehnie şi Biotehnol.,Timisoara, vol. 43 (1), 188-191

[8] Matiuti M., S. T. Bungescu, 2010 „*Identifying the last Mocanitza cattle of theCarpathians area"*, International Conference on Environment and Biodivesity Belgrade, April, 22-24, Rev. Ecologica

[9] Matiuti M., A. T. Bogdan, 2009 „*Marketing of traditional product in Transylvania"*, Simpozion Internațional Fac. Zootehnie şi Biotehnol. 60 de ani de cercetare ştiințifică în domeniul creşterii animalelor Timisoara mai, vol. 42 (1), 483-488

[10] Matiu□i M., Bogdan A. T., Crainiceanu E., 2009 „*A case study of Transylvanian Pinzgauer in Banat areal"*, Simpozion Internațional Fac. Zootehnie şi Biotehnol. 60 de ani de cercetare ştiințifică în domeniul creşterii animalelor Timişoara mai, vol. 42 (1), 169-174

[11] Matiuti M., Bogdan A. T., 2010 „*The Role od Animal Husbandry Enginner in the selection of Animals for preservation zoo-genetics resources of biodiversity in Banat area*", Intern. Symp. Knowledge, Culture, Science Humboldt Kolleg, nov., Timisoara plenary presentation

[12] Bodó I., 1990 - *The maintenance of Hungarian breeds of farm animals threatened by extinction*. In: Genetic Conservation of Domestic Livestock. Ed. Alderson, L., C.A.B. International (RBTS), 73-84.

[13] Bodó I., Gera I., Koppány, G., 2004 - *The Hungarian grey cattle breed*. Passzer Ltd Kiadó, Budapest

[14] Nagy A., 1999 *Bazna and Red Mangalitza pig breeds as local breeds of Carpathian Hills (Red Mangalitza pig breed*), Monitoring and Conservation Strategies Workshop Monitoring Institut for Rare Breeds and Seeds in Europe Suceava Romania may 26-28, Report pag. 60- 61

[15] Sambraus H., 2001 *Farbatlas Nutztier-rassen*, Eugen Ulmer Gmbh, Stuttgard

[16] Velea C., 1999 *Rare Cattle Breeds in Restained Areas of Romania*, Monitorng and Conservation Strategies Workshop Monitoring Institut for Rare Breeds and Seeds in Europe Suceava Romania may 26-28, Report pag. 49- 51

[17]***, 2007 *Global plan of action for Animal Genetid Resources and the Interlaken Declaration*, FAO Interlaken

[18]***, 2007 - *World Watch List for domestic animal diversity*, FAO Rome

CLINICAL PARTICULARITIES IN PULMONARY THROMBOEMBOLISM

Rodica AVRAM[*], Mihai BALINT[*] Iulian AVRAM[**]

[*] Cardiology Clinic, County Hospital Timisoara, Bd. I. Bulbuca 10, e-mail:rodica_avram@yahoo.com

[**] Surgical Clinic I, County Hospital Timisoara, Bd. I. Bulbuca 10, e-mail: iavram@yahoo.com

Abstract. The aim of this study is to assess pulmonary embolism (PE) incidence and its possible particularities in the Timis region. We've studied the hospitalised casuistic over a three-year period regarding the demographic aspects, clinical particularities and prognostic factors in pulmonary embolism. The incidence of pulmonary embolism is increasing with age (71% of patients were over 50 years old), especially in women (62%), with the predominance of moderate PE (42%). PE is a relatively rare clinical condition reported to general admissions per year (0.76%). Having the 6% incidence of death and 4.4% of total deaths, pulmonary embolism remains a severe disease..

Keywords: pulmonary embolism, deep venous thrombosis, women

1. Introduction

If we have in mind that venous thromboembolism (VTE) incidence is about 117 to 100,000 persons in general population, the significance of this problem is clear [1]. Despite of obvious therapeutical and diagnostic progresses, this incidence was not significantly modified suggesting that it is and remains the worldwide serious clinical condition. The aim of this study is to assess pulmonary thromboembolism (PE) incidence and its possible particularities in the Timis region

2. Methods and results

In our study we evaluated all the cases hospitalised in Cardiology Clinic in the Timis Emergency County Hospital over a three year period. The total number of PE patients was 51 (0.75%). The diagnosis was based on clinical strategies [2] and guidelines. Relying on objective and historical data we found deep venous thrombosis (DVT) and supported our findings by venous Doppler ultrasound examination, D-dimers and troponin laboratory findings and confirmed by computed tomography (CT) scanning and scintigraphy partially. Cardiac function was assessed by echo cardiographic examination.

The classification in clinical forms [3] was made as follows: pulmonary micro-embolism (in the presence of normal blood pressure values), moderate pulmonary embolism (in significant vascular obstructions with right ventricle hemodynamic damage, elevated myocardial enzymes, but normal systemic blood pressure) and massive pulmonary embolism (in patients with cardiogenic shock, persistent systemic hypotension, severe right ventricle dysfunction and severe – more than 50% – pulmonary vascular obstruction). Pulmonary infarctions were characterised by typical clinical aspects and confirmed by data obtained in imaging. A significant percent of cases were proved to be embolic accidents in patients with anterior cor pulmonale [4].

Table 1 **Clinical forms of pulmonary embolism**

Clinical forms	No. of cases	Percent
Pulmonary micro-embolism	19	37.25%
Moderate pulmonary embolism	21	42%
Massive pulmonary embolism	11	21.5%
Pulmonary infarction	10	19.66%
Chronic cor pulmonale	14	27.5%

Regarding patients' age : 4 cases (8%) were persons under 30 years old, 11 patients (21%) were in their 30s to 50s and 36 cases (71%) were persons older than 50. Ten patients had pulmonary infarction (7 women and 3 men), 14 were hospitalised with recurrent thromboembolism in the presence of chronic cor pulmonale (10 women and 4 men).

The gender analysis shows that moderate and massive forms are almost equally divided in men and that moderate embolism followed by micro-embolism is the dominant form in women.

Dyspnoea is the most frequent symptom, followed by anxiety and thoracic pain and by palpitations, hypotension and haemoptysis (in that order).

The risk factors present in our casuistic include deep venous thrombosis, which was present in the majority of patients with massive embolism and in more than a half of patients with a moderate form; chronic venous

insufficiency was confirmed in one half of patients with micro-embolism, in those with massive embolism and in ¾ of those with a moderate form. History of pulmonary embolism and obesity was more frequently present in moderate forms; heart failure was present in particular in micro-embolism.

Women are more frequently obese and have a history of pulmonary embolism, in particular in the age group of over 50.

Scoring the risk factors (deep venous thrombosis, chronic venous insufficiency, obesity, heart failure, surgery) we observed that 4 risk factors were present most frequently in the group of patients with history of pulmonary embolism.

Four patients died, 2 men and 2 women, with the average age of 53 and multiple risk factors; 2 patients with acute cor pulmonale and 2 with embolic in the first 10 days.

Table 2 **Age group and clinical forms**

Young patients < 30 years old – 4 patients A. Micro-embolism – 3 (3 men) B. Moderate TE – 1 (1 woman)
30-50 years old – 11 patients ➢ Micro-embolism – 3 (1 man, 2 women) ➢ Moderate TE – 4 (1 man, 3 women) ➢ Massive TE – 4 (1 man, 3 women) => men 3 (36.35%) and women 8 (63.65%)
>50 years old – 36 patients ➢ Micro-embolism – 13 (36%, 3 men, 10 women) ➢ Moderate TE – 17 (47%, 5 men, 12 women) ➢ Massive TE – 6 (27%, 4 men, 2 women) => men 12 (34%) and women 24 (66%)

Table 3 **Gender and clinical forms of TE**

Men – 19	Micro-embolism – 7 (37%)
	Moderate TE – 6 (31.5%)
	Massive TE – 6 (31.5%)
Women – 32	Micro-embolism – 12 (37.52%)
	Moderate TE – 15 (47%)
	Massive TE – 5 (15.5%)

Table 4 **Clinical presentation**

• Dyspnoea – 45 (88%)
• Anxiety – 30 (58%)
• Thoracic pain – 28 (55%)
• Palpitations – 21 (42%)
• Haemoptysis – 16 (31%)
• Hypotension – 19 (36%)

Table 5 **Risk factors and clinical forms**

Risk factors	MICRO EMBOLISM (n=19)	MODERATE P.E. (n=21)	MASSIVE P.E. (n=11)
Deep venous thrombosis	4 (21.05%)	14 (66.67%)	10 (90.90%)
History of pulmonary embolism	2 (10.52%)	18 (85.71%)	6 (54.54%)
Chronic venous insufficiency	9 (47.36%)	16 (76.19%)	6 (54.54%)
Obesity	9 (47.36%)	17 (80.95%)	5 (45.45%)
Heart failure	14 (73.68%)	12 (57.14%)	5 (45.45%)
Cancer	1 (5.26%)	0	0
Surgery	0	3 (14.28%)	0

Table 6 **Risk factors and gender**

Risk factors	MEN (n=19)	WOMEN (n=32)
Deep venous thrombosis	10 (53%)	18 (56.25%)
History of pulmonary embolism	8 (42%)	18 (56.25%)
Chronic venous insufficiency	12 (63%)	19 (60%)
Obesity	8 (42%)	22 (69%)
Heart failure	10 (53%)	21 (65.62%)
Surgery	0	3 (9%)

Table 7 **Risk factors in patients with history of pulmonary embolism**

Risk factors	5	4	3	2	1
Men – 8		6			2
Women – 18		16	1		1

All data have been recorded in Table 1 – 7 and Figure 1.

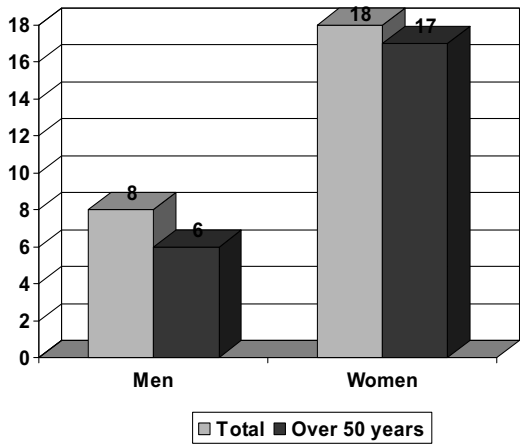


Figure 1. **Gender and history of pulmonary embolism**

3. Discussions

The incidence of pulmonary embolism was 0.76% of all hospitalised patients, which is higher than the incidence in literature – 0.4%. According to the National Hospital Discharge Survey [5], this percent has remained unchanged over the last 21 years, but the incidence of deep venous thrombosis rise from 0.8% to 1.3% More than 2/3 of our cases are patients over 50. Literature noticed an increase of incidence over teh period of 45 years [6] respective an exponential increasing from 5/100,000 persons under 15 to 500/100,000 persons (0.5%) over 80 [7].

In references, there are different data concerning gender as predisposing risk factor: one study performed during 21 years [5] has found no relationship between pulmonary embolism, deep venous thrombosis and gender in hospitalised patients. Other study [6] demonstrated a slightly higher incidence of PE in men, especially in those over 45.

In our study, the incidence of pulmonary embolism was clearly higher in women and it increases with age; moderate clinical forms, followed by micro-embolism were the main clinical manifestations.

Age is a well-known risk factor in women [8], external risk factors can be added: surgery, immobilisation, trauma, pregnancy and postpartum and hormonal therapy [6]. The incidence of PE and deep venous thrombosis in pregnancy is 95,8/100,000 and 1151,8/100,000 respectively [9].

The frequency of PE in women can be connected to obesity, cardiac failure and surgery. Deep venous thrombosis and venous insufficiency are the risk factors for more than a half of the cases in both genders. History of pulmonary embolism was more frequent in women, the fact that was noticed by Monreal also [8]. Hormonal replacement therapy and contraceptive usage could represent particularities for our women taking into account the high usage of these drugs considering long years of abortion interdiction. White noted a higher incidence of pulmonary embolism in winter, but we found a slight increase of incidence during spring, maybe due to climatic changes, warm and unstable spring seasons.

The relapse of pulmonary thromboembolism was present in 85 % of cases with moderate pulmonary embolism and in more than 50 % with massive pulmonary embolism, facts that justify the necessity of anticoagulant treatment. Arnaud [10] found relapses incidence of 8.1% at 3 months and 8.7% at 6 months after the first episode.

The signs and symptoms seemed not to have special particularities, but dyspnoea remains the most frequent symptom.

The prognostic and clinical forms are correlated with the number of risk factors.

The mortality in our study was 7.83% (4 P. in cases of pulmonary embolism) corresponding to 4.4% of all deaths during the studied period and 0.089% of all admissions. The death count is lower than the one that was found in literature (6% of deep venous thrombosis and 12% of pulmonary embolism cases) [7]. However this percent could be higher considering the possible out-hospital deaths.

4. Conclusions

The incidence of pulmonary embolism was 0.76% of all hospitalised patients (0.4% in literature), much more in women, especially those that were older than 50. Deep venous thrombosis and venous pathology are still the major risk factors in both genders. History of pulmonary embolism is present especially in women (70%) over 50 (16 of 32), followed by obesity and surgery. Dyspnoea and chest pain are the most frequent subjective symptoms. The incidence of moderate pulmonary embolism increases with age, especially in women. Having 6% of confirmed incidence of death (12% in literature) and 4.4% of total deaths, pulmonary embolism remains a severe disease.

References

1. John J. Bergan, *The vein book*, Elsevier Academic Press 2007

2. Musset D , Parent F, Meyer G, Maitre S , Girard P, Leroyer C , Revel MP , Carette MF , Laurent M , Charbonnier B , et al. *Diagnostic strategy for patients with suspected pulmonary embolism :a prospective multicenter outcome study.* Lancet 2002 ;360:1914-1920

3. Braunwald's Heart Disease , *A Textbook of Cardiovascular Medicine* Elsevier Sau 2005

4. Shih-Hung Hsiao, MD , Shu-Hsin Yang , MD , Wen-Chin Wang , MD , Chiu-Yen Lee , MD , Shi-Kai Lin , MD , and Chun-Peng Liu , MD. *Usefulness of Regional Myocardial Performance Index to Diagnose Pulmonary Embolism in Patients With Echocardiographic Signs of Pulmonary Hypertension*. Am J Cardiol 2006;98:1652-1655.

5. Stein PD , Beemath A , Olson RE . *Trends in the incidence of pulmonary embolism and deep venous*

thrombosis in hospitalized patients. Am J Cardiol 2005 Jun 15;95(12):1525-6

6. Cushman M . *Epidemiology and risk factors for venous thrombosis* .Semin Hematol. 2007 Apr;44(2):62-9.

7. White RH. *The epidemiology of venous thromboembolism*..Circulation 2003 Jun 17 ;107 (23 Suppl 1):I4-8

8. Monreal M , Barbara R, Tolosa C , Tiberio G , Todoli J , Samperiz AL ; RIETE Investigators. *Deep vein thrombosis and pulmonary embolism : the same disease ?*. Pathophysiol Haemost Thromb. 2006; 35(1-2):133-5.

9. Heit JA, Kobberving CE, James AH, Petterson TM , Bailey KR , Melton LJ. *Trends in the incidence of venous thromboembolism during pregnancy or postpartum :a 30-year population based study*. Ann Intern Med. 2005 Nov15 ; 143(10):697-706.

10. Anand SS. *Comparation of 3 and 6 month oral anticoagulant therapy after a first episode of proximal deep vein thrombosis or pulmonary embolism and comparison of 6 and 12 weeks of therapy after isolated calf deep vein thrombosis*. Pinede L , Ninet J , Duhaut P et al for the investigators of the 'Duree Optimale du Traitement Antivitamines K'(DOTAVK)study . Circulation 2001; 103 2453-60.Vasc Med 2001 Nov;6(4):269-70.

THE CLINICAL VALUE OF NONLINERA DYNAMICS PARAMETERS AS TOOL FOR ECG SIGNAL PROCESSING

Victor Dan MOGA[1], Tudor CIOCARLIE[1], Mariana MOGA[2]
[1]University of Medicine and Pharmacy Victor Babes Timisoara, Romania
[2] IT Department of Emergency County Hospital, Timisoara, Romania

Abstract. Heart failure is world wide cause for increased morbidity and mortality. High sympathetic activity is a potential factor for ventricular arrhythmias. Depressed heart rate variability (HRV) in heart failure is associated with increased mortality. This is thought to be due to reduced parasympathetic activity and heightened sympathetic activity. This study examined 61 patients with heart failure (mean age: 58.6 yrs, M: 42, W: 19), left ventricular ejection fraction (LVEF: 45.7%). The patients are classified in two subgroups related to the relationship LVEF < 45 %, respectively > 45 %. Heart rate variability parameters are measured in both time domain - RR intervals (ms), standard deviation of all RR intervals SDRR (ms) and spectral domain – as very low frequency (VLF, 0.01-0.04 Hz), low frequency (LF, 0.05 -0.15 Hz) and high frequency (HF, 0.15-0.50 Hz), LF/HF ratio, respectively nonlinear dynamics parameters parameters like sample entropy, detrended fluctuation analysis, and Poincare plots. Nonlinear Dynamics parameters have been shown to be a useful tool for diagnosis of patients with cardiac diseases. Dynamic analysis techniques may quantify abnormalities in heart rate variability (HRV) based on nonlinear and fractal analysis (chaos theory). Approximate entropy (ApEn) was applied to quantify the regularity and complexity of time series, as well as unpredictability of fluctuations in time series.

The altered LVEF group is characterized by a lower left ventricular ejection fraction (LVEF: 32.33 % vs. 59.27 %, $p<0.001$), a high sympathetic activity (LF/HF: 1.49) and by altered short-term fractal scaling exponent alpha (1) that is significantly lower in altered LVEF patients (0.67 vs. 0.74; $p < 0.03$) compared with preserved LVEF patients group. In this study LVEF, SDNN (ms), and the LF/HF ratio had been proved to be independent risk factors. The nonlinear dynamics parameters correlates significant with LF/HF ratio (r: 0.45) and with SDNN (r: 0.58). This study suggests that nonlinear analysis technique may complement traditional ECG analysis. The nonlinear dynamic methods could have clinical and prognostic applicability also in short-time ECG series.

Dynamic analysis based on chaos theory point out the multifractal time series in heart failure patients who loss normal fractal characteristics and regularity in HRV, we can conclude that it is necessary to improve ventricular arrhythmia prophylaxis in patients with heart failure and preserved left ventricular left ejection fraction.

Keywords**:** ventricular arrhythmias, dynamic analysis techniques.

1. Introduction

Heart failure is world wide cause for increased morbidity and mortality. High sympathetic activity is a potential factor for ventricular arrhythmias. In patients with cardiovascular disease, inexpensive noninvasive risk stratification remains despite the improvement of methods important [10]. Heart failure is a major and escalating public health care problem, with a prevalence in Europe of 14 million concerend people of all Europeans [10].

Rhythmic changes of blood pressure, heart rate, and other cardiovascular measures have drawn the attention of several investigators, since these oscillations can shed light onto the activity of the underlying control network [8]. In the human body both the autonomic nervous system and the humoral system have direct effect on heart rate coordination [1, 2].

Human cardiac dynamics are driving by the complex nonlinear interactions of two competing forces: sympathetic stimulation increases heart rate, whereas parasympathetic stimulation decreases it [2].

Cardiovascular function is regulated by the autonomic nervous system (ANS). ANS is a neural network that operates at the subconcious level and regulates the visceral functions of the body. The main aim of autonomic cardiovascular regulation is to control cardiac output and the distribution of blood at the central and peripheral levels. Heart rate (HR) and the contractile properties of the myocardium, which contribute to cardiac output, are modulated by the main components of ANS: the parasympathetic and sympathetic nervous systems. The activity of these two ANS branches with opposite effects on HR causes continuous fluctuations in HR, which is called heart rate variability [4, 5].

Heart rate variability (HRV) has become a universal tool to study the neural control of the heart i.e. the delicate interaction between sympathetic and vagal influences on heart rate in health and disease. HRV can be quantified by the simple calculation of the mean and standard deviation of RR-intervals in the time domain. Furthermore, in the frequency domain, spectral analysis of HRV reveals two distinct frequency regions in the modulation of heart rate in humans. A high frequency region (0.16-0.4 Hz) which is a marker of vagal modulation, and a low frequency region (0.04-0.15 Hz), which reflects predominantly sympathetic tone and baroreflex activity [4]. A variety of linear, non-linear, periodical and nonperiodical oscillation patterns are present in heart rate fluctuations [1].

Therefore, heart rate variability (HRV) is a powerful prognostic predictor of arrhythmias in heart diseases like heart failure, myocardial infarction.

Recent studies have shown that the new nonlinear measures, particularly fractal analysis methods of heart rate dynamics, can detect subtle changes in heart rate behavior. Only a few studies have applied new parameters based on nonlinear dynamics theory to HRV analysis in heart failure patients[3, 9].

Application of new signal processing techniques based on nonlinear dynamics provides supplementary information (i.e. hidden underlying mechanisms) about systems involved in cardiovascular function and pathology. The visual analysis of variability by the Poincaré plot and quantification of the unpredictability and complexity of the heart rate using sample entropy are increasingly used because they can be computed from shorter HRV records that are used in community screening [3].

The novel technique of detrended fluctuation analysis (DFA) has been successfully developed to study nonstationary signals [9]. DFA is a modified root-mean-square analysis of a random walk [1, 2, 3, 5]. In recent years, the DFA method has become popular, and has been widely used to detect long-range or long-term (almost 24hr ECG recordings) correlation in nonstationary time series at various fields, such as the autonomic nervous system, ventricular fibrillation, congestive heart failure, dilated cardiomyopathy [7]. Detrended fluctuation analysis (DFA) has been introduced to evaluate the fractal correlation properties of R-R interval dynamics and to characterize the features of HR dynamics that may not be easily detectable by traditional methods of analysis. Breakdown of fractal organization into beat-to-beat R-R interval dynamics indicates increased cardiac vulnerability and a higher risk of mortality in patients with and without structural heart disease [5].

The purpose of this study is to assess the physiological basis of methods evaluating beat-to-beat R-R interval dynamics and to assess new methods in the evaluation of ventricular arrhythmia and sudden cardiac death in congestive heart failure patients [6]. Finding and analyzing hidden dynamical structures of these signals are of basic and clinical interest [3].

2. Methods

The main aim of our study was to compare the autonomic tone behavior of patients with heart failure and to establish the significance of parameters like heart rate variability and nonlinear system theory parameters, in relation with clinical parameters like left ventricular ejection fraction (LVEF %), ventricular arrhythmias, heart rate, and to identify them as prognostic factors. In this study, we analysed 61 ECG recordings from 24 hour ECG Holter monitoring (Labtech ECG Holter) of patients with heart failure admitted between 2008 and 2010 to the Cardiology Clinic of the Emergency County Hospital Timisoara, Romania. The study group (N: 61) consist of patients with heart failure and history of ischaemic heart disease (mean age: 61.3 yrs, M: 42, W: 19). All 61 patients included in the study underwent noninvasive evaluation comprising a physical examination, 12-lead ECG, chest radiography, M-mode and B-mode echocardiography, and 24-h Holter ECG. All patients were in sinus rhythm, and following the left ventricular ejection fraction (LVEF) below 45 % and above 45 % we subdivided the study group in altered LVEF (< 45 %) and preserved LVEF (> 45 %) subgroups. A control group (N: 15, M: 8, W: 7. mean age: 47.6 yrs) was also used. The characteristics of the study population is presented in table 1.

Tabel 1 Characteristics of the study population

Parameters	LVEF > 45 %	LVEF < 45 %	Arrhythmia	Control
No patients	27	29	29	15
Male/Female	15 / 12	22 / 7	22 /7	8 \ 7
Age (yrs)	58.7	63.8	64.8	44.7
LVEF (%)	54.4	37.9	44.3	71.3
NYHA III-IV	12	23	24	0
NSVT	14	16	29	0

All ECG signals were processed using Nevrokard Long-Term aHRV (LT-aHRV v 5.0.0) and Kubios HRV 2.0 software.

The mean of all RR intervals (NN), standard deviation of all normal–normal RR intervals (SDNN), the nonlinear dynamics parameters, as detrended fluctuation analysis short-term $\alpha 1$ (DFA α_1), Poincaré plot analysis, and sample entropy analysis was performed for all ECG signals. From the Poincaré plot analysis, using Kubios HRV 2.0 software, we obtained automatically the values of the short-term scaling exponent ($\alpha 1$).

Spectral power was quantified by fast-Fourier transformation analysis (FFT 256 points, Welch) and by autoregressive method, model 20 in 2 frequency bands: low frequency (0.05 – 0.15 Hz) and high frequency (0.15 – 0.4 Hz). We quantified several time domain HRV parameters: mean HR, standard deviation of normal HR data (SDNN) . and the spectral analysis was performed on linearly resampled (1 Hz) time series using Welch's method. The 256-point fast Fourier transform was repeatedly computed with 50% overlap between adjacent segments. [6]. Low-to-high frequency ratio was considered as marker of the autonomic tone.

Parametric autoregressive modeling and nonparametric fast Fourier transform are the most frequently used frequency domain methods generating R-R interval power spectra [4, 7].

3. Poincaré plot analysis

The Poincaré plot is a popular two-dimensional visualization tool for dynamic systems due to its intuitive

display of the dynamic properties of a system from a time series.

The length (SD2) and the width (SD1) of the Poincaré plot images represent short and long-term variability of any nonlinear dynamic system. A strong correlation was found when comparing high frequency power of heart rate signals (modulated by parasympathetic nervous system) to SD1 [3, 8]. SD2 was found to be well correlated with both low and high frequency power (modulated by both the parasympathetic and sympathetic nervous system) [3, 8]. The Poincaré plot was generated as a scatter plot of current instantaneous heart rate (HR) against the HR immediately preceding it.

4. Fractal analysis of R-R interval dynamics

The detrended fluctuation analysis (DFA) method aims to define rather the quality of beat-to-beat R-R interval dynamics than the quantity of HRV. In the DFA method, the root-mean-square fluctuations of integrated and detrended data are measured in observation windows of different sizes and then plotted against the size of the window on a log-log scale. The scaling exponent represents the slope of this line, which relates (log)fluctuation to (log)window size [5].

5. Sample entropy analysis

Sample entropy (SampEn) values of RR signals from all subjects were calculated. SampEn is a measure quantifying the regularity or complexity of time series (26). Lower values of SampEn indicate a more regular (less complex) signal; higher values indicate more irregularity (greater complexity).

The statistical analysis was performed using t test and R, correlations functions, Pearson, using commercial availabel GraphPadPrism 5 software.

6. Results

All analysed parameters showed altered values in the heart failure patients group compared with the same parameters in the control group.

The mean age of the patients subgroup with altered LVEF (A) was significant lower compared with the mean age of patients subgroup with preserved LVEF (B), 58.7 vs 63.8 yrs, $p<0.05$. The patients subgroup with altered LVEF is characterized by a higher NYHA functional classes (NYHA III-IV, n: 23) compared to the patients subgroup with preserved LVEF (NYHA III-IV, n: 12). The LVEF was signifcant lower in subgroup A compared to subgroup B (54 % vs 38 %, $p<0.001$). The subgroup A has a higher incidence of ventricular arrhythmias compared to the subgroup B.

The patients subgroup with altered LVEF has a lower heart rate compared to the patients subgroup with preserved LVEF (77 b/min vs 87 b/min), probably as a response to β-blockade, but significant higher compared to the control group.

The SDNN (ms) was signifcantly lower in the subgroup with altered LVEF when compared to the preserved LVEF group and to control (118 ms vs 141ms vs 167 ms, $p < 0.001$). A high sympathetic tone is noticed in the heart failure group compared to control, expressed as heart rate or LF/HF ratio (tabel 2). Patients with altered LVEF have a high sympathetic tone characterized by a higher heart rate, high LF/HF ratio and depressed high frequency power spectrum density (figure 1). This is correlate with a higher incidence of ventricular arhythmias.

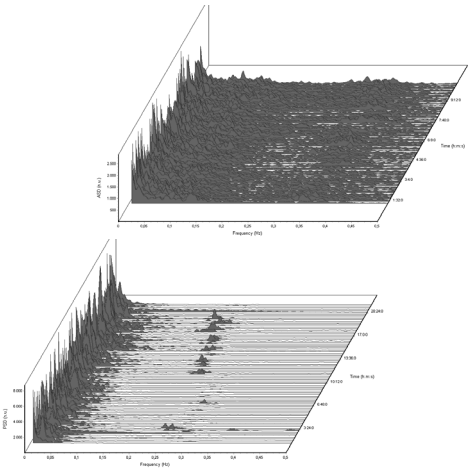


Figure 1 Power spectral analysis in control group (a) and in the heart failure group (b)

The values of the nonlinear dynamic parameters, like DFA α_1 and the Poincaré plots showed altered values compared to control group (figure 2). DFA α_1 was significant lower in the subgroup A compared to the entire heart failure group or to the control group (0.63 vs 0.97, $p < 0.001$).

The nonlinear dynamic parameters are represented in figure 1, in which we compared a control group record to a heart failure record.

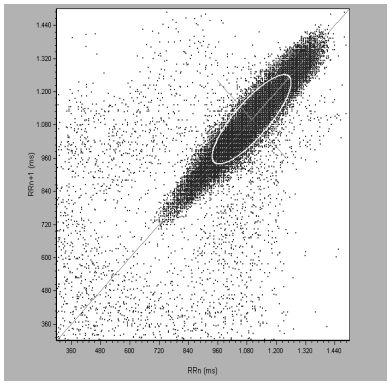
Analysing the heart failure group, from the perspective of the presence or absence of acute coronary syndrome, we noticed that the most vulnerable patients group is characterized by high heart rate, high LF/HF ratio and low DFA α_1 , independedntl from the values of left ventricular ejection fraction.

7. Discussion

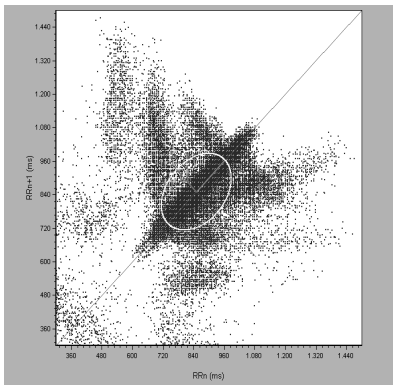
Heart failure remains nowadays one of the most important clinical condition. This observation is sustained by the high number of patients with heart failure world wide. Despite numerous studies, the mortality in heart failure remaines high. The incidence of ventricular arrhythmias, mainly ventricular tachycardia or ventricular fibrillation represents the most important conditions for sudden cardiac death. Comparing to control group or to patients wihout heart failure, our study group was characterized by a high

Tabel 2. HRV and Nonlinear dynamic parameters in heart failure group

	LVEF < 45 %	LVEF > 45 %	Heart Failure	Control Group
N	29	27	56	15
SDNN (ms)	118	141	128,9	167
Heart rate (b/min)	77	87	83.5	72,9
LVEF (%)	37.9	54.4	45.7	71.3
LF/HF	1.74	1.59	1.67	0,85
DFA α1	0,63	0.71	0.68	0,97
DFA α2	0,79	0.87	0.78	0,98
ApEN	0,97	1	0,96	1,21
SamEn	0,87	0,95	0,87	1,15



a.

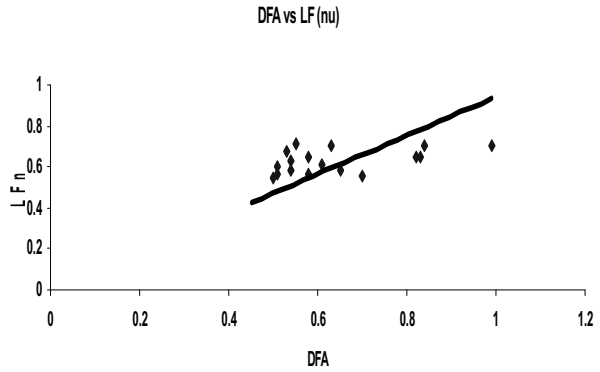


b.

Figure 2 Nonlinear Dynamic Analysis in control group (a) and heart failure group (b)

sympathetic tone, expressed by a high heart rate, high LF/HF ratio and altered nonlinear dynamic parameters. The main aim of our study was to find correlation between nonlinear dynamic parameters and other clinical or autonomic tone parameter in patients with ischaemic heart failure, with or without history of severe ventricular arrhythmias, independently to the left ventricular ejection fraction.

In the study SDNN (ms) correlates with the left ventricular ejection fraction (r: 0.53) and with the high frequency power spectral density parameter (r: 0.67). A good correlation (figure 3) was observed between DFA α_1 and the both power spectral density parameters, LF (n.u) and HF (n.u.).



r: 0.47

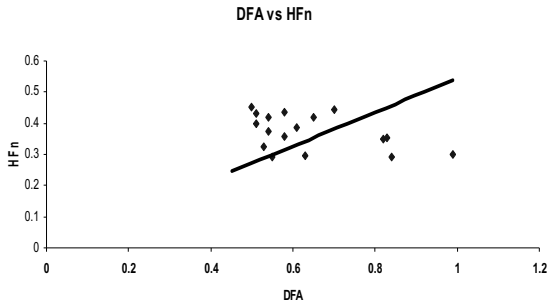


Figure 3. Correlation of Nonlinear Dynamic Parameters

We noticed an important association between variability and complexity organization of heart beat fluctuations may be specific for the process of autonomic imbalance in heart failure and suggests that there are alterations in the cardiac control mechanism associated with ischaemic heart failure.

References

[1] AE Aubert, F Beckers, B Seps - *Non-linear Dynamics of Heart Rate Variability in Athletes: Effect of Training – Computers.* in Cardiology 2002;29:441−444

[2] RONG-GUAN YEH et all, - *Detrended Fluctuation Analyses Of Shortterm Heart Rate Variability* In Surgical Intensive Care Units - Biomedical Engineeringapplications, Basis & Communications - Vol. 18 No. 2 April 2006

[3] Ahsan H Khandoker et all - *Identifying diabetic patients with cardiac autonomic neuropathy by heart rate complexity analysis* - BioMedical Engineering On Line 2009, **8**:3

[4] Akselrod S, Gordon D, Ubel FA, Shannon DC,Berger AC, Cohen RJ: *Power spectral analysis of heart rate fluctuation: a quantitative probe of beat to beat cardiovascular control*. Science 1981; 213:220-222.

[5] Kiviniemi, Antti - *Measurement of cardiac vagal outflow by beat-to-beat R-R interval Dynamics* - Acta Univ. Oul. D 887, 2006 Oulu, Finland

[6] Victor Dan Moga, Mariana Moga - *Analysis of Heart Rate Dynamics in Congestive Heart Failure. Continuous Wavelet Spectrum vs. Heart Rate Variability*. The 33th Electrocardiology Congress, Köln, Germany 2006

[7] Sirkku M. Pikkujamsa, Timo H. Makikallio, K. E. Juhani Airaksinen, Heikki V. Huikuri - *Determinants and interindividual variation of R-R interval dynamics in healthy middle-aged subjects* - Am J Physiol Heart Circ Physiol 280: H1400–H1406, 2001.

[8] Claus D. Wagner, Pontus B. Persson - *Chaos in the cardiovascular system: an update* - Cardiovascular Research 40 (1998) 257–264

[9] Darrel P. Francis et all. - *Physiological basis of fractal complexity properties of heart rate variability in man* - Journal of Physiology (2002), 542.2, pp. 619–629

[10] Andreas Voss et all - *Risk Stratification in Ischemic Heart Failure Patients with Linear and Nonlinear Methods of Heart Rate Variability Analysis* – 4th European Conference of the International Federation for Medical and Biological Engineering 2009, Volume 22, Part 1, 1-4, DOI: 10.1007/978-3-540-89208-3_1

PROGNOSTIC IMPROVEMENT WITH ANTIDEPRESSIVE THERAPY IN PATIENTS WITH MYOCARDIAL INFARCTION

Mariana TUDORAN, Cristina TUDORAN, Cătălina GIURGI
Clinic of Cardiology, Emergency County Hospital,
Timişoara, Romania

Abstract. Depression is recognised as a risk factor for coronary artery disease. Significant depressive simptoms are found in 40-65 percents of patients with myocardial infarction. Depression is often chronic and exacerbates cardiac symptoms. It increases the frequency of angina, morbidity and mortality (through sudden cardiac death). The therapy with serotonin reuptake inhibitor antidepressants improuves depression and has favourable effects on the severity of cardiovascular symptoms, on morbidity and mortality.

Keywords: antidepressive, myocardial, infarction, cardiac
¶

1. Pathophysiological background

Coronary artery disease and depression are in close relation and several pathophysiological mechanisms are proposed: 1. Depression induces hyperactivity of the hypothalamic-pituitary-adrenocortical axis with hypercortisolemia. Corticosteroids have atherogenic effects, including the worsening of hypertension and the elevation of cholesterol and probabely influence arterial endothelial function. Depressed patients show hypersecretion of norepinephrine. Increased plasma catecholamines stimulate heart rate, rise blood pressure and myocardial oxygen consumption and are proarrhythmic. The incidence of ventricular tachyarrhythmias is increased in depressed patients with coronary artery disease (responsable for the excess cardiac mortality); 2. This patients have diminished heart rate variability, resulting from a relative increase of sympathetic tone and/or a relative decrease of parasympathetic tone, which increases the risk of fatal arrhythmias. 3. Depression may be accompanied by changes in platelet aggregability. Serotonin secretion plays a major role in depression and is also known to influence thrombogenesis and enhance platelet activation and responsiveness to other thrombogenic agents.

2. Matherial and methods

The study group consisted from 50 patients admitted in the clinic of cardiology between June-December 2009 with MI and depression. They were assessed for depressive symptoms according to Beck Depression Inventory-BDI (a self-report instrument consisting of 21 questions, total score ranging from 0 to 63) recorded in hospital and at 3, 6, 9, and 12 months post-MI. Patients with BDI score ≥ 10 were assessed for the presence of depressive disorder according to International Classification of Diseases, 10th revision (ICD-10). All patients had an echocardiographic examination with determination of left ventricular ejection fraction (LVEF) and performed a stress test in the first month after infarction and, at 3 and 6 months. 30 patients had Holter monitoring at the same intervals.

Patients were divided into 4 categories according to their LVEF during hospitalization, i.e. LVEF <30%, LVEF 30–45%, LVEF 45–60%, and LVEF ≥60%. During hospitalization, presence of depressive symptoms was higher in patients with LV dysfunction.

Regarding antidepressive therapy the patients were divided in 2 groups: the first group received antidepressant therapy, but those from the second refused it or had a very low compliance. Frequency and severity of angina attacks, complications, morbidity and hospitalization rate were noted. The first includes 31 patients with MI and depression (7 with mild depression, 13 with moderate and 11 with severe form), 26 men and 5 women, aged between 43 and 74 years (mean age 58,4 ± 8,2 years). All patients received conventional therapy for myocardial infarction (beta-blockers, aspirin, statins and nitrates) associated with antidepressant therapy (23 with sertraline and 9 with thianeptine). 11 Patients abandoned this therapy after different time intervals (3 and 6 months) and were added to the next group. The second group includes 19 patients MI and depression (3 with mild form, 8 with moderate and 8 with severe depression), 16 men and 3 women, aged between 51 and 72 years (mean age 61,2 ± 9,2 years). All patients received conventional therapy for myocardial infarction but they refused antidepressant therapy.

The results concerning left ventricular performance (LVEF), tolerance to effort and Holter monitoring and quality of life questionaires obtained in the two groups of patients, in the first month after infarction and at 3 and 6 month are presented in the folowing tabels. The patients treated with antidepressants had better results as those who

refused this medication or those who abandoned therapy. The first group had less angina and the duration of the attaks was reduced. The incidence of arrhythmias was smaller and their severity was reduced. Morbidity and quality of life was better as in the second group. A relationship was found between LVEF and ICD-10 depressive disorder, i.e. a lower LVEF was associated with a higher rate of depression from 3–12 months post-MI. Levels of LVEF inversely correlated with the BDI score at 3 months post-MI, see table 1.reduction measures and rehabilitation. Those patients smoke and drink more and are more likely to drop out exercise programs.

The patients with depression had more anginas during stress test and terminate the test sooner. On the Holter monitoring they had a higher incidence of arrhythmias and a poorer quality of life following myocardial infarction. Depression affects compliance with medication and risk The patients with MI, treated for depression, had a better tolerance to stress test, reflected through a longer duration of stress, a higher double product, lesser ischemic changes and fewer arrhythmias comparative with those that refused antidepressant therapy or abandoned it after some months.

The patients with MI treated for depression had a lesser incidence of arrhythmias, expressed especially through isolated ventricular beats, there were few malignant ventricular arrhythmias and the severity of those was reduced after 6 months of therapy. The incidence of ischemic changes was reduced comparative with those found by patients that refused antidepressant therapy or abandoned it after some months. In the last group the incidence and severity of arrhythmias was higher.

There was evidence of premature ventricular beats class Lown III and IV and also ventricular tachycardia. In some patients conduction disturbances (synusal pauses or episodes of atrio-ventricular blocks) were found, see table 3.

The patients from the treated group reported fewer episodes of angina pain, of palpitations and anxiety comparative with the other group according to table 4.

Table 1. Results of BDI-10 and LVEF determined in patients with MI and depression (mean values)

	Mild depression	Moderate depression	Severe depression
	BDI – 10 P	BDI – 21 P	BDI – 19 P
LVEF ≥60%	3	10	6
LVEF 45–60%	3	5	5
LVEF 30–45%	2	5	4
LVEF <30%	2	1	4

Table 2. Results of stress tests in the groups of patients (mean values):

	first month after MI		3 months after MI		6 months after MI	
	31 P treated	19 P untreated	27 P treated	23 P untreated	20 P treated	30 P untreated
Duration of stress	10 ± 2 min	10 ± 2 min	12 ± 2 min	10 ± 2 min	16 ± 2 min	12 ± 2 min
Double product	225 ± 60	210 ± 40	260 ± 50	220 ± 40	285 ± 40	250 ± 50
Maximal SBP	180 ± 30 mmHg	190 ± 20 mmHg	190 ± 30 mmHg	185 ± 20 mmHg	195 ± 30 mmHg	185 ± 30 mmHg
Maximal Frequency	160 + 30 b / min	164 + 40 b / min	160 + 30 b / min	160 + 30 b / min	160 + 30 b / min	160 + 30 B / min
Ischemic changes	28 P	18 P	23 P	20 P	11 P	22 P
Presence of arrhythmias	11 P	12 P	6 P	16 P	2 P	16 P

Table 3, Results of Holter monitoring in the groups of patients (mean values)

	1 month after MI		3 months after MI		6 months after MI	
	17 P, treated	13 P, untreated	16 P, treated	14 P, untreated	15 P, treated	15 P untreated
Ischemic changes	17 P	13 P	12 P	12 P	9 P	12 P
Presence of Arrhythmias	15 P	12 P	6 P	9 P	4 P	10 P

Table 4.: Results of quality of life questionnaires the two groups of patients (mean values)

	first month after MI		*3 months after MI*		*6 months after MI*	
	31 P treated	*19 P untreated*	*27 P treated*	*23 P untreated*	*20 P treated*	*30 P untreated*
Reduced mobility	*15*	*11*	*11*	*12*	*6*	*13*
Self care problems	*9*	*6*	*4*	*5*	*1*	*8*
Anxiety attacks	*15*	*12*	*12*	*15*	*6*	*18*
Frequency of angina	*5 ± 2 crises/ day*	*4 ± 1 crises/day*	*3 ± 1 crises/day*	*5 ± 2 crises/day*	*2 ± 2 crises/da y*	*4 ± 2 crises/day*
Duration Of angina	*2 ± 0.2 min*	*2 ± 0.5 min*	*1± 0.2 min*	*2 ± 0.2 min*	*0.5 ± 0.2 min*	*1.5 ± 0.6 min*
Presence of Palpitation	*11 P*	*12 P*	*6 P*	*16 P*	*2 P*	*16 P*

3. Conclusions

1. Depression is a negative prognostic indicator for patients with chronic myocardial infarction. It is associated with increased morbidity, mortality and impaired quality of life.

2. In MI patients, the rate of depression and the severity of depressive symptoms are significantly related to the severity of LV dysfunction. The association between depression and LV dysfunction must be acknowledged when evaluating the prognostic effects of depression in cardiac patients.

3. Patients with MI and depression have more anginas during stress test and on Holter monitoring there is evidence of more arrhythmias.

4. Depressed patients with MI have a poorer adherence to the medical regimen, to the exercise program and to risk reduction measures.

5. Administration of antidepressant agents to patients with MI and depression should be considered as an additional therapy with the purpose to improve the quality of life, to increase adherence to the medical regimen, rehabilitation and risk reduction measures.

6.This therapy seems to reduce the frequency of angina, disability and mortality (due to sudden cardiac arrest).

References

[1]. Amanda Nicholson, Hannah Kuper and Harry Hemingway Depression as an aetiologic and prognostic factor in coronary heart disease: a meta-analysis of 6362 events among 146 538 participants in 54 observational studies Eur. Heart J 2006 2 nov 27(23):2763-2774;

[2]. De Jonge P, Ormel J, van den Brink RHS, van Melle JP, Spijkerman TA, Kuijper A, van Veldhuisen DJ, van den Berg MP, Honig A, Crijns HJGM, Schene AH. Symptom dimensions of depression following myocardial infarction and their relationship with somatic health status and cardiovascular prognosis. Am J Psychiatry (2006) 163:138–144.

[3]. De Jonge Peter, Joost van Melle Meta-analysis urges the development of new strategies to treat depression in order to improve cardiac prognosis: European Heart Journal Advance, 2007 5 may 21: 1851-1857.

[4]. Lane D, Carroll D, Lip GY. Anxiety, depression, and prognosis after myocardial infarction: is there a causal association? *J Am Coll Cardiol* 2003;**42**:1808–1810

[5]. Nicholson A, Kuper H, Hemingway H. Depression as an aetiologic and prognostic factor in coronary heart disease: a meta-analysis of 6362 events among 146538 participants in 54 observational studies. Eur Heart J (2006) 27:2763–2774.

[6]. Timmer JR, Ottervanger JP, Thomas K, Hoorntje JC, de Boer MJ, Suryapranata H, Zijlstra F; Zwolle Myocardial Infarction Study Group. Long-term, cause-specific mortality after myocardial infarction in diabetes. *Eur Heart J* 2004;25:926–931.

[7]. Van Melle JP, de Jonge P, Spijkerman TA, Tijssen JG, Ormel J, van Veldhuisen DJ, van den Brink RH, van den Berg MP. Prognostic association of depression following myocardial infarction with mortality and cardiovascular events: a meta-analysis. Psychosom Med (2004) 66:814–822.

[8]. Van Melle JP, de Jonge P, Ormel J, Crijns HJ, van Veldhuisen DJ, Honig A, Schene AH, van den Berg MP. Relationship between left ventricular dysfunction and depression following myocardial infarction: data from the MIND-IT. Eur Heart J (2005) 26:2650–2656.

ENGINEERING, APPLIED MATHEMATICS, COMPUTER SCIENCE

INGINERIE, MATEMATICĂ APLICATĂ, INFORMATICĂ

ANALOGY BETWEEN THE WING SHAPES OF GLIDING BIRDS AND OF GLOBAL OPTIMIZED FLYING CONFIGURATIONS

Adriana NASTASE
Aerodynamik des Fluges, RWTH-Aachen, GERMANY
E-Mail: nastase@lafaero.rwth-aachen.de

Abstract *The global optimized wings look, in transversal sections, like the wings of gliding birds, namely have a convex form at their frontal part and have a wave form at their rear part. Their optimal span decreases and their optimal depth, camber and twist increase, when the wings are global optimized, at higher cruising Mach number. The nature optimizes too.*

1. Introduction

The performing of aerodynamical, global optimization (GO) of the shape of a flying configuration (FC), with respect to minimum drag, at a given cruising Mach num-ber, leads to an enlarged variational problem with free boundaries. The author has developed an optimum-optimorum (OO) theory, as in [1], which enables the de-termination of the GO of the shape of FC, inside of a class of FCs, defined by some chosen common properties. Two FCs belong to the same class, if their surfaces are piece-wise expressed in form of superpositions of homoge-neous polynomes (in two variables) with the same maxi-mal degree, their planforms are polygones, which can be related through affine transformations and they satisfy the same constraints. The parameters of optimization are the free coefficients of the polynomes and also the si-milarity parameters of their planforms. The area of the planforms of the FCs, belonging to the class, is supposed to be the same. A lower-limit hypersurface of the drag functional $C_d^{(i)}$, as function of the similarity parameters ν_i, is defined, namely,

$$(C_d^{(i)})_{opt} = f(\nu_1, \nu_2, ..., \nu_n) \quad . \tag{1}$$

Each point of this hypersurface is obtained by solving a classical variational problem with given boundaries (i.e. a given set of similarity parameters). The position of the minimum of this hypersurface, which is numerically de-termined, gives us the best set of the similarity parameters and the FC's optimal shape, which corresponds to this set, is at the same time the global optimized FC's shape of the class.

2. The Aerodynamical, Global Optimization of the Shape of a Flying Configuration

This OO theory was used firstly for the determination of the inviscid GO shape of delta wing alone model Adela,
which is presented in the (Fig. 1). The camber, twist and thickness distributions and also the similarity parameter ν of the planform of this model were simultaneously optimized in order to have minimum inviscid drag at cruising Mach number $M_\infty = 2$. The optimization is performed dimensionless and dimensionless coordinates are used:

$$\tilde{x}_1 = \frac{x_1}{h_1} \;,\; \tilde{x}_2 = \frac{x_2}{\ell_1} \;,\; \tilde{x}_3 = \frac{x_3}{h_1} \;.\; (\; \tilde{y} = \frac{\tilde{x}_2}{\tilde{x}_1}) \tag{2}$$

The downwashes w and w^* are supposed to be ex-pressed in form of superposition of homogeneous poly-nomes with arbitrary coefficients, namely:

$$w \equiv \tilde{w} = \sum_{m=1}^{N} \tilde{x}_1^{m-1} \sum_{k=0}^{m-1} \tilde{w}_{m-k-1,k} \left|\tilde{y}\right|^k \quad ,$$

$$w^* \equiv \tilde{w}^* = \sum_{m=1}^{N} \tilde{x}_1^{m-1} \sum_{k=0}^{m-1} \tilde{w}^*_{m-k-1,k} \left|\tilde{y}\right|^k \quad . \tag{3a,b}$$

The coefficients of the downwashes, together with the similarity parameter $\nu = B\,\ell$ ($B = \sqrt{M_\infty^2 - 1}$, $\ell = \ell_1 / h_1$) of the planform are the free parameter of optimization and are determined by minimizing the invis-cid drag functional. Hereby are ℓ , ℓ_1 , h_1 the di-mensionless span, the half-span and the depth of the plan-form of the delta wing. Additionally, this model satisfies the following constraints :
- for the thin component, the lift and pitching moment coefficients are given and the pressure coefficient must cancel along the subsonic leading edges (Kutta condition on leading edges), in order to avoid the conturnement of these edges and therefore the induced drag is cancelled and the lift is increased (at cruise, but these positive ef-fects are obtained also for greater ranges of Mach num-bers and angles of attack),

$$C_\ell = C_{\ell_0},\quad C_m = C_{m_0},\quad F_n = 0 \quad ; \qquad \text{(4a-c)}$$
$$(\ n = 0,\ 1,...,(N-1)\ )$$

- for the thick-symmetrical component, the relative volume of the wing ($\tau^* = V_0 / S_0^{3/2}$) is given and the thickness of the wing must cancel along the leading edges, in order to fly shock-free,

$$\tau^* = \tau_0,\quad E_t^* = 0\,.\ (\ t = 0,\ 1,...,(N-1)\ ) \qquad \text{(5a,b)}$$

Hereby V_0, S_0 and N are the volume, the area of planform and the degree of the polynom of highest order taken in the superpositions of homogeneous polynomes entering in the expressions of downwashes w and w^*. If the principle of minimal singularities (which fulfill the jumps of the velocity's components) and the hydrodynamical analogy of Carafoli are used, the following expressions for the axial disturbances of the thin and of the thick-symmetrical components are obtained:

$$u = \ell \sum_{n=1}^{N} \tilde{x}_1^{n-1} \left\{ \sum_{q=0}^{E\left(\frac{n}{2}\right)} \frac{\tilde{A}_{n,2q}\tilde{y}^{2q}}{\sqrt{1-\tilde{y}^2}} + \sum_{q=1}^{E\left(\frac{n-1}{2}\right)} \tilde{C}_{n,2q}\tilde{y}^{2q} \cosh^{-1}\sqrt{\frac{1}{\tilde{y}^2}} \right\}, \qquad \text{(6a)}$$

$$u^* = \ell \sum_{n=1}^{N} \tilde{x}_1^{n-1} \left\{ \sum_{q=0}^{n-1} \tilde{H}_{nq}^* \tilde{y}^q \left(\cosh^{-1} M_1 + (-1)^q \cosh^{-1} M_2 \right) + \sum_{q=1}^{E\left(\frac{n-1}{2}\right)} \tilde{C}_{n,2q}^* \tilde{y}^{2q} \cosh^{-1}\sqrt{\frac{1}{\nu^2\tilde{y}^2}} + \sum_{q=0}^{E\left(\frac{n-2}{2}\right)} \tilde{D}_{n,2q}^* \tilde{y}^{2q} \sqrt{1-\nu^2\tilde{y}^2} \right\}. \qquad \text{(6b)}$$

$$\left(M_{1,2} = \sqrt{\frac{(1+\nu)(1 \mp \nu\ \tilde{y})}{2\nu(1 \mp \tilde{y})}}\ \right)$$

The lift, pitching moment and the pressure coefficients of the upper side of this model were measured in the triso-nic wind tunnel of DLR-Köln , in the frame of research projects of the author, sponsored by the DFG. The com-parison of theoretical and experimental-correlated values of the lift and pitching moment coefficients of the model Adela, presented in the (Fig. 2a,b), show very good agre-ements.

These very good agreements between experimental and theoretical inviscid analytical hyperbolical solutions of the lift, pitching moment and pressure coefficients on FCs with subsonic leading edges, at moderate angles of attack (deduced by the author in closed forms, as in [1]), lead to the following remarks.

- The validity of the three-dimensional hyperbolical analytical potential solutions for the axial disturbance velocity with the chosen balanced singularities and the corresponding developed software for the above coefficients are confirmed;
- the influence of friction upon these coefficients is neglectable;
- the flow is laminar, as supposed here and it remains attached in supersonic flow, for larger angles of attack than by subsonic flow;
- if the FC is flattened enough, the flight with characteristic surface, instead of the flight with shock wave surface, is confirmed.

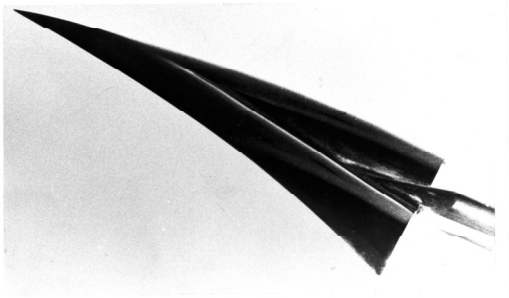


Fig. 1 The Global Optimized Shape of the Wing Model Adela

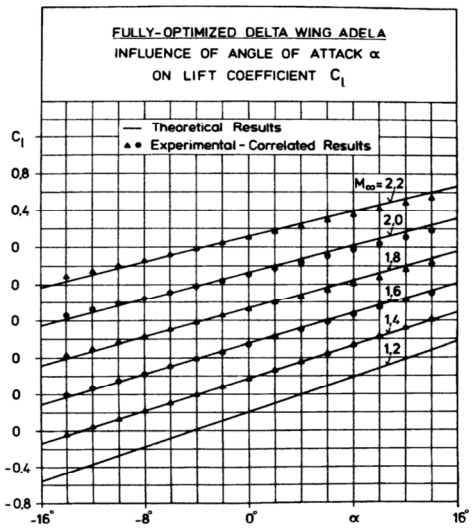


Fig. 2a The Lift Coefficient of the Global Optimized Model Adela

The GO model Adela looks, in transversal sections, like gliding birds, namely:
- has a convex form at its frontal part and has a wave form at its rear part.
-the optimal span decreases and the optimal depth, camber and twist increase, when the FC is optimized at higher cruising Mach number.

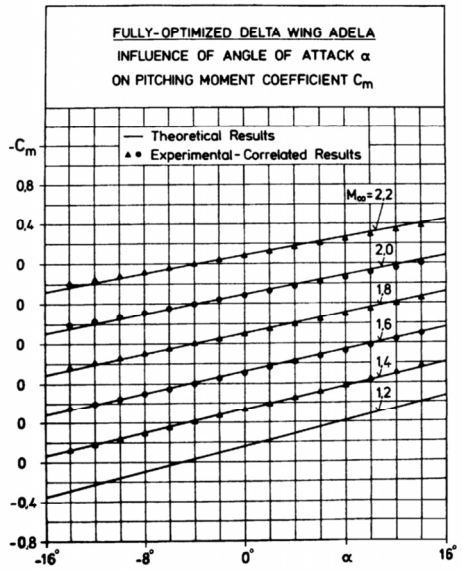


Fig. 2b The Pitching Moment Coefficient of the Global Optimized Model Adela

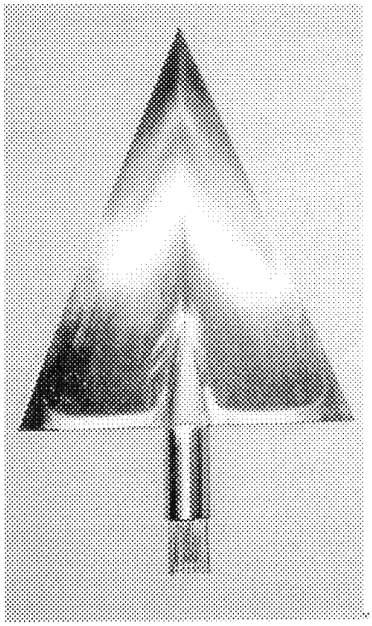
The wave form at the rear part was obtained by all GO shapes of three FC models optimized by the author, na-mely Adela (a delta wing alone), given in the (Fig. 1) and of two integrated wing-fuselage FCs, called Fadet I and Fadet II, given in the (Fig. 3a,b), which present minimum drag, respectively, at cruising Mach numbers 2.0, 2.2 and 3.0 and have the same area of their planforms. These wave shapes are due, especially, to the Kutta condition along the leading edges of the FCs, used as constraint for the enlarged variational problems of the determination of their GO shapes. This constraint leads to a special coup-ling between the camber and twist in each point of the GO surface of FC.

It seems that the fulfilling of Kutta condition on their leading edges is one of the secrets of the gliding flight of birds!

In order to avoid the negative corner effect along the junction lines wing-fuselage, the author has introduced additionally integration constraints along these junction -lines. The integrated FCs have continuous mean surface and the same tangent plane along the junction lines wing -fuselage like the birds, which have also a continuous shape (of class C1) along their junction lines wing -body.

The comparison of the GO shapes of models Fadet I and Fadet II shows a great influence of Mach number upon their planforms, which cannot be followed by an unchan-geable GO shape of FC. Therefore a small morphing of the GO FC was proposed by the author, as in [1]-[3], which is useful for the multipoint design of the GO shape of the FC. It can be technically realized by using leading edge flaps, movable in spanwise direction.

The shape of such FC can be optimized at two different cruising Mach numbers. The shape of FC, with flaps in retracted position, is optimized at the higher cruising Mach number.



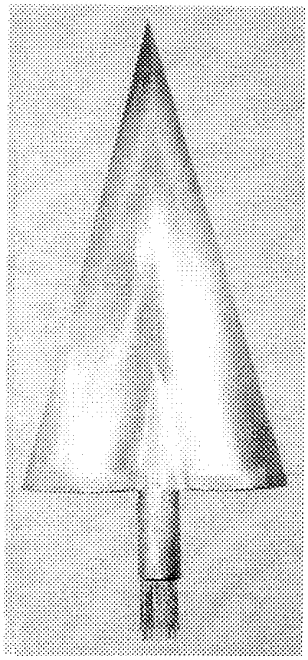


Fig. 3a,b The Integrated and Global Optimized Models Fadet I and Fadet II

The shape of leading edge flaps can be optimized in such a manner that the entire FC, with flaps in open position, is of minimum drag, at a second, lower cruising Mach num-ber.

The birds have morphing possibilities. They have flexible feather's shapes and can modify their camber and twist and they can rotate a part of their wings and, therefore, increase their planform in the spanwise direction, in order to increase their lift by lower gliding speed and they can reduce their span and increase their depth by higher gliding speed.

3. Conclusions

- The study of the flight of birds and insects was and re-mains a great source of inspiration for the development of new technologies with more performances for the benefit of aircraft engineering and also for other transport vehi-cles.

- The similarity of the GO shapes of FCs and of gliding birds are due to the same common aim, namely to fly more economically, with high aerodynamical performan-ces.

References

[1] Nastase, A. *Computation of Supersonic Flow over Flying Configurations*, Elsevier Oxford, UK, (2007).

[2] Nastase, A. The Design of Intercontinental Supersonic Transport Aircraft of Second Generation, by Using Global Optimization Techniques, *ICAS , Proc*., Stockholm, Sweden , (1990).

[3] Nastase, A. The Optimum-Optimorum Shape of the Space Vehicle of Variable Geometry of Minimum Drag, at Two Cruising Mach Numbers. *Proc. of V. International Conference of High Speed Aerodynamics,* **Vol. II**, (Edit. A. Nastase), Mainz Printing House, Aachen, Germany, p. 55-74, (1990).

IMPACT ASSESSMENT OF THE DENT – GOUGE COMBINATION LIKE FLAWS ON OPERATING SAFETY OF THE NATURAL GAS TRANSMISSION PIPELINE

Gheorghe ZECHERU[*], Alin DINITA*

[*] Petroleum Gas University from Ploieşti, Blvd. Bucureşti, nr. 39, adinita@upg-ploiesti.ro

Abstract. This paper presents the procedures developed by the authors to assess the structural integrity and technical risk assessment attached to the gas transmission pipelines that have anomalies like dent-gouge combination, the most dangerous in terms of influence on the bearing capacity of these pipelines and are based on the recommendations of API 579 / ASME FFS - 1. Dent-gouge combination flaws are typically generated by the action of the active elements, usually sharp, of the machines or equipment used to perform various works on the pipes or in their neighbourhood. To highlight the features of the procedures for assessing this anomalies proposed by the authors, the paper presents a case study conducted at the technical expertise of an accident caused by the existence of such anomalies found on a the natural gas transmission pipeline.

Keywords: dent – gouge flaws, transmission pipeline, third-party damage, impact assessment, failure

1. Introduction

Anomalies produced by local plastic deformation, which can be detected in the piping of natural gas transmission pipelines are of several types: dent – ***IN***, gouge – ***SC*** or dent-gouge combination – ***IS***.

Dents - an inward or outward deviation of a cross-section of a shell member from an ideal shell geometry that is characterized by a small local radius or notch.

Gouge - an elongated local mechanical removal and/or relocation of material from the surface of a component, causing a reduction in wall thickness at the defect; the length of a gouge is much greater than the width and the material may have been cold worked in the formation of the flaw. Gouges are typically caused by mechanical damage, for example, denting and gouging of a section of pipe by mechanical equipment during the excavation of a pipeline.

Dent with gouges - a dent with a gouge present in the deformed region. Obviously, type IS anomalies are the most harmful, because in their area are presented both stress concentration effect produced by changing cross-sectional configuration, and the effect of increasing tensions generated by local reduction of wall thickness. The presence of such anomalies on the steel pipelines can significantly affect their loading capacity, determining in many cases their failure and the occurrence of accidents having important consequences. Configurations of these ***IS*** anomalies are suggested by the images presented in Figure 1. Usually these anomalies are caused by third-party interventions (actions performed by individuals or teams working that do not belong to the pipeline operator, and who were not employed by it for maintenance works).

The share of local plastic deformation anomalies of category in the total imperfections or defects found on natural gas transmission pipelines has increased considerably in recent years, reaching approximately 50% for pipelines transportation systems from database EGIG (European Gas - Pipeline Incident Data Group while the statistical research shows that in Romania the amount of this kind of accidents is growing, reaching at present the percent of almost 10 % [1].

2. Analytical assessment of the type IS anomalies

Assessment procedure of anomalies (elasto-plastic deformation), of technical systems in general and of pipeline in particular is achieved, according to [2]. These assessments are based on rigorous, grounded and regulated considerable number of scientific papers, standards and regulations.

Due the anomalies type ***IS*** generation mode, by the action of the active elements, usually sharp, of some third party tools used to perform various works in the vicinity of pipelines, many of these anomalies have at the base gouges made by plastic deformation and/or cutting material from the bottom of the dent, as shown in Figure 2.

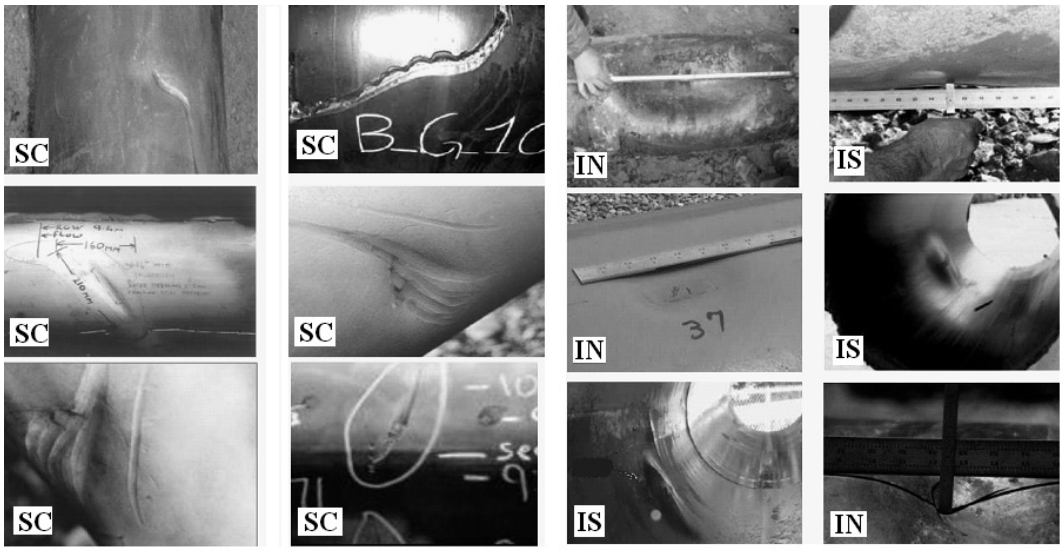


Figure 1 Elasto-plastic deformation anomalies
Gouges – *SC*; Dents – *IN*, Dents with gouges – *IS*

Due to the generating mechanism of ***IS*** anomalies, pipeline material in the area adjacent to the gouges is strongly harden and the material drastically reduce his tenacity, which makes the gouges behave like cracks, which have remarkable effects of stress concentration. Depending on the rigor and precision analysis on the interpretation of results, personnel qualification requirements that apply this procedures, the assessments of the structural integrity of pipelines with ***IS*** anomalies are ranked on three levels: a) ***Level 1*** assessment, which corresponds to the a conservative assessment, based on applying a series of criteria, which require a minimum volume of data and information on the pipeline or pipe element analyzed; b) ***Level 2*** assessment, which corresponds to a more detailed assessment and lead to more accurate results than those obtained by applying the procedures of level 1; data / information necessary for such an assessment are similar to those required by the application of evaluation procedures for level 1, but calculations are based on models more advanced;

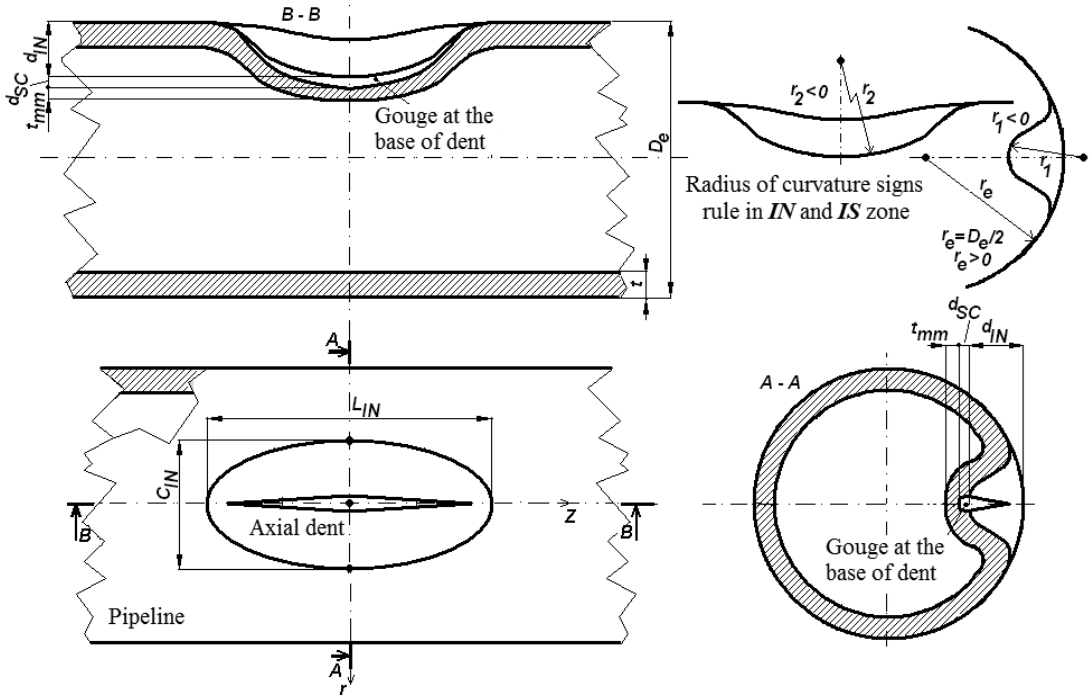


Figure 2 Configuration and characteristic dimensions of dent-gouge combination – IS

c) ***Level 3***, which corresponds to the detailed evaluation, leading to more robust results than those

provided by the Level 2 evaluation procedures, entry data / information required for such an evaluation are more detailed, and assessments are made are based on analysis and numerical simulations using, for example, finite element method.

For application of the procedures for assessing the seriousness of an ***IS*** anomalies it must be know the following initial data categories, which ensures quality characterization of new pipes, pipe status on the time of the anomaly assessment and technical state estimation which is reaches by the pipeline at the end of life time:

- *Data regarding the constructive characterization of the pipeline the anomaly was found on:* external diameter D_e_nominal wall thickness (reduced below the allowable deviation from the module wall thickness) t_{nom}.
- *Data regarding the characterization of the operating technical conditions of the pipeline:* design pressure p, current operating pressure of the pipeline p_{op}, design factor value F; the value of the welded joint factor Z, the minimum operating temperature $T_{\min}$, the additional wall thickness, necessary for supplemental loads (from loads other than the inner pressure) t_{sl}.
- *Data regarding the mechanical properties of the steel the pipeline element is made of:* modulus of elasticity and the minimum specified values (by the standard that settles the steel grade quality the pipes are made of for the yield strength $R_{t0,5}$, the ultimate tensile strength R_m and the impact energy KV at the minimum operating temperature or the effective values of these properties.
- *Data regarding the uniform modification of the wall thickness due to corrosion:* uniform reduction of the thickness (metal loss) from the commissioning till the time of the assessment $LOSS$, the uniform reduction of thickness (the future corrosion allowance) (after the assessment) FCA
- *Data regarding the characterization of the geometry of the anomaly being analyzed:* length of the dent (extension in the longitudinal direction) L_{IN}, width / circumferential extension of the dent C_{IN}, depth of the dent measured when the component is pressurized d_{IN} and depth of the dent measured when the pipeline is not pressurized d_{IN}, maximum depth of the gouge d_{SC}, wall thickness at the base of the gouge t_{mm}, the bending radius at the base of the dent r_1, distance to the nearest weld joint L_w, distance to the nearest major structural discontinuity L_{msd} (determined by taking into account that, in the vicinity of the area where the failure took place, the pipe didn't have any discontinuities such as branches, tees, isolating valves).

Level 1 procedure for assessment of the type ***IS*** anomalies, developed by the authors based on the recommendations from [2], was presented in [3,4].

In the present paper are presented, commented and compared two procedures for level 2, developed by the authors based on indications from [2,5] to evaluate the ***IS*** anomalies.

These procedures can take into account the effects of alteration due to cold hardening by plastic deformation, the material toughness at the tip of type ***IS*** anomalies, thus allowing to obtain relevant information, with a higher degree of trust, on the residual strength of pipes with such anomalies.

2.1. Assessment procedure based on the recommendations of [2]

Evaluation procedure based on the recommendations of [2] contains the following sequence of steps:

Step 1. It verifies the existence and veracity of the input data and it sets the values for depth of dent d_{IN} şi d_{IN0}; if the pipeline operating pressure is $p \geq 0{,}7MAWP$, $d_{IN} = 0{,}70d_{IN0}$, and if the operating pressure is $p < 0{,}7MAWP$, $d_{IN} = d_{IN0}$.

Step 2. Determine effective pipe wall thickness (at the time of evaluation, outside the anomaly area that is assessed) t_{rd}, the pipe wall thickness at the end of future use t_c and the dent depth at the end of pipeline life d_{SCf}, using the formula group (1):

$$\begin{aligned} t_{rd} &= t_{nom} - LOSS; \\ t_c = t_{rd} - FCA &= t_{nom} - LOSS - FCA; \\ d_{SCf} &= d_{SC} + FCA. \end{aligned} \tag{1}$$

Step 3. Checking the fulfilling conditions (2):

$$\begin{aligned} t_{mm} - FCA &\geq 2{,}5 \text{ mm}; \\ L_w &\geq \max[2t_c; 2{,}5 \text{ mm}] \\ L_{msd} &\geq 1{,}8\sqrt{D_e t_c}; \end{aligned} \tag{2}$$

if all conditions are satisfied, proceed to the next stage, otherwise it is considered that assessment with the Level 2 evaluation is unsatisfactory and must be done with a procedure level.

Step 4. Checking the fulfilling conditions:

$$d_{IN} \leq 0{,}07D_e;\ d_{SC} \leq 0{,}66t_c; \tag{3}$$

if both conditions are satisfied, proceed to next step, otherwise the procedure should be evaluated with a higher level.

Step 5. Determine the maximum allowable operating pressure of the pipeline $MAWP$, considering only the effect of reducing the pipe wall thickness due to the gouge depth t_{SC}, using the following formulas:

$$\begin{aligned} MAWP &= \min[MAWP_C; MAWP_L) \\ MAWP_L &= \frac{4R_{t0,5}FZ(t_c - t_{sl} - d_{SC})}{D_e - 1{,}6(t_c - t_{sl} - d_{SC})} \\ MAWP_C &= \frac{2R_{t0,5}FZ(t_c - d_{SC})}{D_e - 0{,}8(t_c - d_{SC})} \end{aligned} \tag{4}$$

Step 6. Determining the remaining strength factor RSF values using the formula:

$$RSF = \frac{2}{\pi}\left(1-\frac{d_{SC}}{t_c}\right)\arccos\left[\exp\left(-\frac{C_1 C_3}{C_2^2}\right)\right], \quad (5)$$

where C_1, C_2 şi C_3 are variables if E şi $R_{t0,5}$ are inserted in MPa, d_{SI}, d_{IN0}, d_{SC} şi t_c – in mm, and KV – in J:

$$C_1 = \frac{31,78\pi E}{\sigma_{ref}^2 d_{SC}};$$

$$C_2 = Y_1\left(1-\frac{1,8d_{IN0}}{D_e}\right)+Y_2\left(\frac{10,2d_{IN0}}{t_c}\right); \quad (6)$$

$$C_3 = 0,020935KV^{1,7544}$$

$$\sigma_{ref} = 1,15R_{t0,5}\left(1-\frac{d_{SC}}{t_c}\right), \quad (7)$$

$$Y_1 = 1,12-0,23\left(\frac{d_{SC}}{t_c}\right)+10,6\left(\frac{d_{SC}}{t_c}\right)^2 - 21,7\left(\frac{d_{SC}}{t_c}\right)^3+30,4\left(\frac{d_{SC}}{t_c}\right)^4, \quad (8)$$

$$Y_2 = 1,12-1,39\left(\frac{d_{SC}}{t_c}\right)+7,32\left(\frac{d_{SC}}{t_c}\right)^2 - 13,1\left(\frac{d_{SC}}{t_c}\right)^3+14,0\left(\frac{d_{SC}}{t_c}\right)^4; \quad (9)$$

Step 7 – It establishes the allowable value of the residual stress factor RSF_a, most codes and design codes and standards for pipes and pressure vessels provide $RSF_a = 0,9$ [6].

When $RSF \geq RSF_a$, the pipeline with type IS anomaly can still be used, operating pressure must not exceed $MAWP$ calculated in Step 5. If $RSF < RSF_a$, pipeline with type IS anomaly can still be used, if the operating pressure is maintained below the value given by:

$$MAWP_r = MAWP\frac{RSF}{RSF_a}. \quad (10)$$

If the pipe is not subject to cyclical variations of the pressure during operation, evaluation of the type ***IS*** anomaly is completed, otherwise is necessary to determine the maximum number of pressure cycles that the pipe with this type of anomaly can still operate at the same level, with the formulas presented in [2].

Based on the results of applying the procedure is determined which of the following is the right decision:

a) whether $MAWP$ or $MAWP_r$ values are considered acceptable, the pipeline with IS anomaly may still work;

b) if the residual mechanical strength of the pipeline is inadequate ($MAWP_r$ values are too small), it is necessary to intervene with maintenance works to eliminate anomaly.

For smooth implementation of this procedure for assessing the seriousness of this type ***IS*** anomalies, the authors of this paper have developed an informatics application (called *EVINSC*) [3,4].

2.2. Assessment procedure based on the recommendations of [5]

A second ***IS*** anomalies assessment procedure it was developed considering that the effects of the such anomalies presented on pipeline are equivalent to those produced by the presence of cracks and can be assessed by building a failure analysis diagram – FAD [7]. In this case, the general principle of assessing the integrity of the pipeline carrying gas under pressure consists in comparing the dates that characterize the mechanical strain at the top of the IS type anomaly with the date characterizing the failure resistance of steel pipes.

Characteristic curve of FAD is the geometric place of the points with coordinates (L_r, K_r), corresponding to a combination of critical factors to achieve the two states describe mechanical stress limit of the pipeline:

a) the limit state corresponding to the generalized plastic deformation of the material from the anomaly plane section, which is reached if $\sigma = R_{t0,5}$ or $L_r = \sigma/R_{t0,5} = 1$;

b) the limit state corresponding to the brittle fracture, by starting a process of unstable propagation of cracks initiated at the top of the anomaly, which is reached if $K_1 = K_{1C}$ or $K_r = K_1/K_{1C} = 1$.

The equation of this curve is:

$$K_r = \frac{L_r}{\sqrt{\frac{8}{\pi}\ln\left[\sec\left(\frac{\pi}{2}L_r\right)\right]}}. \quad (11)$$

As seen in Figure 4, the curve characteristic FAD is delimited in two areas: an area of safety domain and a failure domain. A pipeline is considered safe to working on the operating pressure if the coordinate points (L_{rd}, K_{rd}), proper to the solicitation states from the top of the anomaly, are situated below the curve characteristic of FAD (in the safety domain), and it is likely to failure, if the points with coordinates (L_{rd}, K_{rd}) are located above the curve characteristic of FAD (failure domain).

To determine the coordinates (L_{rd},K_{rd}), corresponding to the presence of an IS anomaly found on the pipeline, you can use the following relationships:

$$K_{rd} = \frac{[\sigma_m Y_1 + \sigma_b Y_2]\sqrt{\pi d_{sc}}}{K_{1C}}; \quad (12)$$

$$L_{rd} = \frac{\sigma_m\left(1-\frac{d_{SC}}{M\cdot t_c}\right)}{1,15R_{t0.5}\left(1-\frac{d_{SC}}{t_c}\right)}, \quad (13)$$

features state of stress in the anomaly area [8] is defined by relations:

pipeline, the authors of this paper have developed an

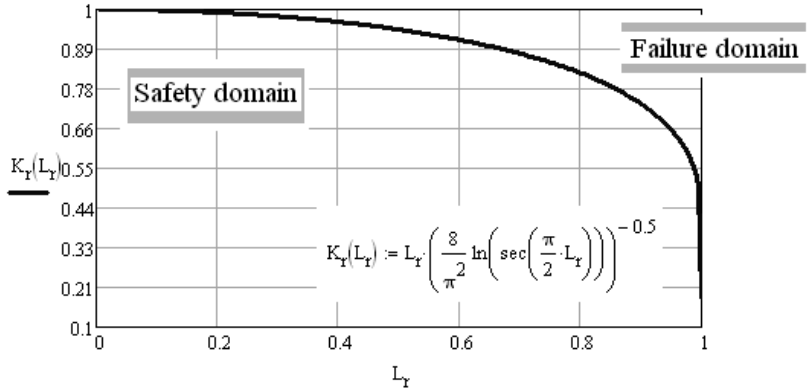


Figure 4 FAD for the assessment of the gravity of type *IS* anomaly

$$\sigma_m = \sigma_h \left(1 - 1{,}8 \frac{d_{IN}}{D_e}\right), \quad \sigma_b = 5{,}1 \sigma_h \frac{d_{IN}}{t_c}, \tag{14}$$

$\sigma_h = p_{op} \dfrac{D_e}{2t_c}$ is the circumferential tension in the wall of the pipe without anomalies, generated by the action of pressure transport gas, and M is the Folias factor, which characterizes the effect of mechanical stress concentration produced by the anomalies:

$$M = \sqrt{1 + 0{,}52 \left(\frac{C_{IN}}{D_e t_c}\right)} \tag{15}$$

Fracture toughness K_{1C} can be determined experimentally or can be estimated, knowing the characteristic of toughness KV (ductile fracture Charpy energy) caused by impact bend test, with formulas such as following:

$$K_{1C} = \min\left[461{,}7\sqrt{KV}; 267{,}8 KV^{0{,}63}\right] \tag{16}$$

which results K_{1C} in N/mm$^{3/2}$, if you will enter in KV energy in J. Obviously, for an accurate assessment is necessary to know the values of fracture toughness K_{1C}, corresponding to the harden area at the base of the ***IS*** anomaly. If coordinates (L_{rd},K_{rd}) of the anomaly analyzed, defined by relations (12) and (13), are introduced in equation (11) of the characteristic curve of failure assessment diagram, it can be determined the pressure $p_{op} = MAWP_r$ for which the pipeline with IS anomaly can operate on safety domain.

Decisions which are taken according to the results obtained by applying the procedure are similar to those presented when applying the procedure based on the recommendations of [2]. For smooth implementation of level 2 procedures for assessing the seriousness of this type ***IS*** anomalies from the the natural gas transmission informatics application (called EVINSC-FAD) [3,4].

It should be noted that fracture toughness K_{1C} *can* also use in the assessment procedure presented in § 2.1, using for calculation of the constant C_3, the following empiric formula:

$$C_3 = 9{,}38763 \cdot 10^{-12} K_{1C}^{3{,}5} \tag{17}$$

2.3. Experimental determination of fracture toughness at the base of the type IS anomalies

Application procedures for evaluating an IS type anomaly from a natural gas transmission pipeline requires knowledge of fracture toughness K_{1C} of the material, cold harden during the cutting process that has been generated the gouge from the base of the dent.

The authors propose the use of the following experimental method to highlight the cold hardening influence on the steel pipeline toughness:

a) cutting from the laminated sheet used to fabricate the pipe a n_p number of specimens with length L_p = 55 mm, width l_p = 10 mm and height h_p = 15 mm;

b) cold plastic deformation, by compressing the specimens on the h_p direction, with different degrees of deformation, GD_i, i = 1...n_p, so that the height of the specimens, after deformation, become, $h_{pd,i} = h_p \left[1 - \dfrac{GD_i}{100}\right]$, i = 1...n_p.

c) machining of the specimens for their transformation in n_p normal Charpy specimens (10×10×55), for Charpy bending test;

d) achievement on each specimen a crack with the length of h_f= 0,5...0,8 mm, in the extension of V-notch, the cracks is achieved by dynamic fatigue bend testing of the specimens (3 or 4 bending points), making bending cycles with asymmetry coefficient R_c = 0...0,2 and the forces intensity is chosen as convenient so the fatigue cracks with length h_f *are* obtained after a number of load cycles $N_c \geq 50000$;

e) on each of the n_p samples with cracks in the extension of V-notch, where the material was cold harden with a deformation degree GD_i, $i = 1...n_p$, is determined the crack opening displacement COD_i, $i = 1...n_p$, using the method recommended in [8,9];

f) knowing the COD_i value suitable to the material cold harden by plastic deformation with different deformation degrees GD_i, can be determined the fracture toughness $K_{1C,i}$, applying the formula:

$$K_{1C} = \sqrt{COD \cdot R_{t0,5} \cdot E} \tag{18}$$

The method was applied for X42 steel pipes, with $E = 205$ GPa and $R_{t0,5} = 320$ MPa working mode and results are summarized in Figures 5-7.

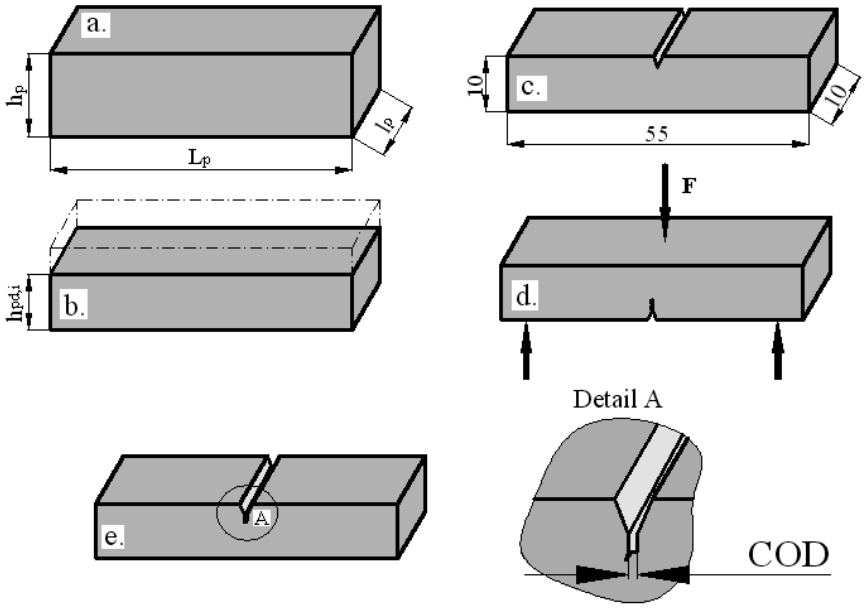


Figure 5 COD characteristic determination scheme

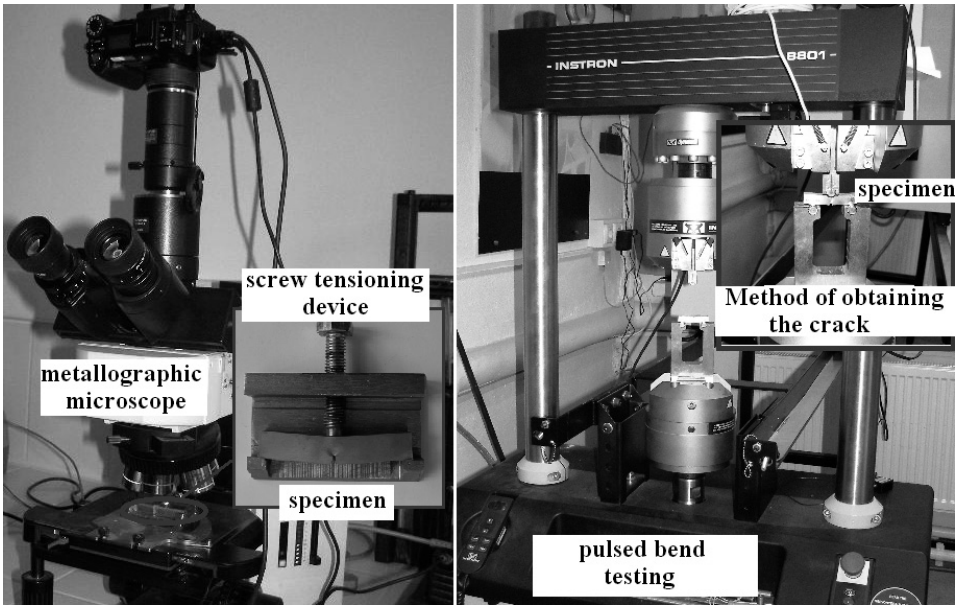
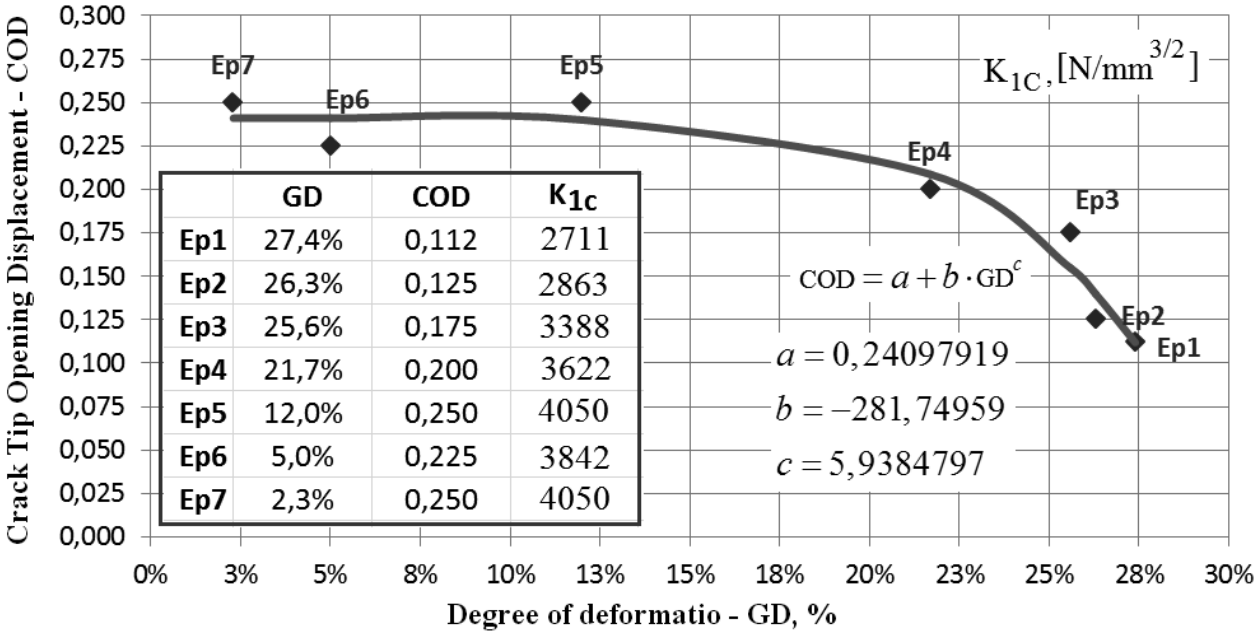


Figure 6 The experimental test method for determining the COD parameter

3. Case study for evaluation of an pipeline with type *IS* anomaly

The assessment procedures described above were applied to determine the causes of failure in operation of a natural gas transmission pipelines with D_e = 711 mm, t_{nom} = 10 mm, t_{mm} = 9,1…9,3 mm; made of X42 steel pipe (E = 205 GPa, $R_{t0,5}$ = 320 MPa) an with a design pressure of p = 4,0 MPa.



	GD	COD	K_{1c}
Ep1	27,4%	0,112	2711
Ep2	26,3%	0,125	2863
Ep3	25,6%	0,175	3388
Ep4	21,7%	0,200	3622
Ep5	12,0%	0,250	4050
Ep6	5,0%	0,225	3842
Ep7	2,3%	0,250	4050

Figure 7 Dependence of the GD, COD and K_{1c} (fracture toughness)

On the failed pipe was reveal the existence of IS type anomalies with L_{IN} = 900...1200 mm, C_{IN} = 300…400 mm, $d_{IN} = d_{IN0}$ = 32,5 … 40 mm, d_{SC} = 0,7…0,9 mm. The failure of the pipeline occurred during operation at a pressure of p_{op} = 2,5 MPa. Anomalies dimensions were determined by direct measurements on analyzed pipeline.

Results from the evaluation procedure presented in § 2.1 are summarized in Table 1. It is noted that the values determined for the safe operating pressure of the pipeline with type IS anomalies are $MAWP_r$ = 0,5...0,9 MPa < p_{op} and therefore, we can say that this ***IS*** anomaly was certainly the main cause of pipeline failure.

Results, from the level 2 evaluation procedure of the anomalies founded on the analysed pipeline detailed in §2.2, are summarized in Table 2.

Table 1 *RSF* şi $MAWP_r$, values for the failed pipeline with *IS* type anomalies

Depth of the gouge d_{SC}, mm		**0,7**	**0,9**
Remaining strength factor *RSF*, for depth of the dent d_{IN}, mm =	**32,5**	0,865	0,690
	40,0	0,713	0,549
$MAWP_r$, MPa, for depth of the dent d_{IN}, mm =	**32,5**	0,758	0,624
	40,0	0,581	0,453

Table 2 *MAWP* values for the pipeline with IS anomalies which failed in service

Depth of the gouge d_{SC}, mm		**0,7**						
Fracture toughness, K_{1C}, N/mm$^{3/2}$		2711	2863	3388	3622	4050	3842	4050
Deformation degree, GD, %		27,4	26,3	25,6	21,7	12,0	5,0	2,3
MAWP MPa, for depth of the dent d_{IN}, mm =	**32,5**	1,424	1,503	1,772	1,891	2,108	2,003	2,108
	40	1,171	1,236	1,459	1,558	1,738	1,651	1,738
Depth of the gouge d_{SC}, mm		**0,9**						
MAWP MPa, for depth of the dent d_{IN}, mm =	**32,5**	1,261	1,331	1,571	1,677	1,869	1,776	1,869
	40	1,037	1,094	1,292	1,380	1,541	1,463	1,541

In this table stands out as the values determined for the safe operating pressure of the pipeline with ***IS*** type anomalies $MAWP_r$ = 1,2...2 MPa, higher than those obtained by the procedure described in § 2.1, and because with this procedure resulted $MAWP_r < p_{op}$, the ***IS*** anomalies are credited as the main cause of pipeline failure which was considered in this paper

It can be appreciated that the procedure described in § 2.1 is more conservative (cover) while the procedure outlined in § 2.2 is more accurate.

It is also can be observed, by examining information summarized in Tables 1 and 2, that the decrease of the ***IS*** anomaly material toughness lead to its embrittlement and the increasing tendency of cracking and, consequently, to reduce the pressure for safe operation of the pipeline. Therefore, we can say that there ***IS*** anomaly was certainly the main cause of pipeline failure.

4. Conclusions

By analyzing the paper, the authors have drawn the following conclusions of a general nature:

- Steel pipes with IS anomalies generated by third-party intervention (actions performed by individuals or teams working that do not belong to the pipeline operator, and who were not employed by it for maintenance works)) may substantially affect pipelines bearing capacity, resulting, in many cases, their failure with serious consequences;
- The level 2 assessment procedures, proposed and developed by the authors, are particularly useful in assessing the residual mechanical strength of pipes with anomalies caused by third-party intervention and obtaining relevant information for making decisions about pipeline continued operation or implementation of maintenance works;
- Procedure based on the recommendations of [2] is covering, allowing to obtain results with high confidence, while the procedure based on the recommendations of [5] is more accurate, giving values of pressures at which the failure limit state lines with IS anomalies is very close to those observed experimentally;
- Informatics applications designed and developed, by the authors, to assess the gravity anomaly type ***IS***, ensure rapid implementation of the procedures from this paper and making rapid decisions on pipelines with such anomalies.

References

1. * * * *6th Report of the European Gas Pipeline Incident Data Group*, Gas Pipeline Incidents 1970 – 2004, December 2004
2. * * * API 579 / ASME FFS-1, *Fitness-For-Service*, Washington, 2007
3. Zecheru Gh., Diniță A., ș.a., *Expertise and simulations on the assessment processes that lead to failure in operation of pipelines*", research contract no. 38/2007, Petroleum Gas University from Ploiesti.
4. Zecheru, Gh., ș.a., Final report on contract research *no. 52/2010*, Petroleum Gas University from Ploiesti, 2011
5. * * * R6 – Revision 4 – *Assessment of the integrity of structures containing defects*, British Energy, BNFL Magnox Generation, AEA Technology, London, 2000
6. * * * *An assessment of measures in use for gas pipelines to mitigate against damage caused by third party activity*, Health and Safety Executive, Contract research report 372/2001
7. * * * *An assessment of measures in use for gas pipelines to mitigate against damage caused by third party activity*, Health and Safety Executive, Contract research report 372/2001
8. Cosham A., Hopkins Ph., *The pipeline defect assessment manual*, Proceedings of IPC 2002, International Pipeline Conference, Alberta, Oct. 2002
9. Khazhinskii G. M., *Approximate evaluation of stresses in dents of cylindrical shells*, Chemical and Petroleum Engineering, Vol. 41, Nos. 3–4, 2005.
10. Horsley D. J., *Background to the use of CTOA for prediction of dynamic ductile fracture arrest in pipelines,* Engineering Fracture Mechanics 70 (2003) 547–552.
11. Rudland D.L., Wilkowski G.M., *Experimental investigation of CTOA in linepipe steels*, Engineering Fracture Mechanics 70 (2003) 567–577

SUPERSONIC REACTING FLOW AROUND A WEDGE CONSIDERING VARIABLE SPECIFIC HEATS WITH TEMPERATURE

Corneliu BERBENTE[*], Sorin BERBENTE[**]
[*]University "Politehnica" of Bucharest, Chair of Aerospace Sciences, "E. Carafoli",
berbente@yahoo.com
[**] University "Politehnica" of Bucharest, Chair Engineering of Aeronautical Systems, "N. Tipei"
sun_so@yahoo.com

Abstract. The supersonic flows are important, as an example, for jet engines in order to avoid the energy losses due to dissociation at high flight Mach numbers ($M_H \geq$ 5-6). In this way the propulsion system (scramjet) efficiency is improved. By using a wedge the strong normal shock waves are replaced by oblique waves thus reducing the pressure losses as well. A more detailed model that takes into account both the chemical reaction and the variation of specific heats with temperature is proposed.

Keywords: variable heats, supersonic combustion

1. Introduction

The problem of supersonic reacting flows was studied untill now [1;2;3] without considering the variation of the specific heats with temperature and without details about the chemical reaction; these facts are important due to the high temperature change both by combustion and by shock jump. On the other hand the change of composition connected with the chemical rection is able to provide a better accuracy. A numerical study with emphasis on reaction mechanism but however not able to provide information about the combustion speed was done in [4]. Because the measurements of the burning rate are difficult at supersonic regimes ***new parameters*** to characterize the combustion are introduced: the concept of the ***equivalent solid body*** and the ***flame position with respect to the equivalent solid body.*** The proposed new parameters prove themselves to be very useful for a new method of calculation, preserving the ***analytical approach.***

2.The physical model and the governing eqs

A gas consisting from a premixed fuel (ex. methane; hydrogen) and oxidizer (air) flows at high supersonic speeds (Mach number $M_i \geq 4$) around a wedge as in Fig.1.After a jump through an oblique shock wave *OS*, the combustion of the gas mixture is initiated and a flame *OF* occurs.The two waves can be seen as resulting from the decomposition of a detonation wave in a shock wave and a deflagration wave (flame), according to ***Clarke model*** [1]. Both waves are planes attached to the wedge tip and the burning is thus stabilized.The wedge, shock and flame semiangles are denoted by $\omega_b, \omega_s, \omega_f$ respectively. The initial gas velocity, density, presure and temperature are denoted by V_i, ρ_i, p_i, T_i

The 2 D flow is studied in a polar system of coordinates *z, r,* ω where the velocity components are V_r, V_ω (Fig.1) and $V_z = 0$. The ignition is initiated by sparking plugs at the wedge tip and entertained due to the high temperature after the shock wave. The viscous effects are concentrated in the shock wave, whereas the thermal conductivity effects are concentrated in the flame. These two waves are then the only entropy sources. The governing equations are:

$$\nabla.\left(\rho\vec{V}\right)=0 \ (continuity); \qquad (2.1-a)$$

$$\rho(\vec{V}.\nabla)\vec{V}+\nabla p=0 \ (momentum); \qquad (2.1-b)$$

$$h+0.5\,V^2=const. \ (energy);\ (V^2=V_r^2+V_\omega^2), \qquad (2.1-c)$$

where $\vec{V}(r,\omega)$ is the velocity field, h the enthalpy and ∇ the vectorial operator. The enthalpy of an ideal gas is a function of the temperature *T* only, and can be written as:

$$h(T)=h(T_{ref})+\int_{T_{ref}}^{T} c_p(T)\,dt \qquad (2.2)$$

T_{ref} = 298.15 K being a reference temperature and $c_p(T)$ - specific heat at constant pressure. The specific heat realised by reaction, denoted by *q*, is the enthalpy difference:

$$q=h_1(T_1)-h_2(T_1) \qquad (2.3)$$

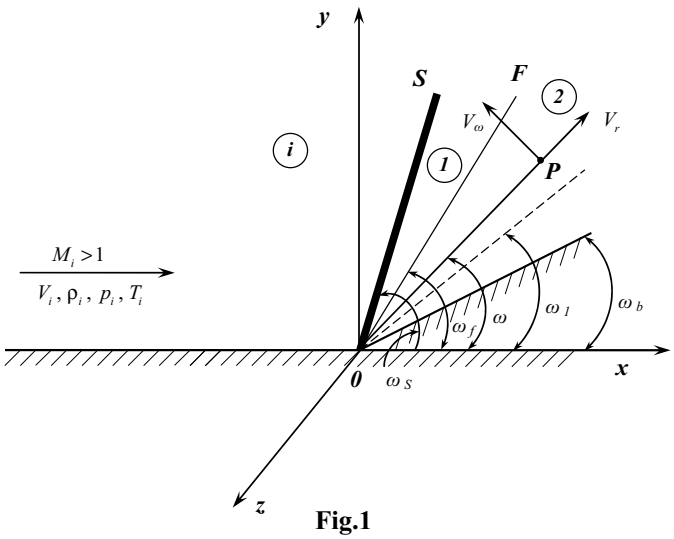


Fig.1
Waves configuration and system of coordinates

3. The method of calculation

The solution can be written on three regions : ***i-the initial region*** (constant, parallel flow; ***2-the cold region*** (between the waves) and ***3-the hot region*** (between the flame and wedge), with discontinuities at the shock and combustion waves where the continuity, momentum and energy equations are directly applied.
The velocity distribution is:

$$V_{r,j} = A_j V_i \cos(\omega - \omega_j)\,;\; V_{\omega,j} = -A_j V_i \sin(\omega - \omega_j);$$
$$j \in \{i;1;2\}, \qquad (3.1)$$

where the constants $A_j, \omega_j, j \in \{i;1;2\}$ have to be determined from the initial state and from conservation conditions at the two waves. First one obtains:

$$A_i = 1;\; \omega_i = 0\;;\; \omega_2 = \omega_b, \qquad (3.2)$$

the last condition (3.2) expressing that the wedge is a stream line. From (3.1) one yields:

$$V_j^2 = V_{r,j}^2 + V_{\omega,j}^2 = A_j{}^2 V_i^2 = const.;\; j \in \{i;1;2\}. \qquad (3.3)$$

Then taking into account the gas general equation (Clapeyron) and the equation of energy (2-c), one obtains:

$$p_j = \rho_j R_j T_j\,;\; T_j, p_j, \rho_j = const.;\; j \in \{i;1;2\}\;, \qquad (3.4)$$

R_j being the gas constants on regions.

The conservation conditions at waves are:
- at the shock wave:

$$\omega = \omega_s\,;\; \rho_1 V_{\omega 1} = \rho_i V_{\omega i}\,;\; p_1 + \rho_1 V_{\omega 1}^2 = p_i + \rho_i V_{\omega 1}^2\,;$$
$$V_{r1} = V_{ri}\,;\; h(T_1) + A_1^2 V_i^2/2 = h(T_i) + V_i^2/2; \qquad (3.5)$$

- at the combustion wave:

$$\omega = \omega_f\,;\; \rho_1 V_{\omega 1} = \rho_2 V_{\omega 2}\,;\; p_1 + \rho_1 V_{\omega 1}^2 = p_2 + \rho_2 V_{\omega 2}^2\,;$$
$$V_{r1} = V_{r2}\,;\; h(T_1) + A_1^2 V_i^2/2 = h(T_2) + A_2^2 V_i^2/2 \qquad (3.6)$$

Unknowns are at this stage: the constants A_1, A_2, ω_1 , the densities, ρ_1, ρ_2, the temperatures T_1, T_2, the pressures p_1, p_2 and the waves angles ω_s, ω_f, in all 11 unknowns, whereas one has only 10 equations given by (3.4), (3.5) and (3.6). The missing condition can be related to the combustion speed, $|V_{\omega 1}(\omega_f)|$ - the mixture velocity normal to the flame. This is related to reaction rate, depending on the mixture composition, temperature and the flow configuration. It can vary in large intervals, being even supersonic in case of detonation waves. Our burning model is intermediary, between detonation and subsonic burning. First, instead a combustion velocity, we introduce a ***combustion Mach number,*** m_{1f}, defined by: $m_{1f} = |V_{\omega 1}(\omega_f)|/a_{1f}$, a_{1f} being the speed of sound. With m_{1f} given one obtains a nonlinear system of 11 equations with 11 unknowns.

4. New parameters to characterize the combustion speed and intensity. Equivalent solid body (ESB) and flame position.

In order to simplify the solving of the nonlinear system of 11 equations and obtain a simpler representation of the supersonic reacting flow, one remarks that at $\omega = \omega_1$ one has, $V_{\omega 1}(\omega_1) = 0$, i.e. the cold region and the shock wave corespond to a solid wedge of semiangle ω_1 . We call this wedge ***equivalent solid body (ESB).*** For reacting flow with heat addition one always has $\omega_1 > \omega_b$ because the gas is expanded and the shock wave is pushed against the flow stream. Then the angle difference $(\omega_1 - \omega_b)$ can be taken as a measure of the added heat. A qualitative representation of the normal Mach number $m = |V_\omega|/a$, points out that the combustion Mach number increases with ***the angle difference*** $(\omega_f - \omega_1)$ that can be taken as a measure for m_{1f}. One can estimate small values of the combustion Mach number: $m_{1f} \in (0.01 - 0.10)$ and $(\omega_f - \omega_1) \in (1^o - 3^o)$. for a large variety of mixtures.

5. Examples of calculation

The reaction is methane - air combustion . One considers an irreversible reaction:

$$\text{CH4} + 2(1+\beta)\text{O2} + 2(1+\beta)0.79/0.21\ \text{N2} = \text{CO2} + 2\ \text{H2O} + 2(\beta - \gamma)\text{O2} + 2((1+\beta)0.79/0.21 - \gamma)\ \text{N2} + 4\gamma\ \text{NO}, \qquad (5.1)$$

where β is the excess of air and γ the percentage of NO that could be obtained. The variation of specific heat with temperature is calculated by introducing a dimensionless temperature θ [5,6] as folows:

$$F_{ci}(\theta)=\sum_{j=1}^{7}\alpha_{ji}\theta^{j-3},\ j=\overline{1;7},i=\begin{cases}1,\ if\ \theta\in I_1=[0.2\ ;1];\\ 2,if\ \theta\in I_2=[1;6]\end{cases}\qquad(5.2)$$
$$c_p(\theta)/R=F_c(\theta);\ \theta=T/\Delta T_{\dim};$$

the dimensionless coefficients α_{ji}, $j=\overline{1;7};i=\overline{1;2}$ being calculated from NASA data [5,6]. The temperature interval used for θ is $\Delta T_{\dim}=1000K$.

Given are: the initial state V_i,ρ_i,p_i,T_i , the wedge angle ω_b and the mixture composition according to the above chemical reaction. The calculation involves the following steps: 1) one chooses a value for ESB angle ω_1;2) one calculates the flow parameters in the cold region 1, by using the method given in [7]; 3) for a fixed angle difference $(\omega_f-\omega_1)$ one verifies the energy equation at the flame; the angle ω_1 is adjusted in order to satisfy the enthalpy increasing by reaction; 2-3 iterations are sufficient.

The results for $T_i=309.5K$, $M_i=4$, $\omega_b=20^o$ and various β and γ are given in Table 1.

6.Conclusions

As one can see the wedge system is able for combustion of various percentages of dilution, with or without dissociation. Of course the percentage of NO depends on temperature needed to reach the chemical equilibrium, being important for T > 2500 K, but the tendency is clear: it leads to temperature decreasing. The combustion Mach number is in the forseen interval (0.01-0.10) for $\delta_f\in(1^o-2^o)$. The released heat q depends mainly on mixture composition, and very slightly on burning speed (δ_f). The flame temperature T_2 for air in excess is close to the one reported by some papers [8,9,10,11,12], whereas the burning speed is larger than the one met at subsonic flow velocities (hundreds of m/sec [3,10], as compared with m/sec [8,9,12]), but smaller than in case of detonation waves (thousands of m/sec). Because at supersonic speed the kinetic energy is important, in order to compare with experiments at low speeds one has to extract the temperature increase corresponding to the difference $(V_i^2-V_2^2)/2$ .Then in case at β = 0.6 (last line from Table 1) an amount of 326.2 K should be extacted, giving 1652.76 K, as compared to 1650 K reported in [12], for the same exces of air. One confirms the advantage and the utility of the new introduced parameters ω_1 **a**nd $\delta_f=(\omega_f-\omega_1)$ to characterize the supersonic combustion.

Table 1

$Methane; T_i=309.5K$, $M_i=4$, $\omega_b=20\deg$ **;** $\delta_f=(\omega_f-\omega_1)$

$\beta//\gamma$	$\omega_1{}^o$	$\omega_s{}^o$	T_1	T_2	$\delta_f{}^o$	q.E-6	m_{1f} .E2
0//0	28.238	41.750	683.1	2598.8	2	1.4687	7.364
0//0	24.151	36.764	609.0	2550.0	1	1.4691	4.154
0.2//0.0	27.246	40.572	668.1	2338.9	2	1.2179	7.556
0.2//0.2	26.695	39.887	657.8	2188.5	2	1.0065	7.687
0.2//0.2	23.366	36.640	598.0	2140.0	1	1.0068	4.231
0.6//0.0	25.882	38.973	647.0	1980.2	2	0.09071	7.833

Aknowledgements. The work has been co-funded by the Sectoral Operational Programme Human Resources Development 2007-2013 of the Romanian Ministry of Labour, Family and Social Protection through the Financial Agreement POSDRU/89/1.5/S/62557.

References

1. Clarke J.E.: *Some Remarks on the Fully Supersonic Flames as Gasodynamical Discontinuities*, The College of Aeronautics, Co. A.Report Aero, 179, UK, 1965
2. Carafoli E., Dumitrescu H.*: The Determination of the Combustion Wave in a Conical Supersonic Flow*, J. Math. And Phys. Sciences, VII, 4, p.397-414, India, dec. 1973
3. Berbente C., Dumitrescu H.*: The Supersonic Combustion Around a Truncated Cone*, Rev.Roum. Sci. Techn.- Mec. Appl., Tome 27, No. 5, p 555-564, Bucharest, 1982.
4. Racoți D.: *Curgeri cu reacții chimice.* (in romanian), PhD Thesis, University "Politehnica" of Bucharest, Bucharest, Romania, 2007
5. Mc.Bride B.J., Zehe, M.J. and Gordon S.: *NASA Glenn Coefficients for Calculating Thermodynamic Properties of Individual Species*, NASA/TP-2002-21556, September 2002
6. Berbente C., Crunțeanu D. Racoți D.: *On the interpretation of certain thermodynamical functions and coefficients for ideal gases in terms of average values within temperature intervals*, TERMOTEHNICA, Anul XIII, nr.1, p.33-42, ISSN 1222-4057, Bucharest, 2009

7. Berbente C., Berbente S.: *Oblique shock waves in 2D supersonic flow considering variable specific heats with temperature*, Proceedings of the 34-th ARA Congress, BUCHAREST, 18-23 May, pg.444-446, Polytechnic International Press, Montreal, 2010
8. Soika A., Dinkelacker F., Lleipertz A.: *Measurement of the resolved flame structure of turbulent premixed flames with constant Reynolds number and varied stoichiometry*, Twenty-Seventh Internat. Symposiumon Combustion/The Combustion Institute, Pittsburg, USA, pp.785–792, 1998
9. Jeffrey A. Sutton and James F. Driscoll: *Rayleigh Scattering Cross Sections of Combustion Species at 266, 355, and 532 nm for Thermometry Applications* OPTICS LETTERS / Vol. 29, No. 22 / November 15, p. 2620-2622, USA, 2004
10. *Berbente* C., Schetz J.A.: *Experiments on Combustion of Liquid Fuel Jets Injected Normal to a Supersonic Hot Air Stream*, Balcksburg VA, USA,,V.PS.I.,Report 054, aug.1976
11. Racoți D., Berbente C.: *Analysis of complex chemical models in hydrogen scramjet combustion*, The First European Conference on H2–FUEL CELLS–MILLENIUM CONVERGENCE, Sept. 21-22, Bucharest, 2007
12. Leventiu C., Cabot G., Renou B.: *Experimental analysis of the thermal structure of highly turbulent premixed flame*, Conference on Highly Resolved Experimental and Numerical Diagnostics forTurbulent Combustion, May 25-26, CORIA, Rouen, France, 2011

CHARACTERISTICS OF JOINING ALUMINIUM MATRIX COMPOSITES

Traian FLESER*, Marius POP-CALIMANU*
* "Politehnica" University of Timisoara , Bv. Mihai Viteazu 1, RO-300222 Timisoara, Romania,
calimanumarius@yahoo.com

Abstract: This paper highlights based on the experimental results the possibilities to extend the use of aluminum matrix composites reinforced with particles of chemical compounds and permanent joint. Also within this paper are presented the results obtained with ultrasound and laser joints by metallographic examination and physical and mechanical tests. Further it is presented a comparison between the results obtained by the joining processes mentioned above.

Keywords: aluminum matrix composites, ultrasonic welding, laser welding

1. Introduction

In the last years, the development of metal matrix composite (MMC) has received worldwide attention because of higher strength and stiffness, in addition to wear resistance and creep resistance compared to corresponding forged alloys. Now, global research focuses mainly on aluminum because of its unique combination of good corrosion resistance, low density and excellent mechanical properties. Unique thermal properties of aluminum composite materials such as metallic conductivity with coefficient of creep, which can be adapted till zero, add new perspectives in aerospace and aeronautics industry [1,2,3].

Current practice uses several methods of jointing metal matrix composites based on Al. The problems that occur from the combination of composite materials are:

- big difference between the melting temperature of the reinforcing elements (2500°C) and the matrix (600-1700°C);
- large differences between thermal expansion coefficient of matrix and the reinforcing elements, which causes high thermal stress;
- thermal conductibility and specific heat of different components, leading to a difference between thermal fields and crystallization conditions of the components;
- implications of the diffusion phenomenon that occurs at the interface of the reinforcement-matrix particles, favored by own thermal fields of the welding process [4,5].

When jointing composite materials based on Al, there might be the risk of emerging an oxide film which makes harder the welding process. On the Al-SiC composite materials, was found that at high temperatures, the laser beam interaction with SiC particles produces a harmful microstructure for weld zone with the occurrence of Al4C3 compound and blocks based on Si. Occurrence of the Al4C3 compound can be avoided by optimizing the welding parameters. Another way to significantly reduce the occurrence of this compound is adding an element of reactive training, such as titanium carbide or use the Ti under shape of wire. In most cases, composite materials are jointing at high temperature and pressure, which leads to deterioration of particles from the material. At the ultrasonic welding this phenomenon is avoided because the welds are made in solid state which reduce the thermal gradients leading to deformation and material embrittlement [6,7,8,9,10].

Our experimental program was based on laser beam welding processes and ultrasound. The results, highlighted the certain possibilities of jointing aluminum matrix composites materials, reinforced with SiC chemical compounds, in terms of elaboration of an improved technology.

2. Experimental program

For experiments were used areas from an extruded piece. Work piece material is: aluminum 70% + 30% SiC. The diameter of the piece in the central zone it was ∅ 40, that was labeled **4.**, diameter ∅ 20 mm, labeled **4..**, in the end zone (Figure 1). The composite material used has weak capacity of plastic deformation.

Figure 1 Subject analyzed through welding tests

Proper preparation of the components in view of jointing the composite material is an essential step for the quality of welding, because processes are sensitive to the hydrogen absorption and porosity. We have used mechanical abrasion tools to remove oxide film from the surface. In some situations, we use an easy chemical attack, but it is necessary to neutralize the effect of the corrosive agent.
The experimental program has focused on technological tests jointing, through next methods:

2.1. Ultrasonic welding

Ultrasonic welding was applied on all available samples, at the parameters from Table 1.

Table 1 The parameters for ultrasonic welding

N°	Sample	Welding time [ms]	Amplitude [μm]	Force [kgf]
1	4.1	20	160	30
2	4.2	20	160	30
3	4..1	20	160	20
4	4..2	20	160	15

2.2. Laser welding

Laser processing procedure was used in two ways:

- evaluation of beam interaction with the composite material;
- evaluating the possibility of jointing components from composite materials.

The working parameters are presented in Table 2.

Table 2 The working parameters for laser processing

N°	1	2	3
Sample	4.	4.	4..
Destination	Interaction	Jointing	Jointing
Power [W]	1200	2000	2400
Pulse width [ms]	8	8	8
Frequency[Hz]	8	6,5	6
Speed[mm/sec]	3,72	3,72	3,72

3. Experimental results and discussion

The experimental program includes metallographic examination and determination of hardness HV1 in the characteristic area of the welded joints. Metallographic examinations were performed on all samples visually classified as appropriate, to evaluate areas of joint and macro- and micro structural state.

3.1. Metallographic examination

3.1.1. Ultrasonic welding

The samples with marks 4. and 4.. using a welding time of 20 ms, highlights the possibility of their jointing (Figure 2 ÷ 3). However, there is a slight nonlinearity of components interface.

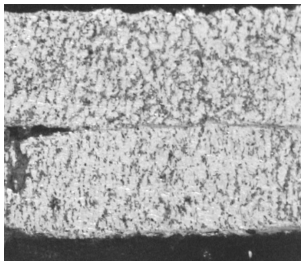


Figure 2 Macroscopic appearance of the sample 4.1 [Attack NaOH5%]

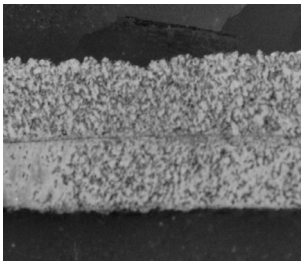


Figure 3 Macroscopic appearance of the sample 4.2 [Attack NaOH5%]

The samples marked by 4.., showed similar behavior (Figure 4 and 5).

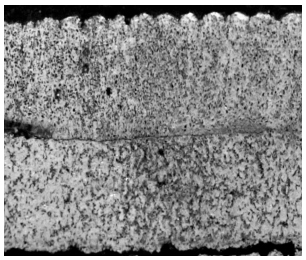


Figure 4 Macroscopic appearance of the sample 4..1 [Attack NaOH 5%]

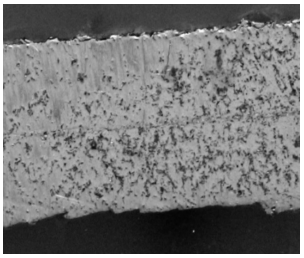
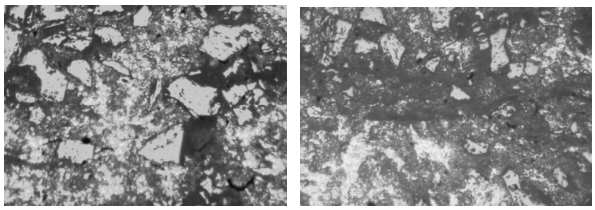


Figure 5 Macroscopic appearance of the sample 4..2 [Attack NaOH 5%]

Microscopic examinations of samples with 4.1 marks have been made in characteristic zones of welds. This characteristics zone is base material (BM) and welding zone (WZ). The samples were attacked with NaOH 5%. Image is magnified by 100 X. It was highlighted a solid solution α (Al) with silicon carbide particles in Figure 6.



a) b)

Figure 6 Solid solution α (Al) with silicon carbide particles. a) – BM, b) – WZ.

It was found that the remaining samples of the 4.1 mark, had the same types of constituents. The situation is normal, considering that, the joints were made at temperatures that do not generate significant structural transformations.

3.1.2. Laser welding

Due to laser processing of materials samples 4. and 4.. presented in Figure 7 and 8, it results an incomplete penetration of the base metal. After increasing beam power, only on a second pass to sample 4.. it is distinguished

melting and adhesion throughout the thickness of base material. Observe the appearance of pores after rapid solidification of the melt.

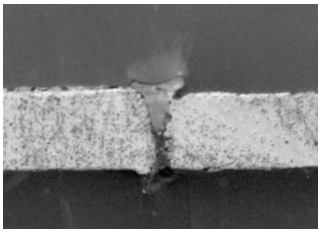


Figure 7 Macroscopic appearance of the sample 4. [Attack NaOH 5%]

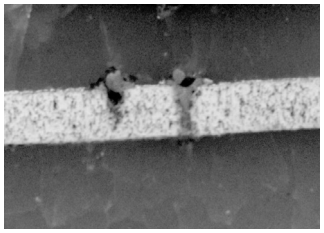


Figure 8 Macroscopic appearance of the sample 4.. [Attack NaOH 5%]

It is noted a certain tendency to expel the molten material from the melt channel. It might be due to porosity of materials for joint.

Microscopic examinations were performed in typical areas of welds BM, HAZ, WM . The samples were attacked with NaOH 5%. Image is magnified by 100 X.

The results of microstructural examinations of areas by laser welding are presented in Table 3.

Table 3 The results of microstructural examinations of areas by laser welding

Sample marker	Examined zone	Microstructure jointing	Figure
4.	BM1	Solid solution α (Al) with clumps of SiC particles	9a
4.	HAZ1	Solid solution α (Al) with SiC particles, dispersed	9b
4.	WM1	Solid solution α (Al) with eutectic (αAl+βSi)	9c
4..	BM2	Solid solution α (Al) with SiC particles, dispersed	9d
4..	HAZ2	Solid solution α (Al) with clumps of SiC particles, eutectic αAl+βSi)	9e
4..	WM2	Solid solution α (Al) with primary crystals βSi and eutectic	9f

* BM – base metal, HAZ – heat-affected zone; WM-welding metal;

The emergence of different constituents was noted, in characteristic zones of different constituents of examined samples, which affects the welding process and is presented in Figure 9. This was due to induced melting high temperature and high cooling speed.

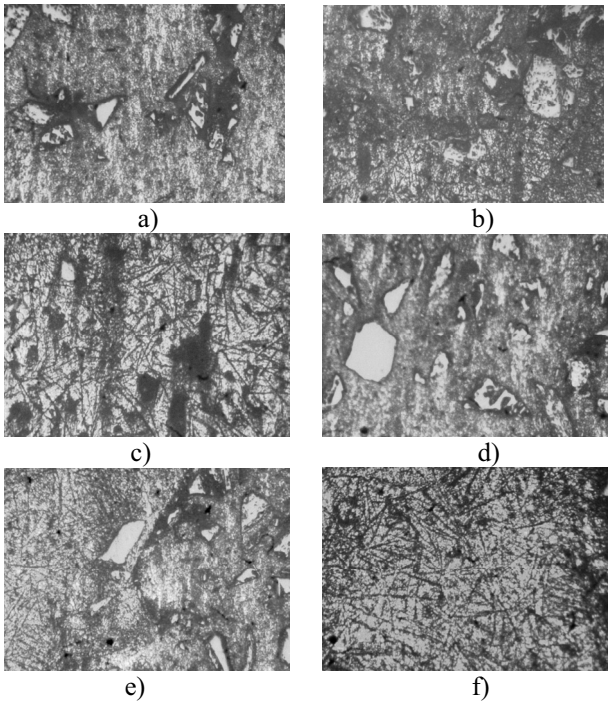


Figure 9 Microstructures of examinating zone, welded by laser

3.2. Determination of hardness

After welding the sample using ultrasonic and laser, were made hardness measurements HV1, presented in Figure 10 and 11.

For samples welded with ultrasound, the hardness values are affected by the presence of reinforcement particles in significant quantity.

Lowest hardness values are in the welding zone up to 20÷25% below of base material. Thus, the hardness of the sample 4.1, in the welding zone it was between 39, 0 ÷ 40,5 HV1, and in the base material between 42,9 ÷51,4 HV1.

On the test 4.., the hardness was between 28,5 ÷ 45,0 HV1in the welding zone, and in the base material between 37,6÷ 44,2 HV1.

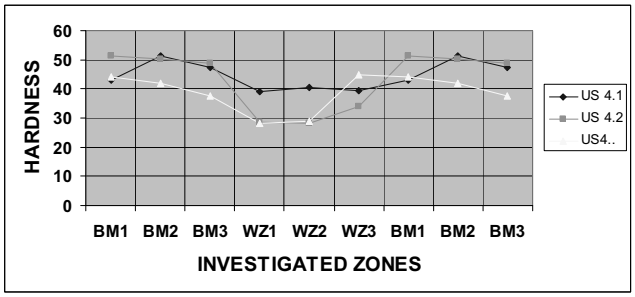


Figure 10 Variation of hardness HV1 in ultrasonic welding

The diagram representation highlights the small-scale effects on hardness HV1, after ultrasonic welding process. In central areas of joints there is a decrease in hardness compared to neighboring areas.

It is finds significant dispersion of hardness of values, which is in concordance with micrographic images. At the material unaffected by the jointing process this behavior also emerges. The cause of dispersion it is the presence of SiC particles of random sizes and positions. As increasing technological parameters of the jointing process, the dispersion of hardness values between jointing areas enhances.

For samples with laser welding, the hardness values are different in areas affected by the process, compared with the previous method of jointing.

There are significant differences between hardness values, especially in melted metal, due to the occurrence of an area with eutectic and agglomerations of SiC particles.

Thus, on sample 4.. , taken from the end of extruded piece, the evolution of hardness was between 43, 7 ÷ 46, 8 HV1 in the base material, 39, 0 ÷ 70, 7 HV1 in heat-affected-zone, and between 106 ÷ 193 HV1 in the welding metal.

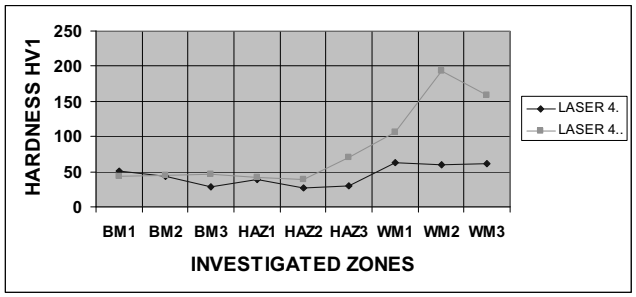


Figure 11 Variation of hardness HV1 in laser welding

Laser process brings significant changes, in joints area subjected to high thermal effects, evidenced by increasing hardness.

4. Conclusions

a) Examination of samples from composite materials Al + 30% SiC in extruded state, welded with ultrasonic, highlighted the technological possibilities for achieving the corresponding joints. Some issues in terms of adherence of extruded components were reported in samples processed.

b) At the laser processing it is observed that a part of molten metal it was removed from the action zone of concentrated energy. That material quickly solidifies, making a random joint on the thickness of the components. The porosity of the components material disturbs the ongoing process.

c) By microscopic examination of samples (Al + 30% SiC), we observed that the degree of distribution and the particles size of SiC, are variable from one sample to another, which affects the joints process.

d) At the ultrasonic welding, no significant changes in hardness HV1 were found.

e) At the basic material from the samples (Al + 30 % SiC), may arise increases in hardness. In heat-affected zone (HAZ), at the laser welding, arisen increases of hardness, due to formation of eutectic areas (αAl+βSi) generated by agglomerations of Si carbide. In molten metal (MM), hardness value is higher, generally, over 100 HV1 units, by incorporating into the melt, a larger quantity of Si carbide and the formation of eutectic (αAl+βSi), at the cooling.

Acknowledgement

"This work was partially supported by the strategic grant POSDRU 107/1.5/S/77265, inside POSDRU Romania 2007-2013 co-financed by the European Social Fund – Investing in People."

References

[1] Naresh P., *Development and characterization of metal matrix composite using red mud an industrial waste for wear resistant applications*, India, 2006;

[2] J.R. Davis, ASM Specialty Handbook, *Aluminium and Aluminium Alloys*, ASM International, 1993.

[3] Ejiofor J.U., Reddy R.G., *Developments in the Processing and Properties of Particulate Al-Si Composites*, JOM, 49 (11) (1997), pp. 31-37.

[4] Popescu M., Constantin M., *Imbinarea materialelor composite*, ISBN 978-973-625-762-9,Timisoara, 2008

[5] Persson H., *Guidelines for joining of metal matrix composites*, Volume 8 MMC Asses, Thematic Network,2001;

[6] Fleser T., Pascu R., *Quality evaluation of some composites materials joining*, 5th Int. Conference Structural Integrity of Welded Structures (ISCS2007), Timisora, Romania, 20-21 Nov 2007

[7] Anandkumar R., Almeida A., *Microstructure and wear studies of laser clad Al-Si/SiC(p) composite coatings,* Surface & Coatings Technology 201 (2007) 9497–9505

[8] Niu J.,Zhang D., *Effect of pulse parameters on microstructure of joint in laser beam welding for* $SiC_p / 6063$ *composite,* Trans. Nonferrous Met. Soc. China, Vol 13 Apr. 2003

[9] Imai, H., Matsuoka, S., 2005, *Finding the optimum parameters for ultrasonic welding of aluminum alloys*, JSME Int. J. 48-4,311–316.

[10] Kong, C.Y., et al., 2003, *Characterisation of aluminium alloy 6061 for the ultrasonic consolidation process*,Mater. Sci. Eng. A 363, 99–106.

ANALYSIS OF THE FLOW FOR OPTIMIZING THE COANDA EJECTOR PERFORMANCE

Alexandru DUMITRACHE[*], Florin FRUNZULICA[*,], Octavian PREOTU[***], Horia DUMITRESCU[*]**

[*] Institute of Mathematical Statistics and Applied Mathematics, Calea 13 Septembrie 13, sect. 5, RO-010145 Bucharest, alex_dumitrache@yahoo.com, horiadumitrescu@yahoo.com

[**] Politehnica University of Bucharest, Faculty of Aerospace Engineering, Gh. Polizu 1-6, sect 1, RO-011061, Bucharest, ffrunzi@yahoo.com

[***] University of Craiova, A. I. Cuza 13, 200585, Craiova, Romania, opreotu@yahoo.com

Abstract. In this approach, we are interested in detailed behavior of an existing Coanda ejector model, used in propulsion systems. For numerically investigations we use an implicit formulation of the compressible Reynolds-average Navier-Stokes equations (RANS) for axisymmetric flow with a shear stress transport k-ω (SST model) turbulence model. The numerically results was obtained for a total pressure range 1-5 Bars, imposed at the reservoir inlet. The computational domain includes the adjacent regions of the ejector with the physical opening boundaries condition.

The task of this study is to investigate the influence of various geometric parameters and pressure ratios on the Coanda ejector performance. The effect of various factors, such as, the pressure ratio, primary nozzle and ejector configurations on the system performance has been evaluated based on defined performance parameters. The performance of the Coanda ejector mainly depends on the primary nozzle configuration and the pressure ratio. The mixing layer growth plays a major role in optimizing the performance of the Coanda ejector as it decides the ratio of secondary mass flow rate to primary mass flow rate and the mixing length.

The numerical results have been compared with theoretical and experimental results for a given Coanda ejector configuration.

Keywords: Coanda effect, Coanda flow, Turbulent flow

1. Introduction

The Coanda ejector is an axisymmetric device that uses the injected primary flow on the inner curved surface and entrains the secondary flow (induced flow). The main purpose of the Coanda ejector is to provide a high ratio of the induced mass flow rate to the primary mass flow rate

A primary flow is supplied from a high pressure reservoir. The primary flow follows the curved contour of the ejector after a sonic throat, due to the Coanda effect, and expansion waves/compression waves are created depending on the pressure at the outlet section of the primary nozzle. Due to the high velocity of the expanding primary jet, a mixing zone is developed at the primary nozzle outlet. This turbulent mixing of the primary flow with the ambient air near the entrance of the ejector transfers the momentum of the primary jet to the stagnant air in the ejector throat. The secondary or induced flow is thus dragged by the turbulent shear stress along with viscous effects towards the ejector exit while being mixed with the primary flow by the persistence of a large turbulent intensity throughout the ejector. There are few works [1-5] which examine the basic mechanism by which the secondary flow is induced in the ejector, the semi-empirical relations to predict the mixing parameter of an arbitrary configuration are not available yet.

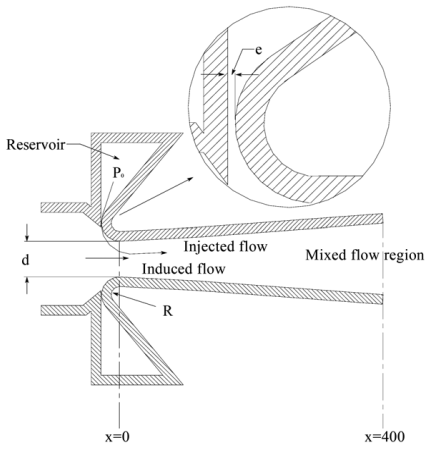


Figure 1 Schematic of the Coanda ejector

In this paper the authors will study the various flow patterns inside the Coanda ejector and the effect of various design parameters on the mass flow rate of the induced flow numerically.

2. Equations

2.1. Dimensionless Forms of Fluid Transport Equations

Dimensionless quantities are universal, and independent of operating variables, such as fluid, geometric scale, operating pressure, etc. Therefore, all parameters in the research are converted to the dimensionless terms.

The fluid transport equations such as the mass (continuity), momentum, and energy conservation equations are demonstrated in this section.

The mass conservation equation, or continuity equation, for the compressible flow is:

$$\partial\rho/\partial t + \overline{\nabla}\cdot(\rho\overline{v}) = 0$$

where: $\rho =$ fluid density (kg/m^3), t = time (s), v = fluid velocity in a vector notation (m/s), $\overline{\nabla} =$ gradient operator. The characteristic density and velocity are introduced to transform this equation to the dimensionless form. We define: $\rho_c =$ characteristic (an inlet) density of the fluid (kg/m^3) , U = characteristic (an inlet) velocity of the fluid (m/s) , $t_c =$ characteristic time (s), and L = characteristic length = an inlet diameter of ejector (m).

Then each term is converted to dimensionless form by multiplying and dividing each term by their characteristic parameters, and then rearranging the equation to the dimensionless parameters. Consequently, the dimensionless form of this equation is presented in the following equation

$$\partial\widetilde{\rho}/\partial\widetilde{t} + \widetilde{\overline{\nabla}}\cdot(\widetilde{\rho}\widetilde{v}) = 0$$

Momentum conservation for compressible flow in dimensional form is [6]:

$$\rho\frac{\partial}{\partial t}(\rho\overline{v}) + \overline{\nabla}\cdot(\rho\,\overline{v}\overline{v}) = -\overline{\nabla}P_{dyn} + \mu\nabla^2\overline{v} + 2\overline{\nabla}\mu\cdot\overline{\nabla}\overline{v}$$
$$+\overline{\nabla}\mu\times(\overline{\nabla}\times\overline{v}) + \frac{1}{3}\mu\overline{\nabla}(\overline{\nabla}\cdot\overline{v}) - \frac{2}{3}(\overline{\nabla}\cdot\overline{v})\overline{\nabla}\mu$$

where: D/Dt = material derivation, P_{dyn} = dynamic pressure (Pa), μ = fluid viscosity ($\mathrm{N}\cdot\mathrm{m}$) , ∇^2 = Laplacian operator. Since the geometrical configuration of the ejector is axisymmetric, the continuity equation will be used in axisymmetric coordinates

$$\frac{\partial\rho}{\partial t} + \frac{\partial}{\partial x}(\rho\overline{v}_x) + \frac{\partial}{\partial r}(\rho\overline{v}_r) + \frac{\rho\overline{v}_r}{r} = 0$$

and the mass conservation equation in axisymmetric case is

$$\frac{\partial}{\partial t}(\rho\overline{v}_x) + \frac{1}{r}\frac{\partial}{\partial x}(r\rho\overline{v}_x\overline{v}_x) + \frac{1}{r}\frac{\partial}{\partial r}(r\rho\overline{v}_t\overline{v}_x) = -\frac{\partial P}{\partial x}$$
$$+\frac{1}{r}\frac{\partial}{\partial x}\left[r\mu\left(2\frac{\partial\overline{v}_x}{\partial x} - \frac{2}{3}(\overline{\nabla}\cdot\overline{v})\right)\right] + \frac{1}{r}\frac{\partial}{\partial r}\left[r\mu\left(\frac{\partial\overline{v}_x}{\partial r} + \frac{\partial\overline{v}_r}{\partial x}\right)\right]$$

2.2. The Energy Equation

In compressible fluid, the energy equation is used corporately with the transported equations to calculate fluid properties.

The governing energy equation is presented (Fluent, 2001):

$$\frac{\partial}{\partial t}(\rho E) + \overline{\nabla}\cdot\left[\overline{v}(\rho E + P)\right] = \overline{\nabla}\cdot\left[k_{eff}\overline{\nabla}T - \sum_j h_j\overline{J}_j + (\overline{\overline{\tau}}_{eff}\overline{v})\right] + S_h$$

where: E = internal energy (J), k_{eff} = effective conductivity (J/K), $\nabla T =$ total temperature difference (K), h_j = sensible enthalpy of species j {J), $\overline{J}_j$ = diffusion flux of species j, $\overline{\overline{\tau}}_{eff}$ = effective viscous dissipation ((Js)/m), and $S_h =$ volumetric heat sources (J).

The equations can be spatially averaged to decrease computational cost, yet the averaging process yields a system with more unknowns than equations. Hence, the unclosed system requires a model (e.g., turbulence, or subgrid scale) to make the problem well posed. Such models are used in **RANS** and LES approaches to CFD.

All the equations stated above are used to calculate fluid properties in CFD code, **Fluent**.

2.3. The Turbulence Modeling: SST Model Formulation

The basic idea behind the SST model is to retain the robust and accurate formulation of the Wilcox $k-\omega$ model in the near wall region, and to take advantage of the free stream independence of the $k-\varepsilon$ model in the outer part of the boundary layer.

In order to achieve this aim, the $k-\varepsilon$ model is transformed into a $k-\omega$ formulation by means a function that is one in the near wall region and zero away from the surface. The final form is

$$\frac{\partial}{\partial x_j}(u_j k) = \frac{\partial}{\partial x_j}\left[(\nu + \sigma_{k1}\nu_t)\frac{\partial k}{\partial x_j}\right] + P_k - Y_k$$
$$\frac{\partial}{\partial x_j}(u_j\omega) = \frac{\partial}{\partial x_j}\left[(\nu + \sigma_\omega\nu_t)\frac{\partial\omega}{\partial x_j}\right] + \gamma P_\omega - Y_\omega +$$
$$2(1-F_1)\sigma_{\omega1}\frac{\nu_t}{k}\frac{\partial k}{\partial x_j}\frac{\partial\omega}{\partial x_j}$$

Model constants and implementation are presented in detail in the papers [7, 8].

3. Numerical model

In the CFD study, the jet ejector model geometry matched the experimental apparatus. A commercial CFD code **FLUENT** with a preprocessor, **GAMBIT** has been used to conduct the numerical analysis on the Coanda ejector. An axisymmetric Coanda ejector model has been created with a structured and unstructured grid system with quadrilateral cells. The grid size was optimized to be small enough to ensure that the CFD flow results were virtually independent of size, but large enough to ensure the model run efficiently at an acceptable speed [9].

A non-uniform grid was selected because it provided the greatest control of the number of cells and

their localized density. For optimal meshing, the grid density increased near the wall and in areas where flow gradients were steep. This was accomplished by applying weighting factors to increase the grid density at these areas.

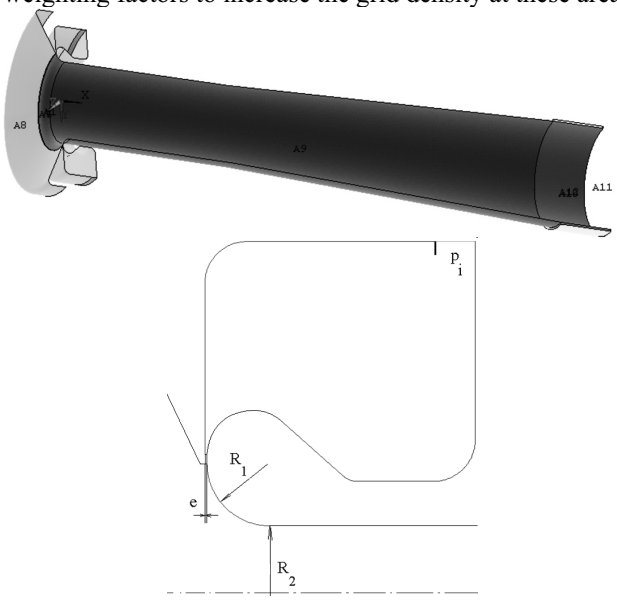


Figure 2 3-D geometric configuration (up) and zoom of the throat gap and Coanda surface (down) of the investigated Coanda ejector.

The used mesh is divided in structured grid near the wall and unstructured grid otherwise. The y^+ values of the wall-next grid points were between 0.2 and 1, and the Δx^+ values were between 50 and 300.

The numerically results was obtained for a total pressure value of 5 bar, imposed at the reservoir inlet. The computational domain includes the adjacent regions of the ejector with the physical opening boundaries condition.
FLUENT is a density based finite volume computational fluid dynamics code which solves the three-dimensional or axisymmetric compressible Navier-Stokes equations in the desired domain. The flow is considered to be steady.

There are the following geometrical configurations (Figure 2):
$e_1 = 0.25\,mm, R_1 = 7.5\,mm; e_2 = 0.4\,mm, R_2 = 37.5\,mm$.

4. Results and discussion

Figures 3 and 4 show the velocity vectors and the Mach contours for an axisymmetric model of the Coanda ejector. The induced flow does not follow the path defined by the primary jet. The Mach contours clearly show the flow patterns of the primary and induced flows and how they mix in the divergent portion of the ejector.

Figures 5 and 6, the flow velocities at x = 0, and x = 550 are plotted against the diameters of the Coanda ejector for various values of "e" (continuous line – CFD results, Exp –experimental data). One can easily understand the degree of mixing of the primary flow and the induced flow. It may be seen that the graph can be split into two parts: the first part characterized by large velocity gradient with high velocities and a second part where the velocity gradient is small. The first part represents the primary flow while the second part is related to the induced flow.

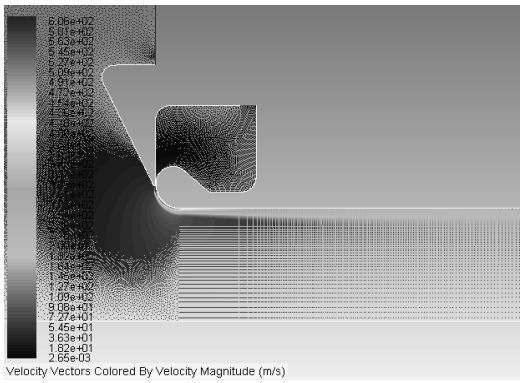


Figure 3 Velocity vectors at the primary flow nozzle exit

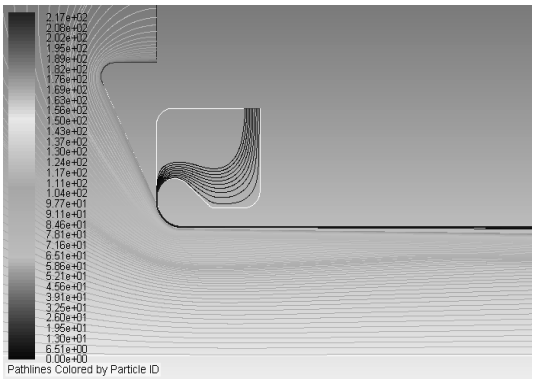


Figure 4 Mach contours at the ejector throat

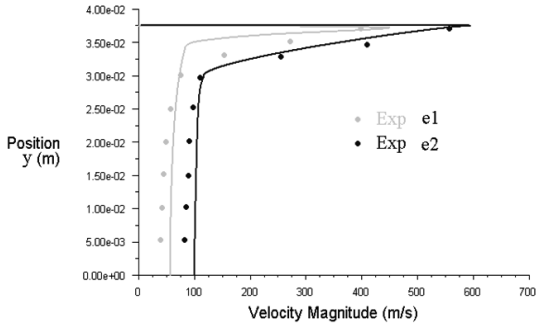


Figure 5 Velocity profiles at section x = 0 for various 'e'

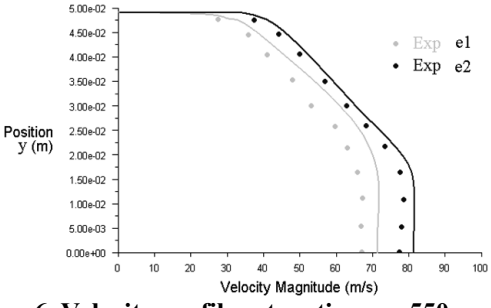


Figure 6 Velocity profiles at section x = 550 mm for various 'e'

The flat portion of the velocity profile indicates that the two flows are mixed completely. Similar trend can be seen in Fig. 6 also, where the velocity profile at a section x = 550 is plotted against the diameter of the Coanda ejector. Flow velocity is low here and the mixing percentage is higher.

Also the flow velocities for two diameters of the Coanda ejector are analysed. Although cross-sectional area increases when the diameter increases, the increment in mass flow rate is quite low. This phenomenon can be explained based on the fact that the induced flow is dragged due to turbulent mixing that leads to momentum transfer from injected flow to induced flow.

Considering the velocity at x = 550, it is easily observable that the mixing layer is more developed for the higher diameter. The compression imposed on the primary flow by the shock waves will also be weaker and its Mach number downstream of the shock wave compression zone is higher. This will lead to a slower expansion rate of the mixing layer due to the compressibility effect.

4.1 Performance analysis

The performance of a Coanda ejector is the efficiency with which the primary flow drags the secondary flow and how well both the flows are mixed in the ejector. Thus, the efficiency may partly be defined in terms of the length from the supply throat, where the two flows are mixed completely. Also, from an energetic point of view, the ratio of the induced mass flow rate to the primary mass flow rate per available stagnation pressure in the reservoir, termed as ω, will be an important parameter to measure the Coanda ejector performance. The optimization study of the Coanda ejector is attempted mainly based on the primary nozzle throat and the stagnation pressure ratio.

Based on the computational results, it is seen that the throat gap and the stagnation pressure ratio are the two critical parameters which have great influence on the performance of the Coanda ejector [10]. Changing the throat gap leads to a modified pressure distribution at the throat of the nozzle resulting in modified average flow velocity in the ejector. Hence, enhancing the average velocity by modifying the throat gap of the primary nozzle in the Coanda ejector could yield performance enhancement. So, the selection of proper stagnation pressure ratio and a better defined relation between the induced inlet section and the sonic throat can lead to an optimum design of the device. The present computational study has permitted to identify the important parameters which have strong influence on the Coanda ejector behavior and performance.

5. Conclusion

By a computational study the effect of various geometric parameters on the performance of the Coanda ejector has been analyzed. The throat gap of the primary nozzle (‘*e*’) has a strong influence on the ratio of mass flow rates of the induced flow and the primary flow and a critical control over the mixing length as well. For reduced throat gaps, the mixing length decreased, and this possibly indicates the rapid mixing layer growth in the ejector. Another important parameter which has a strong influence on the performance of the ejector is the stagnation pressure ratio due to the relation of which with the jet shock cell structure, stability of the jet and the entrainment rates. Even though the performance factors for different diameters of the ejector did not differ much, the mixing layer was more developed for higher values of the diameters of the ejector throat.

Acknowledgement: This work was supported by IDEI Research Program of Romanian Research, Development and Integration National Plan II, Grant no. 543/2008.

References

1. Smith, D. G. G. and Gilchrist, A. R.: *The Compressible Coanda Wall Jet – An Experimental Study of Jet Structure and Breakaway,* Intl. J. Heat and Fluid Flow, Vol.8, 1987, p. 156-164.
2. Smith, D. G. G. and Senior, P.: *The Effect of Base Steps and Axisymmetry on Supersonic Jets over Coanda Surfaces*, Intl. J. Heat and Fluid Flow, Vol.15, no.4, 1994, p. 291-298.
3. Guerriero, V., Baldas, L. and Caen, R.: *Numerical Solutions of Compressible Flow Mixing in Coanda Ejectors,* in CD-Rom Proc. The Eighth Symposium on Fluid Control, Measurement and Visualization, China (8FLUCOME), Q.-D. Wei and X.-G. Deng, Eds. Chengdu, China, 2005, p. P343:1-7.
4. Dumitrache, F., Frunzulica, F., Preotu, O., Dumitrescu, H.: *Numerical analyis of turbulent flow in a Coanda ejector,* 82nd Annual Scientific Conference of the International Association of Applied Mathematics and Mechanics (GAMM), Graz, Austria, April 18 - 21, 2011 (to be published in PAMM J.).
5. Frunzulica, F., Dumitrache, A., Preotu, O.: *Control of two-dimensional turbulent wall jet on a Coanda surface*. 82nd Annual Scientific Conference of the International Association of Applied Mathematics and Mechanics (GAMM), Graz, Austria, April 18 - 21, 2011 (to be published in PAMM J.).
6. Happel J, Brenner H.: *Low Reynolds Number hydro- dynamics*, Englewood Cliffs, NJ: Prentice-Hall, 1965.
7. Menter, F.R.: *Eddy viscosity transport equations and their relation to the k-ω mode,* ASME Journal of Fluids Engineering, vol. 119, 1997, p. 876-884.
8. Neuendorf, R., Wygnanski, I.: *On a turbulent wall jet flowing over a circular cylinder,* Journal of Fluid Mechanics, vol. 381, no. 1, 1999, p. 1-25.
9. Riffat, S. B., Everitt, P.: *Experimental and CFD modeling of an ejector system for vehicle air conditioning*, Journal of The Institute of Energy, vol. 491, p.41-47, 1999.
10. Kim, H.D., Lee, J.H., Setoguchi, T., Matsuo, S.: *Computational analysis of a variable ejector flow*, Journal of Thermal Science, vol. 15, 2006, p.140-44.

ACTIVE AND PASSIVE CONTROL METHODS ON THE AERODYNAMIC SURFACES

Florin FRUNZULICA[*,], Alexandru DUMITRACHE[**], Octavian PREOTU [***], Horia DUMITRESCU[**]**

[*] "POLITEHNICA" University of Bucharest, Faculty of Aerospace Engineering, Polizu 1-7, 011611 Bucharest, ROMANIA, e-mail: ffrunzi@yahoo.com

[**] "Gheorghe Mihoc-Caius Iacob" Institute of Statistics and Applied Mathematics, Calea 13 Septembrie no. 13, 050711 Bucharest, ROMANIA, e-mail: alex_dumitrache@yahoo.com

[***] University of Craiova, st. A. I. Cuza no.13, 200585, Craiova, Romania, e-mail: opreotu@yahoo.com

Abstract. Flow control refers the ability to alter flows with the aim to achieve a desired effect: examples include delay of boundary layer separation and drag reduction, noise attenuation, improved mixing or increased combustion efficiency among many other industrial applications. The main objective of this paper is to investigate ways of keeping the flow attached to a larger length of a Coanda surface, with application in aerospace and wind energy. We investigated two possibilities: one passive, which uses a slot, and an active one, based on the principle of synthetic jet. Reynolds averaged Navier-Stokes simulations (RANS) with shear stress transport k-ω (SST model) of Menter have been used to compute the two-dimensional turbulent flow. The numerical results are presented for the two methods considered.

Keywords: active control, passive control, turbulent flow, RANS

1. Introduction

In the field of aerospace engineering, the aerodynamic design of future civilian and military aerospace vehicles will be greatly influenced by flow control technologies available for high-lift devices, flight at high angle of attack, jet engine inlet and exhaust systems, thrust vectoring, jet noise reduction, etc. The flow control devices will be used in a variety of flow situations: to energize the boundary layer and to control of boundary layer transition in low and high speed regimes, to modify the shear layers, to produce jet deflections and to control oscillations of different structural parts of the aircraft.

In the field of wind energy, aerodynamic control is achieved by variable pitch blades and in present by stall control; however, other control concepts for efficiency improvement become a substantial source of study.

The approaches for separation control can be broken in: (1) *passive control* (vortex generators, flaps/slats, slots, absorbant surfaces and riblets) and (2) *active control* (mobile surface, planform control, jets, advanced controls - magnetodynamics).

The circulation control as active control technique is know as beneficial in increasing the bound circulation and hence the lift coefficient of airfoil. This technology has been investigated both experimentally and numerically in the last decade [1]. Circulation control is implemented, usually, by tangential blowing a small high-velocity jet over a highly curved surface, such as a rounded trailing edge. This causes the boundary layer and the jet to remain attached along the curved surface due to the Coanda effect (the tendency of a moving fluid to attach itself to a surface and flow along it) and causing the jet to turn without separation.

Forced jets have a few disadvantages: complexity of internal piping from a source of pressure or vacuum, and the parasitic cost to produce this pressure. A currently challenge is to reduce the power consumption to produce the jet and using efficiently the jet to control flow separation.

The active control without additional net mass flow can be achieved by synthetic jets or small vibrating flap. A synthetic jet is a concept that it consists of an orifice or neck driven by an acoustic source in a cavity [2]. At sufficiently high levels of excitation by the acoustic source, a mean stream of flow has been observed to emanate from the neck. The excitation cycle increase the ability of the boundary layer to resist separation.

Another technique of increasing the lift of airfoils is the use of passive devices, one of these being known as Gurney flap [3]. The Gurney flap is a small tab attached perpendicular to the lower surface of the airfoil in the vicinity of the trailing edge, with a height that can vary from 1% to 5%. The results showed a significant increment in lift compared to the baseline airfoil.

Another passive device uses a slot between lower-pressure and high-pressure points (near the separation

point) on the upper surface of the thick airfoil (at positive angle of attack). Mounting on the slot a controlled hydraulic resistance we can control the separation point of the boundary layer [4].

In this paper we investigate three issues related to flow control with applicability in aerospace and wind energy: appropriate turbulence model for the study of jets on convex surfaces, passive control using a slot and active control using synthetic jet at medium frequencies on Coanda surfaces.

2. Coanda effect. Computational analysis

The main goal is to provide a systematic survey of the performance of selected eddy-viscosity models in a range of curved flows and to establish more clearly their potential and limitations.

Reynolds averaged Navier-Stokes simulations (RANS) with different turbulence models have been employed to compute the two-dimensional turbulent wall jet flowing around a circular cylinder: (1) Spalart and Allmaras (SA - one equation turbulence model) [5], (2) Launder and Spalding k-ε model [6], (3) Wilcox k-ω model [7] and (4) Menter k-ω SST model [8]. The predictions of the simulations were compared to available experimental measurements in the literature.

The particular configuration shown in figure 1 is considered since cylindrical wall jet properties have been reported by Neuendor and Wygnanski [9] and provide a means for evaluation of simulation results (diameter d=0.2032 m, nozzle height b=2.34 mm and jet-exit velocity V_{jet}=48 m/s). For the turbulence models used in these calculations the laminar sublayer needed to be resolved. The y^+ values of the wall-next grid points were between 0.2 and 1, and the Δx^+ values were between 50 and 300. The grid resolution in the jet was between 40 and 180 times the local Kolmogorov length scale. The computational grid consists of 720 nodes (on cylindrical wall) x 150 nodes (on radial direction).A fully developed channel velocity profile was prescribed at the nozzle inflow. The ambient was quiescent.

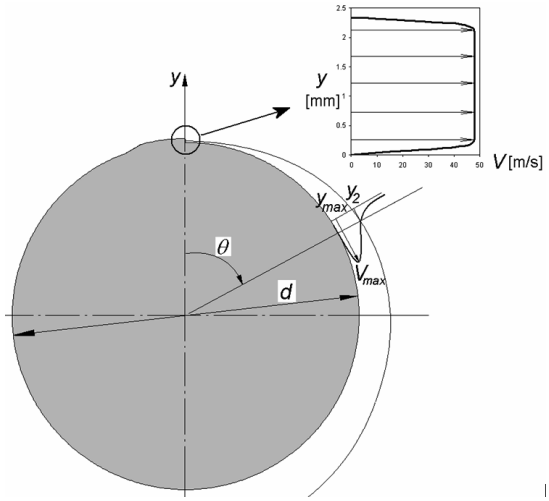


Figure 3 Configuration used in analysis

One weakness of the eddy-viscosity models is that these models are insensitive to streamline curvature and system rotation. Based on the work of Spalart and Shur a modification of the production term has been derived, which allows to sensitize the standard k-ω, SST model to these effects.

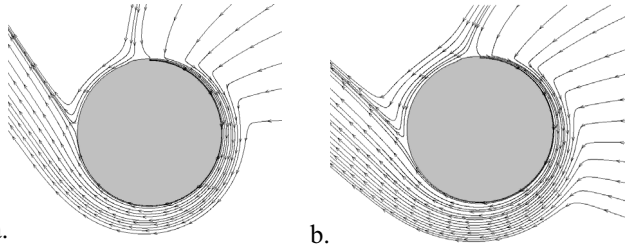


Figure 2 Streamlines: k-ε (a) and k-ω SST c.c. (b)

For the k-ω SST model (with curvature correction – c.c.) the separation location was slightly closer to the experiment. When the k-ε and Spalart-Allmaras models were used, the jet remained attached to the cylinder for more than 270 deg (figure 2).

For some of these turbulence models the jet-velocity decay and jet-half-thickness are plotted in figure 3 against streamwise angle. When the k-ω SST c.c. model was used a close match of the jet-velocity decay with the measured data was achieved.

Because the predicted half-thickness was small for all models, the normalized velocity profiles do not match the experimental velocity profiles, either in the mild pressure region or in the adverse pressure region.

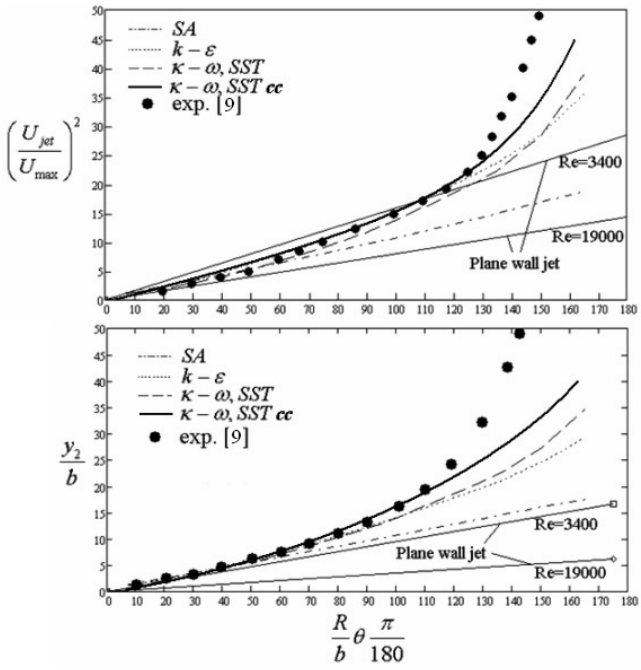
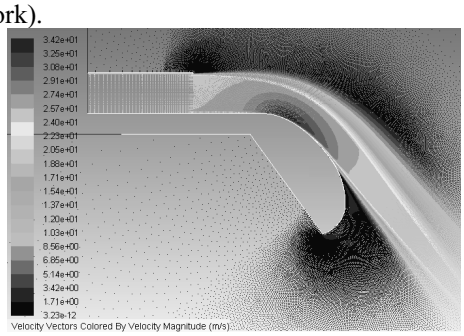


Figure 3 Jet velocity decay and jet-half-thickness

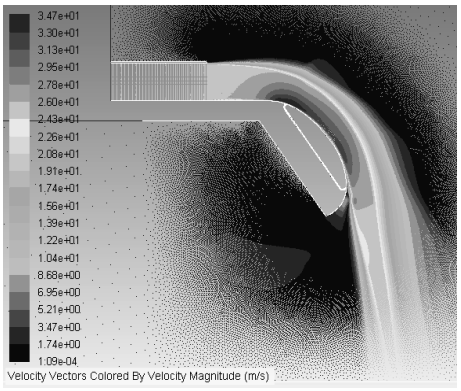
3. Passive control using a slot

The first computational case uses a simple convex surface and the second computational case uses the same convex surface with a slot between over-pressure point on the surface and under-pressure point on the surface (placed in separation boundary layer region). The tendency of equalization of pressures leads to blow in the first orifice of slot, while in the second orifice we have the suction.

The jet is developed in a rectangular channel with 9 mm height and it has velocity V_{jet}=25 m/s. For computation we use steady RANS with k-ω SST c.c. turbulence model and computational grid has 219,300 nodes. The suction-blowing phenomenon has a beneficial effect on keeping boundary layer attached on 82% of the surface compared to the case without the slot when boundary layer is attached to the 58% of the surface. The figure 4 shows the two situations mentioned. The jet is deflected by 20 degrees from the original direction. Using a hydraulic resistance on the slot we can control the separation point of the jet and the jet orientation (the problem will be investigated in a future work).



a.



b.

Figure 4 Velocity vectors without (a) and with (b) slot

4. Active control using synthetic jet (SJ) concept

4.1. Laminar boundary layer interacting with SJ on flat plate

The concept is shown in figure 5, where the synthetic jet is embedded in the wall of a boundary layer for which separation control is desired. The cavity is provided at the bottom with a mobile surface that oscillates sinusoidal with 1 mm amplitude and 50 Hz frequency. The flow (15 m/s) over plate is laminar with Blasius velocity profile.

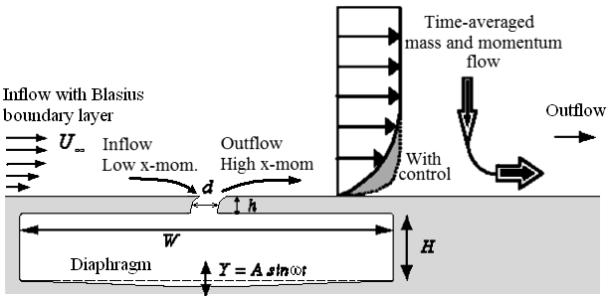
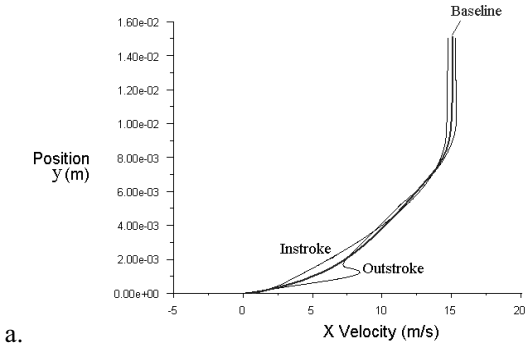


Figure 5 Boundary layer interacting with SJ

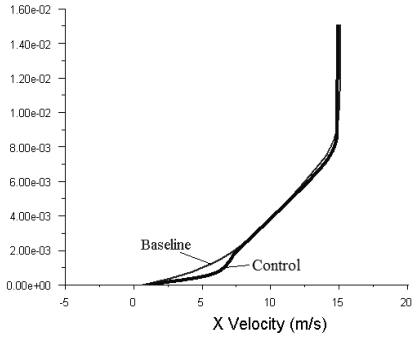
One parameter found useful in the normalization of the jet velocity is the maximum inviscid jet velocity which for the prescribed membrane motion (sinusoidal oscillation) is given by $V_{\max}^{inv} = AW\omega/(2d)$ =6.3 m/s.

The simulation includes the dynamic mesh model using a spring network near the membrane for interacting between membrane and adjacent fluid.

In figure 6.a the instantaneous profiles downstream of the slot (40 mm) at the peak of the in-stroke and peak of the out-stroke are shown versus the baseline. The in-stroke profile illustrates the wall removal of the low-momentum fluid at the same time with a freestream velocity decrease, and the out-stroke profile illustrates the high-momentum injection at the same time with a freestream velocity increase. The time-averaged controlled boundary versus the baseline profile is given in figure 6.b which shows the energization effect of the synthetic jet with a net diffusion of the freestream.



a.

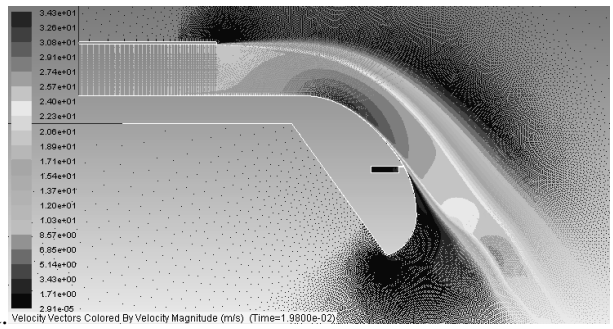


b.

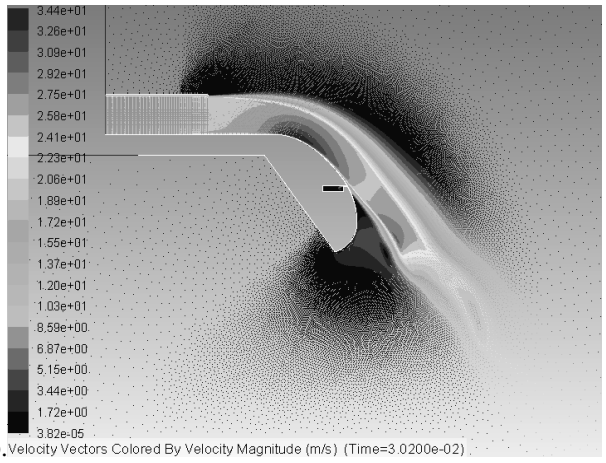
Figure 6 The velocity profile: Instantaneous velocity profiles on flat plate with and without control (a) and time-averaged velocity profiles on flat plate with and without control (b).

4.2. Turbulent boundary layer interacting with SJ over Coanda surface

The configuration is the same as in section 3 but it has an actuator with lateral slot placed at the point of the detached boundary layer. The diaphragm oscillates sinusoidal with 100 Hz and 1 mm amplitude. For simulation we used unsteady RANS, k-ω SST turbulence model with curvature correction. The computational grid has 160,000 nodes and the y^+ values of the wall-next grid points were between 0.05 and 1, and the Δx^+ values were between 10 and 100. In this investigation did not completely suppress the separation, boundary layer not enough energized by the vortical structures generated. We observed a small unsteady deviation on the jet, about 3 degrees (figure 7).



a.



b.

Figure 7 Velocity vectors at maximum expulsion (a) – t = 0.02 s, and maximum ingestion (b) - t=0.03s

5. Conclusions

The Coanda wall jet developing on a circular cylinder was investigated numerically. This configuration was used to evaluate turbulence models for steady RANS of flows over curved surfaces. The main conclusion was that none of the models tested correctly predicted all relevant aspects of the flow. Relatively speaking, the k-ω SST model with curvature correction performed best.

Two methods for flow control were presented:

- One passive, which uses a slot that connects the low pressure and high pressure points on the Coanda surface. Adding a controlled resistive device on the slot we can change the jet orientation and the system become an active control device.
- An active one, based on the principle of synthetic jet, created through an orifice located near the point of detachment of the jet.

The synthetic jet concept and a numerically investigation of interacting jet with boundary layer were investigated. Numerically investigation of medium frequencies of synthetic jets hasn't led to expected results on the Coanda surface.

Future work: we will introduce the active control on the slot and we will investigate the using of the piezo-actuators on the Coanda surface.

Acknowledgement: This paper was supported by National Research Program – 543 – IDEI/2008.

References

1. Slomski, J.F., Chang, P.A.: *Large Eddy Simulation of a Circulation Control Airfoil*. AIAA Paper 2006-3011, 3rd AIAA Flow Control Conference, 5 - 8 June 2006, San Francisco, California
2. Glezer, A., Amitay, M.: *Synthetic Jets*. Annu. Rev. Fluid Mech., 34, 2002, p. 503-529
3. Van Dam, C.P., Yen, D.T., Vijgen, P: *Gurney flap experiments on airfoil and wings.* Journal of Aircraft (0021-8669), 36 (2), 1999, p.484–486
4. Frunzulica, F., Dumitrache, A., Preotu, O.: *Control of two-dimensional turbulent wall jet on a Coanda surface*. 82nd Annual Scientific Conference of the International Association of Applied Mathematics and Mechanics (GAMM), Graz, Austria, April 18 - 21, 2011 (to be published in PAMM J.)
5. Spalart, P.R., Allmaras, S.R.: *A one-equation turbulence model for aerodynamic flows.* AIAA Paper 92-0439, 1992
6. Launder, B.E., Spalding, D.B.: *The numerical computation of turbulent flows*. International Journal for Numerical Methods in Fluids, 15, 127, 1974
7. Wilcox, D.: *Simulation of transition with a two-equation turbulence model.* AIAA Journal, 32, 1192, 1994
8. Menter, F.R.: *Eddy viscosity transport equations and their relation to the k-ω model.* ASME Journal of Fluids Engineering, 119, 876, 1997
9. Neuendorf, R., Wygnanski, I.: *On a turbulent wall jet flowing over a circular cylinder.* Journal of Fluid Mechanics, 381, 1, 1999
10. Shur, M. L., Strelets, M. K., Travin, A. K., Spalart, P. R.: *Turbulence Modeling in Rotating and Curved Channels: Assessing the Spalart-Shur Correction.* AIAA Journal, 38, No. 5, 2000, p. 784-792

THERMODYNAMIC AND STRUCTURAL PROPERTIES CALCULATIONS OF POLYCHLORINATED BIPHENYLS

Georgiana C. MINDRILA, Cristina MANDRAVEL
Department of Physical Chemistry, Faculty of Chemistry, University of Bucharest
4-12 Blv. Regina Elisabeta, 030018, Bucharest, Romania, chrism@gw-chimie.math.unibuc.ro

Abstract. Aim of the present paper consists in obtaining of the values corresponding to the basic thermodynamic (enthalpy of formation) and structural (frontier orbital energies, dipole-moment) of polychlorinated biphenyls (PCB's) properties, which are determinant for its environmental behavior. In this paper calculations of the mentioned thermodynamic and structural properties were based on molecular mechanics MM+ and quantum semi-empirical AM1 methods, both included in HYPERCHEM program. Restricted Hartree Fock approximation and a Root Mean Square gradient of 0.01kcal/mol·Å were used. Analysis of obtained data allowed to understand PCB's behavior in different environmental compartments and to propose adequate reagents for their removal.

Keywords: theoretical study, enthalpy of formation, orbital energies, dipolmoment, HYPERCHEM program

1. Introduction

Although now production of polychlorinated biphenyls (PCB's is forbidden, problems related with their recurrence in all environmental compartments are of actuality, due to partitioning, biotransformation and bioaccumulation of these hazardous chemicals [1].

PCB's are a numerous class of substances. Seventy eight of 209 PCB's congeners which have substituents in ortho positions display an axial chirality, due to a limited rotation of the phenyl group around C_1-C_1' bond, being considered as atropisomers. Mirror image of PCB45 atropisomers is given in Fig. 1.

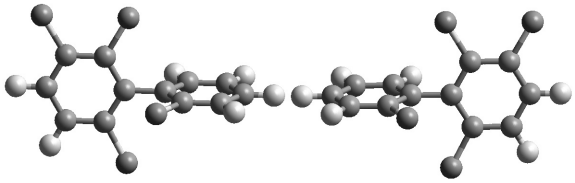


Figure 1 Mirror image of PCB45 (2,3,6,2'-tetrachlorobiphenyl) atropisomers; (+) left and (-) right

Only the 19 atropisomers (45, 84, 88, 91, 95, 131, 132, 135, 136, 139, 144, 149, 171, 174, 175, 176, 183, 196, 197) are stable at physiological temperatures, having an preponderant role in partitioning, bioaccumulation and toxicological activity [1, 2]. Prediction of **PCB**'s physical properties based on molecular descriptors was initiated by Oberg in 2001 [3], being recently developed in [4, 5] for the case of such properties as threshold limits values (TLV's) and chromatographic retention indices, significant for prevention, respectively for its identification or separation.

Prospective studies [6, 7] demonstrate utility of using PCB's chiral analysis to investigate biotransformation within biota of Arctic food webs.

Aim of the present work consists in obtaining of the values corresponding to the basic thermodynamic (enthalpy of formation) and structural (frontier orbital energies, dipole-moment) PCB's properties, which are determinant for its environmental behavior in accord with statements from works [8, 9].

2. Calculation details

In this paper calculations of the mentioned thermodynamic and structural properties were based on molecular mechanics MM+ and quantum semi-empirical AM1 methods, both included in HYPERCHEM program [10]. Approximation RHF with a gradient of 0.01kcal/mol was used. A first step in modeling was structure edition for all 209 PCB's congeners. The second, was geometry optimization for the same number of species [11].

3. Results and Discussion

The calculated properties correspond those determined by super-molecular level of substance organization (enthalpy of formation, Hf) or to nuclear-electronic level (orbital energies: Ehomo, Elumo, dipole-moment). Concerning the first type property, (enthalpy of formation, expressed in kcal/mol) we calculated only energy associated to the certain conformational disposition. The obtained values present utility only for comparison between different structural isomers. That is the case for PCB's where, for example, for tetra chlorinated biphenyls it is 42 possible isomers and 41 are identified in practice [12]. In the Table 1 we done calculated properties values for all 209 congeners, disposed after number of chlorine atoms indicated by PCB's substitution [5]. The PCB's: 1, 8, 31, 44, 101, 138, 180, 203, 206 are presumable as standards in GC or HPLC studies [6, 7]. For the mentioned 19 atropisomers, stable at physiological temperatures, computation of the properties are of interest in our current research.

Table 1. PCB's calculated properties after [11].

PCB no.	PCB substitution	Hf kcal/mol	ε_{HOMO} eV	ε_{LUMO} eV	μ D

1	2	42.562	-9.502	0.120	1.160
2	3	41.270	-9.540	0.113	1.388
3	4	41.142	-9.470	0.057	1.437
4	22'	36.817	-9.517	0.087	1.519
5	23	37.173	-9.567	-0.108	1.955
6	23'	35.564	-9.555	0.002	1.958
7	24	35.928	-9.569	-0.203	1.402
8	24'	35.404	-9.506	-0.001	2.115
9	25	35.836	-9.464	-0.209	0.372
10	26	37.456	-9.615	-0.108	0.821
11	33'	34.327	-9.625	-0.006	1.559
12	34	35.681	-9.531	-0.197	2.206
13	34'	34.187	-9.581	-0.061	1.264
14	35	34.791	-9.668	-0.131	1.547
15	44'	34.053	-9.578	-0.066	0.001
16	22'3	31.491	-9.571	-0.123	2.301
17	22'4	30.225	-9.599	-0.238	1.987
18	22'5	30.168	-9.478	-0.230	1.313
19	22'6	31.732	-9.528	-0.142	1.142
20	233'	30.283	-9.637	-0.209	2.191
21	234	32.105	-9.682	-0.387	2.292
22	234'	30.116	-9.597	-0.214	2.132
23	235	30.957	-9.565	-0.427	1.348
24	236	32.349	-9.548	-0.414	0.851
25	23'4	30.014	-9.554	-0.231	2.752
26	23'5	28.965	-9.558	-0.316	1.194
27	23'6	30.527	-9.558	-0.226	1.965
28	244'	27.686	-9.183	-0.701	1.118
29	245	29.722	-9.262	-0.681	2.529
30	246	31.367	-9.721	-0.425	0.526
31	24'5	28.795	-9.564	-0.320	1.043
32	24'6	30.334	-9.526	-0.227	2.230
33	23'4'	30.014	-9.554	-0.231	2.752
34	23'5'	29.163	-9.673	-0.166	2.202
35	33'4	27.829	-9.278	-0.665	1.383
36	33'5	27.002	-9.435	-0.636	1.314
37	344'	27.686	-9.183	-0.701	1.118
38	345	29.722	-9.262	-0.681	2.529
39	34'5	26.831	-9.309	-0.675	0.175
40	22'33'	26.255	-9.643	-0.274	2.552
41	22'34	26.460	-9.671	-0.427	2.724
42	22'34'	24.994	-9.667	-0.352	2.136
43	22'35	25.351	-9.572	-0.439	1.963
44	22'35'	24.948	-9.558	-0.326	1.880
45	22'36	26.684	-9.550	-0.422	1.392
46	22'36'	26.461	-9.566	-0.243	2.237
47	22'44'	23.737	-9.702	-0.349	1.369
48	22'45	25.095	-9.556	-0.494	2.151
49	22'45'	23.685	-9.573	-0.346	1.141
50	22'46	25.681	-9.628	-0.457	1.397
51	22'46'	25.172	-9.618	-0.261	2.027
52	22'55'	23.639	-9.560	-0.332	0.086
53	22'56'	25.144	-9.478	-0.255	1.176
54	22'66'	26.646	-9.596	-0.168	0.003
55	233'4	25.308	-9.716	-0.497	2.116
56	233'4'	24.815	-9.637	-0.325	2.589
57	233'5	24.188	-9.654	-0.524	1.353
58	233'5'	23.984	-9.740	-0.309	2.168
59	233'6	25.521	-9.628	-0.510	1.615
60	2344'	25.135	-9.680	-0.499	1.675
61	2345	27.385	-9.654	-0.628	2.115
62	2346	27.752	-9.668	-0.642	1.272
63	234'5	24.008	-9.661	-0.530	0.816
64	234'6	25.320	-9.612	-0.517	1.674
65	2356	27.681	-9.577	-0.656	0.652
66	23'44'	23.581	-9.650	-0.411	1.672
67	23'45	23.948	-9.632	-0.575	1.282
68	23'45'	22.747	-9.761	-0.423	1.119
69	23'46	23.827	-9.457	-0.717	1.231
70	23'4'5	21.970	-9.589	-0.647	0.896
71	23'4'6	21.145	-9.402	-0.598	1.088
72	23'55'	23.889	-9.677	-0.431	1.256
73	23'5'6	22.645	-9.266	-0.703	0.967
74	244'5	20.029	-9.645	-0.829	0.794
75	244'6	21.268	-9.229	-0.692	1.227
76	23'4'5'	22.448	-9.429	-0.621	1.107
77	33'44'	23.417	-9.695	-0.412	1.331
78	33'45	23.018	-9.398	-0.832	1.981
79	33'45'	21.606	-9.417	-0.828	1.015
80	33'55'	20.790	-9.598	-0.802	0.000
81	344'5	22.844	-9.301	-0.859	1.099
82	22'33'4	20.208	-9.646	-0.524	2.101
83	22'33'5	20.207	-9.646	-0.524	2.100
84	22'33'6	21.494	-9.617	-1.000	2.082
85	22'344'	19.909	-9.643	-0.796	1.992
86	22'345	21.805	-9.666	-0.652	2.677
87	22'345'	19.998	-9.633	-0.524	2.016
88	22'346	22.119	-9.669	-0.662	1.908
89	22'346'	21.452	-9.725	-0.441	2.857
90	22'34'5	18.950	-9.661	-9.661	1.222
91	22'34'6	20.494	-9.655	-0.553	1.867
92	22'355'	18.915	-9.636	-0.532	1.048
93	22'356	22.075	-9.576	-0.657	1.473
94	22'356'	20.377	-9.567	-0.443	2.038
95	22'35'6	20.192	-9.552	-0.516	0.933
96	22'366'	21.647	-9.546	-0.425	1.136
97	22'34'5'	19.945	-9.634	-0.584	2.135
98	22'34'6'	20.494	-9.655	-0.554	1.867
99	22'44'5	18.690	-9.649	-0.596	1.089
100	22'44'6	19.213	-9.715	-0.565	1.063
101	22'455'	18.649	-9.637	-0.595	1.102
102	22'456'	20.094	-9.561	-0.510	2.277
103	22'45'6	19.191	-9.568	-0.565	0.159
104	22'466'	20.621	-9.706	-0.481	1.321
105	233'44'	19.905	-9.713	-0.586	1.945
106	233'45	20.685	-9.743	-0.730	1.735
107	233'4'5	20.082	-9.852	-0.631	1.873
108	233'45'	19.089	-9.820	-0.598	1.646
109	233'46	21.008	-9.708	-0.743	1.315
110	233'4'6	20.072	-9.643	-0.592	2.347
111	233'55'	17.995	-9.733	-0.614	0.864
112	233'56	20.949	-9.658	-0.746	1.099
113	233'5'6	19.275	-9.712	-0.599	1.773
114	2344'5	20.501	-9.748	-0.733	0.911
115	2344'6	20.803	-9.690	-0.747	0.794
116	23456	24.604	-9.702	-0.808	1.516
117	234'56	20.739	-9.669	-0.753	0.744
118	23'44'5	19.309	-9.659	-0.762	1.017
119	23'44'6	19.099	-9.656	-0.629	1.716
120	23'455'	17.745	-9.717	-0.671	0.062
121	23'45'6	18.297	-9.753	-0.641	1.018
122	233'4'5'	20.022	-9.791	-0.535	2.731
123	23'44'5'	18.790	-9.803	-0.546	1.752
124	23'4'55'	13.843	-9.777	-0.738	0.953
125	23'4'5'6	14.355	-9.811	-0.712	1.910
126	33'44'5	18.649	-9.779	-0.606	1.065
127	33'455'	17.824	-9.867	-0.618	0.892
128	22'33'44'	16.398	-9.868	-0.598	2.327
129	22'33'45	16.717	-9.740	-0.740	2.502
130	22'33'45'	15.325	-9.718	-0.610	1.844
131	22'33'46	16.995	-9.707	-0.751	2.077
132	22'33'46'	16.552	-9.699	-0.586	2.409
133	22'33'55'	14.262	-9.713	-0.613	1.051
134	22'33'56	16.959	-9.645	-0.735	1.859
135	22'33'56'	15.497	-9.635	-0.594	1.585
136	22'33'66'	16.724	-9.600	-0.513	1.187
137	22'344'5	15.465	-9.755	-0.752	1.552
138	22'344'5'	15.058	-9.708	-0.667	1.643
139	22'344'6	15.717	-9.763	-0.763	1.190
140	22'344'6'	15.557	-9.812	-0.640	1.930
141	22'3455'	15.433	-9.696	-0.750	1.735
142	22'3456	19.021	-9.698	-0.637	2.159
143	22'3456'	16.849	-9.666	-0.669	2.848
144	22'345'6	16.094	-9.702	-0.728	1.239
145	22'3466'	17.102	-9.675	-0.677	1.966
146	22'34'55'	13.989	-9.711	-0.678	0.831

147	22'34'56	15.678	-9.664	-0.749	1.000
148	22'34'56'	14.499	-9.652	-0.652	0.948
149	22'34'5'6	15.208	-9.634	-0.599	1.717
150	22'34'66'	17.102	-9.675	-0.677	1.966
151	22'355'6	15.671	-9.618	-0.742	0.287
152	22'3566'	17.084	-9.570	-0.650	1.446
153	22'44'55'	13.719	-9.712	-0.678	0.001
154	22'44'56'	14.213	-9.649	-0.651	0.957
155	22'44'66'	14.681	-9.909	-0.582	0.001
156	233'44'5	15.349	-9.778	-0.814	1.165
157	233'44'5'	15.177	-9.859	-0.674	1.869
158	233'44'6	15.622	-9.713	-0.828	1.493
159	233'455'	14.554	-9.824	-0.825	0.812
160	233'456	17.935	-9.759	-0.895	1.285
161	233'45'6	14.837	-9.805	-0.837	0.859
162	233'4'55'	15.177	-9.863	-0.668	1.871
163	233'4'56	15.567	-9.711	-0.823	1.589
164	233'4'5'6	15.331	-9.773	-0.665	2.588
165	233'55'6	14.790	-9.734	-0.827	0.875
166	2344'56	17.722	-9.748	-0.902	0.114
167	23'44'55'	13.842	-9.772	-0.745	0.953
168	23'44'5'6	14.356	-9.810	-0.713	1.910
169	33'44'55'	13.954	-9.912	-0.701	0.000
170	22'33'44'5	11.882	-9.811	-0.821	1.830
171	22'33'44'6	12.110	-9.820	-0.832	1.846
172	22'33'455'	10.829	-9.775	-0.831	1.322
173	22'33'456	13.955	-9.750	-0.900	2.129
174	22'33'456'	12.020	-9.731	-0.753	2.259
175	22'33'45'6	11.069	-9.705	-0.842	1.024
176	22'33'466'	12.239	-9.683	-0.762	1.523
177	22'33'45'6	11.069	-9.705	-0.842	1.024
178	22'33'55'6	11.044	-9.694	-0.813	0.861
179	22'33'566'	12.229	-9.632	-0.724	1.075
180	22'344'55'	10.553	-9.770	-0.830	0.845
181	22'344'56	12.679	-9.785	-0.912	1.091
182	22'344'56'	11.026	-9.750	-0.765	1.604
183	22'344'5'6	10.777	-9.704	-0.841	0.823
184	22'344'66'	11.222	-9.760	-0.773	0.875
185	22'3455'6	12.676	-9.676	-0.911	1.121
186	22'34566'	14.045	-9.693	-0.831	2.290
187	22'34'55'6	10.747	-9.698	-0.815	0.808
188	22'34'566'	11.207	-9.653	-0.737	0.819
189	233'44'55'	10.693	-9.882	-0.889	0.818
190	233'44'56	12.599	-9.766	-0.973	1.033
191	233'44'5'6	10.937	-9.867	-0.903	1.550
192	233'455'6	11.832	-9.844	-0.983	0.036
193	233'4'55'6	10.893	-9.791	-0.887	1.754
194	22'33'44'55'	7.431	-9.864	-0.894	0.961
195	22'33'44'56	9.117	-9.837	-0.981	1.625
196	22'33'44'56'	7.633	-9.802	-0.905	1.343
197	22'33'44'66'	7.807	-9.799	-0.839	0.989
198	22'33'455'6	8.092	-9.752	-0.992	0.832
199	22'33'455'6'	7.612	-9.768	-0.869	1.461
200	22'33'4566'	9.236	-9.726	-0.916	1.728
201	22'33'45'66'	7.800	-9.702	-0.842	0.791
202	22'33'55'66'	7.798	-9.680	-0.796	0.001
203	22'344'55'6	7.794	-9.754	-0.990	0.03
204	22'344'566'	8.219	-9.775	-0.926	0.981
205	233'44'55'6	7.970	-9.909	-1.049	0.917
206	22'33'44'55'6	4.692	-9.848	-1.053	0.82
207	22'33'44'566'	4.846	-9.818	-0.991	0.834
208	22'33'455'66'	4.847	-9.746	-0.994	0.827
209	22'33'44'55'66'	1.924	-9.849	-1.051	0

From analysis of obtained data in [11], results some regularities which will be discussed now.

Enthalpy of formation (Hf=y), a thermodynamic important information, decreases when number of chlorine atoms (x) increases in conformity with relation:

$$y=-4.501x+42.94$$

where correlation coefficient is $r^2=0.953$.

The same type of linear dependence is obvious for variation of the orbital energies Ehomo, Elumo (expressed in eV), but correlation coefficients r^2 are very poor. Between the properties reported to nuclear-electronic level, dipole-moment (expressed in D) shows the most spectacular variation as function of the chlorine atoms number in biphenyl ring. This fact is expected considering influence of strong polar C-Cl bond in positions *ortho, meta, para* for the two rings of biphenyl on the resultant dipole-moment.

Considering variation of calculated here properties we selected PCB**84** for the future theoretical study of interaction with β-cyclodextrin (β-CD) by Mulliken overlap population (MOP).

PCB**84** is a *penta*-chlor biphenil atropisomer, stable at physiological temperatures, which posses a high value of dipol-moment (2.08 D) and -1.000 eV for Elumo.

In β-cyclodextrin, the selected partner of interaction, electrostatic term shows a maximal value in the ponder of global energy [11]. In accord with statements from [9] complexation energy between such partners must be favored.

4. Conclusions

The values corresponding to the basic thermodynamic (enthalpy of formation) and structural (frontier orbital energies, dipol-moment) properties for all 209 PCB's congeners are calculated using molecular mechanics MM^+ and quantum semi-empirical AM1 methods.

The obtained values of the basic properties were discussed and used in studies on the 19 atropisomeric PCB's inclusion complexes with β-CD and γ-CD and in selection of PCB**84** for more elaborated theoretical studies.

5. References

1. Frame G.M., PCB's Recent Advances in Environmental Toxicology and Health Effects. University Press of Kentucky, 2001, 4
2. Oki M., Recent advances in atropisomerism, Top. Stereochem. 14, 1983, 1-9.
3. Oberg T., Prediction of Physical Properties for PCB congeners from molecular descriptors, Internet J. Chem 4, 11 (2001)
4. Done R., Mindrila G., Tarko L., QSAR Study concerning toxicity and threshold limit value VL8 of halogen containing compounds, Rev. Chimie 60, 10, 2009, 992-995
5. Stanculescu I., Mindrila G., Mandravel C., *Evaluation of PCB's chromatographic retention indices using multiliniar regression method*, Bulgarian Chem. Comm. 42, 4, 2010, 343-348, ISSN 0324-1130, Sofia, Bulgaria
6. Warner N.A., Rosss Nostrom J., Wong Ch.S., Fisk A.T., Environmental Toxicology and Chemistry 24, 11, 2005, 2763-2767
7. Benica E., Takacova D., Krupcik J., Skacani I., Onuska F., Terry K., *Gas chromatographic separation of PCB atropisomers on cyclodextrin stationary phases* Chirality 10, 1998, 540-547

8. Mandravel C., Stanescu Dumitru R., *Physico-chemical methods used to measure noxes in occupational environment,* Romanian Academy Publishing Co., Bucharest, 2003, 116-117, ISBN 973-27-1031-4, (in Roumanian)
9. Mandravel C., Stanescu Dumitru R., Chiosa V., *Relationships between structure, properties and biological activity of industrial pollutants*, Bucharest University Publishing Co., 2003, 97-133, ISBN 973-575-725-7, (in Roumanian)
10. x x x Hyperchem program, Release 6.02 for Windows, Hypercube Inc, 2000.
11. Mindrila G., *Contributions to studies of some chloroderivatives/ contaminants by gas-chromatographic coupled with mass-spectrometry method. Modeling of some adsorption specific processes*. Ph.D.Thesis, University of Bucharest, 2011, 58-62, (in Roumanian)
12. Frame G.M., *A collaborative study of 209 PCB congeners and 6 Aroclors on 20 different HRGC columns 1. Retention and coelution database*, Fresenius J. Analyt. Chem. 357, 1997, 701-713

THE INFLUENCE OF UV RADIATIONS ON SOME DYES TEXTILES

Liliana ROSU[*], Dan ROSU[*], Cristian GAVAT[**]
[*]"Petru Poni" Institute of Macromolecular Chemistry, Iasi, 70487, Romania,
e-mail: lrosu@icmpp.ro
[**]University of Medicine and Pharmacy „Gr.T.Popa" Iasi, 700115, Romania

Abstract. As early as 1869, textile dyes and subsequently finishes have been reported to cause various manifestations of contact dermatitis, from mild to severe and debilitating. Reactive dyes are chemical compounds widely used in dyeing textile materials of cellulose fibbers (100% cotton and cotton blend), regenerated cellulose (viscose, cellulose acetate), skin fibers (flax, hemp), protein fibers (wool, natural silk). With these compounds, the human body makes contact every day, so it is very important to know their biological action on the human body, in correlation with their physico-chemical properties. Dyes are chemical substances containing chromophore groups and auxocrome. Dyes fixed to a material they absorb a certain wavelength of the spectrum. In this paper the influence polychromic light with λ>300 nm on the properties of colored textile, was investigated. The influence of UV radiation on structural and color changes of colored textiles was also studied. The discoloration is important register of all reactive dyes used. Change is due to structural changes in the dyes, especially in the structure of carbonyl and aromatic structures. In most cases were identified photo-oxidative processes in the structure of dyes. It remains to be determined by toxicology studies if the structures have not changed this way irritating action on living organisms

Keywords: textile, azo dye, UV radiation, decolourization, degradation

1. Introduction

Although the skin protection against ultraviolet radiation provided by a textile fabric has been a topic for some years, there is still a lack of knowledge on the subject. It is a general misconception that the protection provided by any textile article would be appropriate. The protection provided by a garment depends on several factors: fiber type, structural characteristics of the fabric, color and dyeing intensity, the presence of optical brightening agents or UV-absorbers as finishing products, etc. [1-7]. Color is one of the variables with a greater influence on the ultraviolet protection factor of a fabric. Most of the textile articles are colored whatever their origin or end use is. The perception of the color of a dyed fabric is based on the selective absorption of certain specific wavelengths of the incident visible light by the dyestuff molecules on the surface of the material. The unabsorbed wavelengths of the light are reflected by the material, reach the photoreceptors in the eyes, and are processed by the brain. Speaking about color implies to refer to the zone of the electromagnetic spectrum between 400 and 700 nm of wavelength that corresponds to the visible spectrum and is the important interval for the definition of color. Nevertheless, the absorption of energy by the dyestuff extends in some part to other regions of the electromagnetic spectrum, including the UV zone. There are several color characteristics that may influence the improvement of the UV protection: the type and chemical structure of the dyestuff, the shade of color, and its intensity. Dark colors have been reported as providing better protection than light colors [1, 3, 5, 8, 9].

Sun radiation has a continuous energy spectrum over wavelength range of about 0.7 nm to 3000 nm and the effective spectrum of the solar radiation reaching on the surface of earth spans from 280 nm to 3000 nm [10], where the wavelength of ultraviolet spectrum lies between 290 nm to 400 nm. Ultraviolet radiation constitutes to 5% of the total incident sunlight on earth surface (visible light 50% and IR radiation 45%) [11]. UV radiation has wavelengths shorter than that of visible region, but longer than that of soft X-rays, in the range of 10 nm to 400 nm, and energies from 3 eV to 124 eV. The UVR spectrum can be subdivided into near UV (400 - 300 nm), middle UV (300 – 200 nm) and vacuum UV regions (200 – 10 nm) by physicists, or into UVA (400 – 315 nm), UVB (315 – 280), UVC (280 – 100 nm) and UVD (100 - 10 nm) regions by biologists [8]. Color is one of the most influential variables on the protection against ultraviolet radiation provided by a fabric. The protection against UV radiation of a fabric is expressed quantitatively by means of its UPF. The present paper shows the results of a study

about the influence of the color on the UPF of cotton woven fabrics. The influence of UV radiation on structural and color changes of colored textiles was studied. The discoloration is important register of all reactive dyes used.

2. Experimental

2.1 Reagent

Five azo dyes, reactive yellow 143 (a), reactive blue 204 (b), reactive red 183 (c), reactive red 2 (d), reactive orange 13 (e) were used as received. The chemical structure of azo dyes is presented in Fig 1.

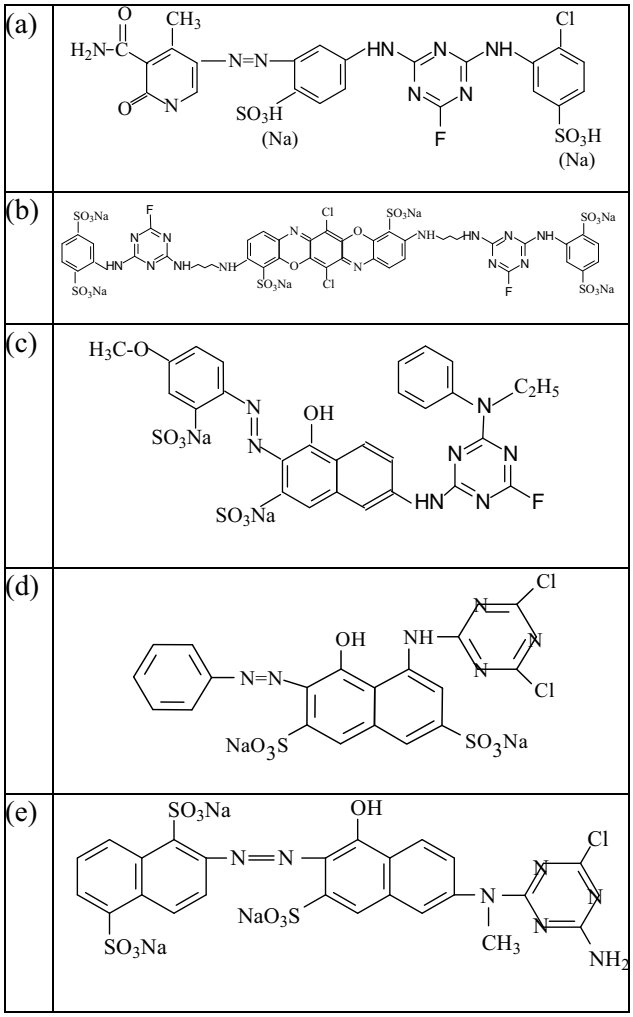


Figure 1. The chemical structure of textile dye

2.2. Characterization technique

The textile dyes samples were irradiated in air, in an accelerated weathering rotative device equipped with a middle pressure mercury lamp HQE-40 type, having a polychrome emission spectrum in the field of 240–570 nm, with a 30 mW/cm^2 light intensity. The more energetic radiations with λ < 300 nm, not presented in the natural light spectrum, were eliminated using a 30 μm borosilicate glass filter. A water filter and a fan were used to prevent the thermal degradation of the sample during the photochemical treatment. The samples were mounted on the device, which was positioned at a distance of 60 mm from the lamp. The temperature inside the irradiation chamber was kept around 40–45°C. During the accelerated weathering, the surface color difference of the test samples was measured in order to record the photochemical degradation. The surface color difference (ΔE*) was measured using a Pocket Spec Color (USA) color comparison spectro- photometer. The surface color difference was calculated using the CIEL L* a* b* system. The color change as a function of UV treatment was calculated using Eq. (1).

$$\Delta E_{ab} = \sqrt{(L_2^* - L_1^*)^2 + (a_2^* - a_1^*)^2 + (b_2^* - b_1^*)^2} \quad \text{Eq. 1}$$

where L*, a* and b* represent the lightness, yellowness and redness, respectively.

The FT-IR spectra were recorded with a Bruker Vertex 70 Spectrophotometer. The peak surface was used to evaluate the FT-IR intensity, which is expressed in absorbance.

3. Results and Discussion

3.1. Color changes during photo-irradiation

The occurrence of colors changes on the surface of the samples is related to an increasing number of chromophores during irradiation. The total color change of the samples as a function of irradiation time is given in Fig. 2-6. for color reactive dyes.

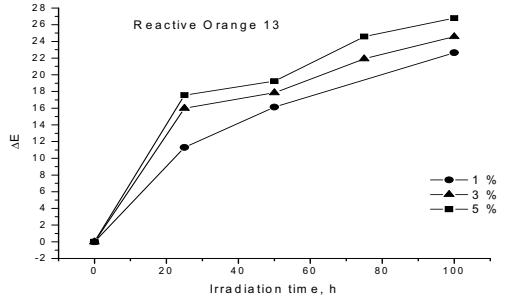


Figure 2. Color change difference ΔE_{ab} as a function of irradiation time for Orange 13

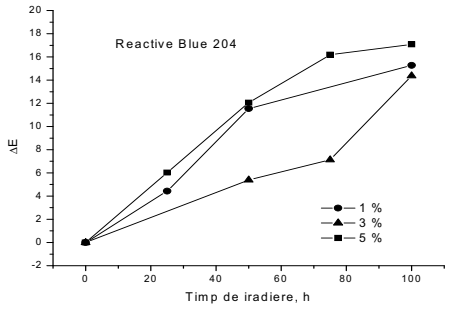


Figure 3. Color change difference ΔE_{ab} as a function of irradiation time for reactive Blue 204

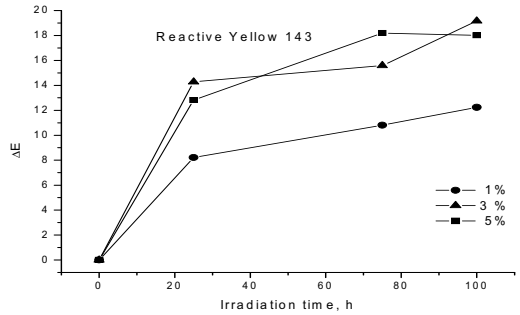


Figure 4. Color change difference ΔE_{ab} as a function of irradiation time for reactive Yellow 143

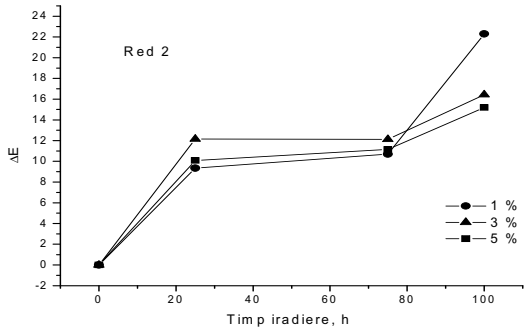


Figure 5. Color change difference ΔE_{ab} as a function of irradiation time for reactive Red 2

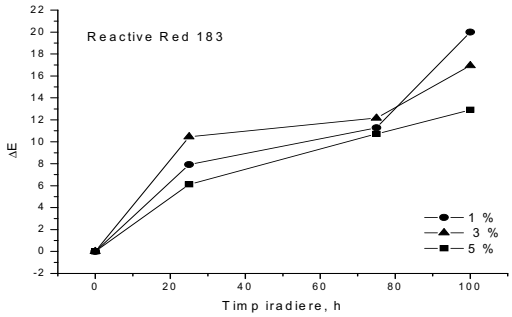


Figure 6. Color change difference ΔE_{ab} as a function of irradiation time for reactive Red 183

It can be seen from Figures 2-6 that the color difference (ΔE) increases with time of irradiation for all samples studied. Critical times for ($t_{\Delta E=3}$) when the color difference becomes visible (ΔE=3), are presented in Table 1.

Table 1. Critical times of dicolorations color textile

Textile colored with	Dye concentration (%)	$t_{\Delta E=3}$ (h)
Reactive Yellow 143	1	10
	3	6
	5	5
Reactive Red 183	1	7
	3	10
	5	13
Reactive Blue 204	1	17
	3	29
	5	13
Reactive Red 2	1	8
	3	6
	5	5
Reactive Orange 13	1	7
	3	4
	5	4

Table 1 shows that there is a direct correlation between the concentration of reactants and $t_{\Delta E=3}$, but during irradiation all samples and changed color depending on the dye structure

3.2. FTIR measurement

The main structural changes were investigated by FTIR spectroscopy (Fig. 7). FTIR spectra show major structural changes in irradiated sample. Is affected mainly the wavelength range from 1800 to 1400 cm^{-1}. The etheric connection between the dye and the cellulose support (1123-1090 cm^{-1}) is also affected. Fig. 8 shows as an example the variation of the signal surface which is specific to the etheric bond with irradiation time, for Blue 204. The other samples had a similar behavior. Is an indication of dye detachment from celluloses support during irradiation. Dye so released can pass into transpiration causing toxicological problems.

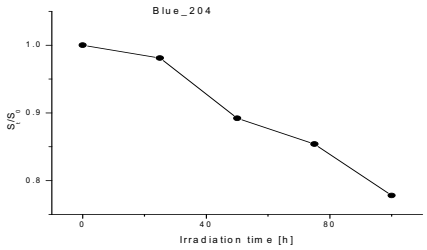
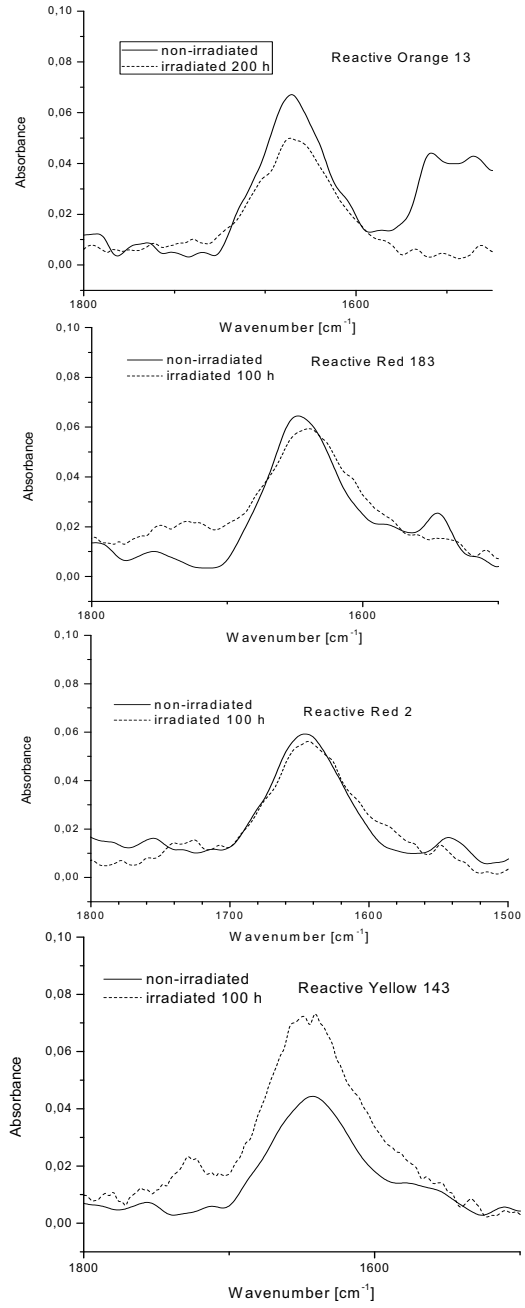


Figure 8. Variation of surface ether linkage signal with irradiation time



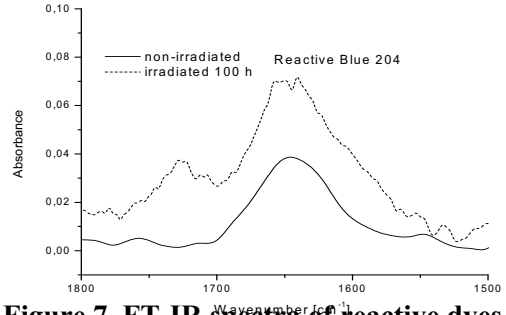


Figure 7. FT-IR spectra of reactive dyes, region 1800-1400 cm^{-1}

4. Conclusions

We followed the action of polychromatic light with $\lambda > 300$ nm on the properties of colored textiles. We studied the influence of UV radiation on structural changes of color and colored textiles.There were significant changes in color of all reactive dyes used (> 3). The changes are due to structural changes in the dyes, especially in the structures of carbonyl and aromatic structures. In most cases processes were identified in the composition of photo-oxidative dyes. As a result of toxicological studies, the structures have changed in this way irritating action on living organisms. By evaluating the acute toxicity of the dyes studied, colors blue, garnet and red were classified as very toxic group, while yellow and orange colors, the group of those with a moderate degree of toxicity.

Acknowledgments

This research was financially supported by European Social Fund —"Cristofor I. Simionescu" Postdoctoral Fellowship Programme (ID POSDRU/89/1.5/S/55216) and Sectoral Operational Programme Human Resources Development 2007–2013.

References

[1] Pailthorpe, M.: *Sun Protective Clothing*. Text. Horiz., 16(5), 1996, p.11–14.

[2] Hilfiker, R., Kaufmann, W., Reinert, G., Schmidt, E.: *Improving Sun Protection Factors of Fabrics by Applying UV-Absorbers.* Text. Res. J, 66(2), 1996, p. 61–70.

[3] Reinert, G., Fuso, F., Hilfiker, R., Schmidt, E.: *UV-protecting properties of textile fabrics and their improvement.* Text. Chem. Color., 29(12), 1997, p. 36.

[4] Crews, P., Kachman, S., Beyer, A.: *Influences on UVR transmission of undyed woven fabrics.* Text. Chem. Color., 31(6), 1999, p. 17–26.

[5] Srinivasan, M., Gatewood, B.: *Relationship of dye characteristics to UV protection provided by cotton fabrics*. Text.Chem.Color.Am.Dyest.Rep.,32(4), 2000, p.36

[6] Riva, A., Algaba, I., Pepio´, M.: *Action of a finishing product in the improvement of the Ultraviolet Protection provided by cotton fabrics.* Cellulose*,* 13(6), 2006, p. 697.
[7] Algaba, I., Pepio´, M., Riva, A.: *Modelisation of the influence of the treatment with two optical brighteners in the UPF of cellulosic fabrics*. Ind. Eng. Chem. Res*.,* 46(9), 2007, p. 2677–2682.
[8] Dubrovski, P.D., Golob, D.: *Effects of woven fabric Construction and Color on Ultraviolet Protection.* Text. Res. J*.,* 79(4), 2009, p. 351–359.
[9] Gorensek, M., Recelj, P.: *Modifying the UV blocking effect of polyester fabric*. Text. Res. J., *74*(6), 2004, p. 469.
[10] Reinert, G., Fuso, F., Hilfiker, R., Schmidt, E.: *UV-Properties of textile fabrics and their improvement*. Text. Chem. Color., 29(12), 1997, p. 36-43.
[11] Palacin, F.: *Textile finish protects against ultraviolet radiation.* Melliand Int., 3, 1997, p. 169-172.

PREDICTING AND CONFIRMING THE LIFETIME OF THE POLYURETHANES

Liliana ROSU, Dan ROSU, Stefan OPREA
*"Petru Poni" Institute of Macromolecular Chemistry, Iasi, 70487, Romania,
e-mail: lrosu@icmpp.ro

Abstract. This paper presents results from studies of thermal aging of polyester urethane obtained by melt polyaddition technique in two stages, resulting in a regular structure. Polymer chain sequences are more regularly than rigid-flexible-rigid distribution of rigid segments with a single step process where the distribution is random. This structural regularity can lead to superior mechanical properties for rigid polyurethane segments are easier because aggregated or crystallized by the formation of physical crosslinking points. Thermal aging was performed by exposing the specimen to form polyurethanes temperature up to 200 hours. The structural changes were evidenced by FTIR spectroscopy It was found at temperatures (40°C) and low exposure time changes occur mainly in the soft segments being affected primarily carbonyl group. At higher temperatures and longer exposure times, are affected and urethane groups. These changes lead to significant changes and physico-mechanical properties (tensile strength, elongation, modulus of elasticity) and of the optical properties such as the color in specially. Results will be used in attempts to predict the life time of polyester urethane.

Keywords: lifetime prediction, polyurethane, thermal aging

1. Introduction

The polyurethane elastomers (PUR) are considered among the most important classes of polymers because they can be processed by extrusion, injection and moulding [1,2]. The physico–mechanical properties, the chemical resistance and good processability make PUR available in many technical applications as protective coatings, adhesives, biomedical applications or materials for vibrations damping [3,4]. Although the polyurethanes have special properties however their practical applicability is limited by their sensitivity to temperature [5-7] and to the light [8-11]. While the color changes on the surface of polyurethane samples occur especially under the light influence, the increase of temperature significantly accelerating the aging tests. This paper investigates the change of physico-mechanical properties of some cross-linked polyurethanes under the influence of temperature. The influence of temperature on the color changes was also analyzed. The results were used in attempts to predict the lifetime of the studied polymers.

2. Experimental

2.1 Synthesis of polyurethanes

The synthesis of polyurethanes (PUs) was performed in a one liter glass reactor at normal pressure, under nitrogen blanket and vigorous agitation. The NCO/OH ratio of all formulations was 1.03-1.05. The PU composite was produced by a prepolymer process. In the case of the prepolymer procedure, filler was first mixed with polyester, followed by the addition of at 80^0C for 1 h to yield a prepolymer that was mixed in the second step with a chain extender to 90^0C for 10 min. The resulting material was poured into a mold and left to cure at 100^0C for 20 h, post-curing TPU at laboratory temperature for 7 days. Under these conditions the addition of catalyst was not necessary. The composition of polyurethane samples is shown in Table 1.

Table 1. Composition of polyurethane samples

Sample	Rate Polyester/ Diisocyanate/ Chain extenders	Diisocyanat	Chain extenders
PUR1	1:2:1	MDI*	BD***
PUR2	1:2:1	HDI	BD
PUR3	1:2:1	MDI	HD ****
PUR4	1:2:1	HDI**	HD
PUR5	1:3:2	MDI	BD

**4,4' diphenyl methane diisocyanate (MDI)*
***1,6 hexamethylene diizocyanate (HDI)*
****1,4 butane diol (BD)*
*****1,6 hexane diol (HD)*

The polyurethane sheets thus prepared were used for the determination of mechanical and physical properties and for the resistance study. Samples were produced by molding, using cross-linked polyurethane resins doped with talc powder having ~ 0.05 mm sized particles, and composites containing ~ 0.07 mm sized graphite and $CaCO_3$ grains.

2.2 Measurement and analysis

Thermal aging was performed using an oven, the heating of PUR samples at different temperatures (40, 70, 100 and 130^0C) within 200 hours. The polyurethanes block copolymers were molded into tensile specimens with 6 mm thickness depending on the hard/soft segment content, and the the prepared polyurethane specimens were used for tensile test. A tensile test was performed using a TIRA test 2161 apparatus, from Germany, with a dumbbell-type specimen. Measurements were run at an extension rate of 10mm/min, at 25^0C. At least five specimens were tested, and the average was plotted. Hardness was measured on Instron Shore Durometer using scale A.

FTIR spectra were obtained with a Bruker Vertex 70 spectrometer coupled with attenuated total reflectance equipment provided with a diamond crystal. All the spectra were acquired with a spectral resolution of 4 cm^{-1}.

The color changes during the thermal aging of the specimens can be described using CIEL*a*b* system, where L* can be thought as a lightness factor, a* is the redness factor and b* is the yellowness factor. The L*, a* and b* parameters were measured with a color comparison device (Pocket Spec Color QA, SUA with a sensor head of 6 mm). Measurements were made using D65 illuminant and a 10^o standard observer. The L*, a* and b* values were used to calculate the color change ΔE_{ab} as a function of the thermal time, according with the equation 1:

$$\Delta E = \sqrt{(L_2^* - L_1^*)^2 + (a_2^* - a_1^*)^2 + (b_2^* - b_1^*)^2} \quad (1)$$

In (1) the subscript 1 represents the values before light exposure and subscript 2 denotes the values measured after exposure.

3. Results and Discussion

Important modification of some surface properties such color and gloss was observed during the heating. Figure 1 shows the ΔE variation with temperature and heating time of PUR-1. The other studied samples show a similar behavior.

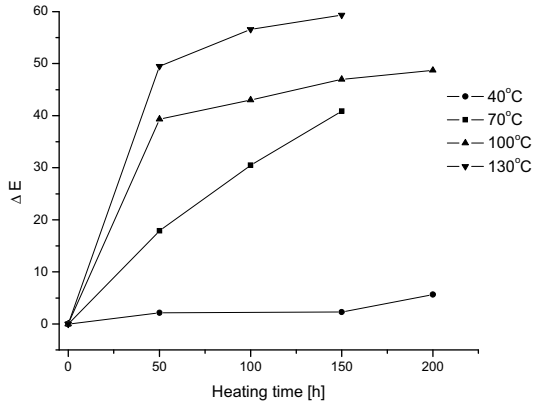


Figure 1. The ΔE variation with temperature and heating time of PUR-1

On can note a significant increase of ΔE value with increasing of temperature and of heating time. Apparently the most important color changes occur in the first 50 hours of irradiation.

The studied samples darken when are heated. Figure 2 shows the variation of lightness factor of PUR-1 sample with temperature and heating time.

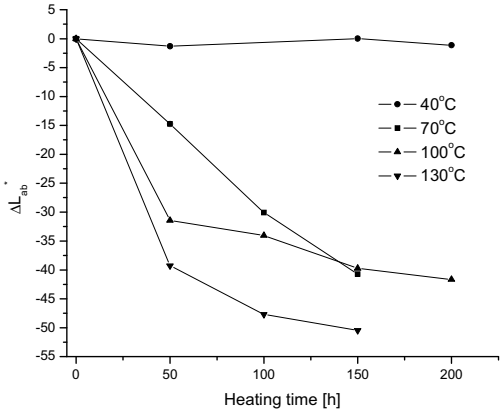


Figure 2. Variation of lightness factor with temperature and heating time specific to PUR-1 sample

The negative ΔL values indicate the darkening of studied samples during the thermal treatment.

Red and yellow cromophores accumulates on the surface of samples during the thermal treatment as can be seen from Figure 3 and Figure 4.

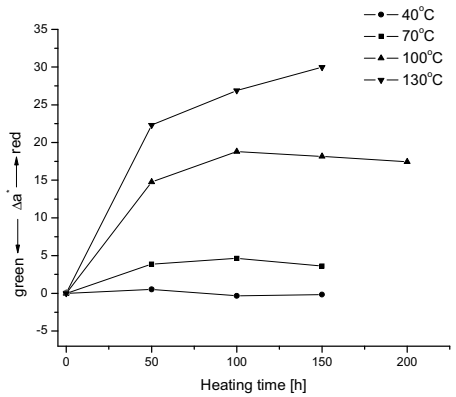


Figure 3. Variation of Δa values with temperature and heating time for PUR-1 sample

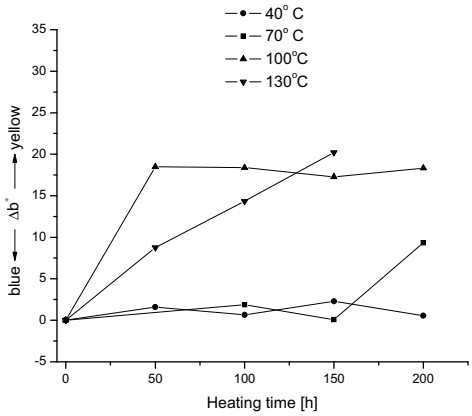


Figure 4. The variation of Δb values with temperature and heating for PUR-1 sample

The displacement of Δa^* and Δb^* to positive values with increasing of temperature and of heating time indicates the accumulation intermediates colored in red and yellow during the thermal treatment.

The FTIR analysis showed that the changes of the physico-mechanical and of the surface properties are generated by some major structural changes of PUR-samples. Figure 5 shows an example of the specific changes in FTIR spectrum of PUR-1 after aging 200 h at 40°C.

From Figure 5 results the loss of urethane linkage during heating which is accompanied by the enlargement of the band from 3347 cm^{-1} which characterize the urethane NH structure and the decrease of the signal from 1728 cm^{-1} and decrease of signal from 1728 cm^{-1}, which is specific to the urethane carbonyl group. It's like the urethane group breaks during the aging.

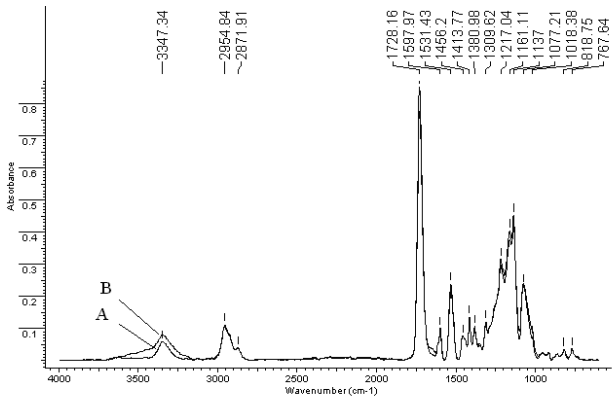


Figure 5. FTIR spectra of PUR-1: A, without thermal treatment; B, after aging 200 h at 40°C

To estimate the lifetime polyurethane samples a simplified form of an Arrhenius type relation based on time-temperature relation was used (Eq.2) [12]. The time (t) required for 20% deterioration in a physical property such as ΔE at various temperatures is used in Eq. 2,

$$t = t_0 e^{E/RT} \qquad (2)$$

where t is the lifetime, t_0 is the pre-exponential factor, E is the activation energy, T is the ageing temperature and R is the gas constant.

Aging periods that correspond of an increase of ΔE value from 0 to 5, when the colour differences became visible, are shown in Table 2.

Table 2. Ageing periods that correspond to the increase of ΔE value from 0 to 5.0

Sample	Aging time [h]			
	40°C	70°C	100°C	130°C
PUR-1	200	63	6	-
PUR-2	100	71	17	4
PUR-3	58	32	5.5	4.8
PUR-4	29	12	9.5	5.2
PUR-5	33	27	7.7	6.6

The kinetic parameters obtained from the Arrhenius plots are shown in Table 3.

Table 3. The kinetic parameters obtained from Arrhenius plot

Sample	E (kJ mol^{-1})	ln t_0	Correlation coefficient	Lifetime at 25°C (hours)
PUR-1	67	-19.514	0.967	1568
PUR-2	38	-9.580	0.861	306
PUR-3	29	-7.110	0.954	116
PUR-4	19	-3.987	0.949	39
PUR-5	19	-3.955	0.837	127

4. Conclusions

Five samples of polyurethane with chemical structures and different degrees of cross-linking were synthesized. The obtained samples were subjected to accelerating aging at temperatures between 40 and 130°C for 200 h. Modification of mechanical properties and colour variations during the thermal aging were observed. The variation of properties has been correlated with the structural changes occurred during the thermal aging. The FTIR spectra have shown the urethane bond destruction during the thermal treatment. The destruction of the urethane bond is more advanced as the temperature is higher and the exposure time is longer. The lifetime prediction of synthesized polyurethanes was made following the colour changes during the thermal aging. The lifetime calculation was made with an Arrhenius type relation.

The best results were obtained with PUR-1 sample, synthesized from 4, 4'diphenyl methane diisocyanate and 1, 4 butane diol.

Acknowledgments

This research was financially supported by European Social Fund — "Cristofor I. Simionescu" Postdoctoral Fellowship Programme (ID POSDRU/89/1.5/S/55216) and Sectoral Operational Programme Human Resources Development 2007–2013.

References

[1]. Saunders, H., Frisch, K.C.: *Polyurethane Chemistry and Technology*. Part 1, Chemistry, Willey, New York, 1962.

[2]. Rosu, L., Cascaval, C.N., Ciobanu, C., Rosu, D., Ion, D.E., Morosanu, C., Enachescu, M.: *Effect of UV radiation on the semi-interpenetrating polymer network based on polyurethane and epoxy maleate of bisphenol A*. J. Photochem. Photobiol., A. Chem., 169, 177-185, 2005.

[3]. Zia, K.M., Bhatt, I.A., Zuber, M.: *Surface characteristics of UV irradiated polyurethane elastomers extended with ω-alkane diols*. Appl.Surf. Sci., 254, 2008, p. 6754-6761.

[4]. Oprea, S.: *Structure and properties of Cross-linked Polyurethane Copolymers*. Adv.Polym.Technol., 28(3) 2009, p. 165-172.

[5]. Frick, A., Rochman, A.: *Characterization of TPU-elastomers by thermal analysis (DSC)*. Polym. Test. 23, 2004, p. 413-418.

[6]. Rosu, D., Rosu, L., Cascaval, C.N.: *IR-change and yellowing of polyurethane as a result of UV irradiation*. Polym. Degrad. Stab., 94, 2009, p. 591-596.

[7]. Rosu, D., Tudorachi, N., Rosu, L.: *Investigations on the thermal degradation of a MDI based polyurethane elastomer, Investigations on the thermal stability of a MDI based polyurethane elastomer*. J.Anal.Appl. Pyrol 89, 2010, p. 152-158.

[8]. Allen, N.S., Edge, M.: *Fundamentals of Polymer Degradation and Stabilization*. Elsevier, Applied Science, 1992.

[9]. Yang, X.F., Tallman, D.E., Bierwagen, G.P., Croll, S.G., Rohlik, S.: *Blistering and degradation of polyurethane coatings under different accelerating tests*. Polym. Degrad. Stab., 77, 2002, p. 103-109.

[10]. Rosu, D., Rosu, L., Cascaval, C.N.: *IR-change and yellowing of polyurethane as a result of UV irradiation*. Polym. Degrad. Stab., 94, 2009, p. 591-596.

[11]. Rosu, D., Ciobanu, C., Rosu, L., Teaca, C.-A.: *The influence of polychromic light on the surface of MDI based polyurethane*. Appl. Surf. Sci., 255, 2009, p. 9453-9457.

[12]. Akbas, A., Aksoy, S., Harsirchi, N.: *Effects of thermal degradation ageing on the properties and lifetime prediction of hydroxyl-therminated polybutadiene*. Polymer, 35(12), 1994, p. 2568-2572.

COMPUTER GRAPHICS IN INFORMATION, KNOWLEDGE AND CONSCIENCE SOCIETIES

Sergiu PERETETCU, , Dumitru TODOROI,
e-mail **pereteatcu@ya.ru, todoroi@ase.md**

Abstract. In present communication are discussed memory recuirements for Human - Machine Graphical Interface: BI - dimensional computer graphics, 3D - computer graphics, and Adaptable computer graphics. It is analyzed modern evolution of Computer graphics: Next Generation Graphics & Thunderbolt I/O Technology, NVIDIA Quadro® 400 graphics processing unit, Video Editing Requirements of Creative Professionals. In conclusion are presented computer classes and their enabling components

Keywords: computer graphics, application education, memory requirements

1. Introduction

Modern society evolves under the sign of rapid changes. Permanent innovation through the creative capacity of the individuals – in all domains of knowledge – is equivalent to a huge amount of information and an implicit step towards progress.

Change has become a reality at all levels: everyday-life of the individuals, the life of the organizations and social systems. In our modern society, change equals to "a new way of life".

Since the 70s, Alvin Toffler was pointing, in his work "Shock wave", the unprecedented acceleration of the transformation of the whole society. This transformation has been mainly generated by the informatics revolution. The annalists identified this new type of revolution in economy and society, next to the industrial revolution.

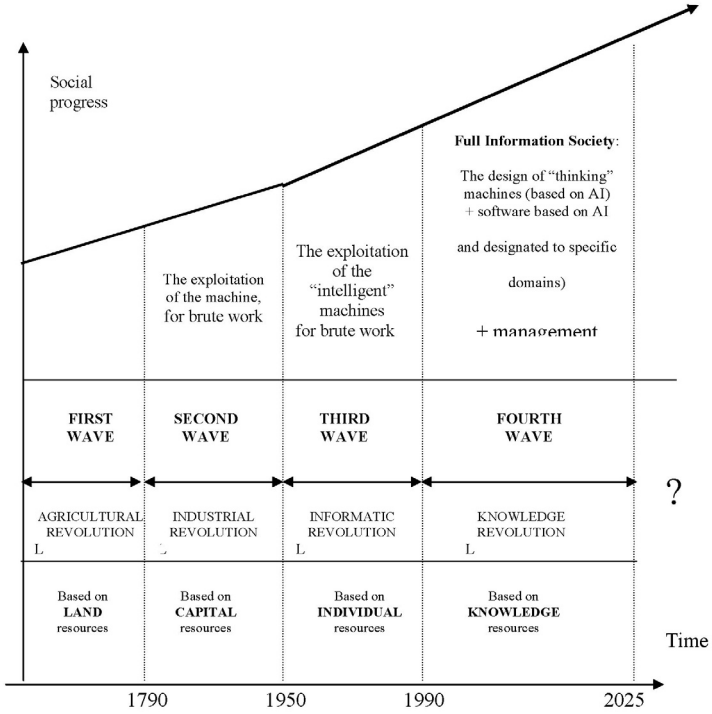


Figure 1. Social progress

In “The fourth wave”, Alvin Toffler’s work published in 1993, he predicted the approach of a new wave of progress. This wave follows the post-industrial economies and is indebt to a revolution of knowledge, especially of the knowledge sprang from intuition, imagination and creative capacity of the human being. This stage, together with the previous ones, is represented in Figure 1.

2. Memory requirements

Multiple languages are a barrier to communication, and much of the world's population is illiterate. Video and music, including gestures are, however, universal languages easily understood by all. Thus, the coupling of images, music, and video with computer translation of speech may become a new, universal form of communication.

All this information will be networked, indexed, and accessible by almost anyone, anywhere, at any time - 24 hours a day, 365 days a year. With more complex data-types, the performance and memory requirement increase, as shown in Figure 2. Going from text to pictures and video, demands performance increases in processing, network speed and file memory capacity. Figure 2. lists the memory requirements necessary for an individual to record everything he or she has read, heard, and seen during their lifetime. These values vary by a factor of 40,000: from a few gigabytes to one petabyte (PB) - a million gigabytes.

Data type	Data rate (bytes per	Storage needed per hour and day	Storage needed in a lifetime
Read text, few pictures	50	200 KB; 2 -10 MB	60 - 300 GB
Speech text (≈120 wpm)	12	43 K; 0.5 MB	15 GB
Speech (compressed)	1,000	3.6 MB; 40 MB	1.2 TB
Video (compressed)	500,000	2 GB; 20 GB	1 PB

Table 2. Data rates and storage requirements per hour, day and lifetime for a person to record all the read text, all the heard speech and all the seen video

In what follows, we shall examine the three cyberspace building blocks: platforms, hardware and software cyberization interfaces, and networks. We will still live in towns, but in 2047 we will be residents of many "virtual villages and cities" in the cyberspace sprawl defined by geography, demographics and intellectual interests.

3. Human - Machine Interface (HMI).

The People-Machine-People interactions, at different stages of the Development of the Informational Society, are based on the raising possibilities of Software, Hardware, People, Brainware (Procedures, Algorithms, Modules, Models), Knowledgeware (Data, Information, Knowledge) and Communications in Computer Based Information Systems (CBIS), main phases of which are Input, Storage, Processing and Output.

The following three different types of such interactions are well known:

(a) IT professional - Software - Hardware - Specialist User (Figure 3.);

(b) Specialist User - Software - Hardware - People (Figure 4.);

(c) People - Software - Hardware - People (Figure 5.).

Each phase of the Human-Machine interactions is supported by the correspondent groups of Software - Hardware units.

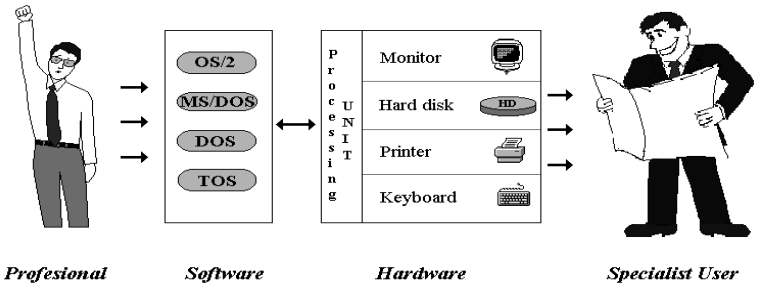


Figure 3. First type of human-machine interaction

3.1. BI - dimensional computer graphics.

BI - dimencional conputer graphics represents mostly the Operating Systems which support first type of human-machine interaction. This situation is characterized by the next interactions: IT professional - Software - Hardware - Specialist User (Figure 3). Computer graphics inteaction is based on vectorial graphics, omogen coordinates, and Bezier curves. These types of graphical representation are mostly supported and introduced in every day activity as parts of TOS, DOS, MS/DOS, and, partly, of OS/2.

Our experiments comprise such Operating Graphical Systems as GRAPHICS, GEOGRAPHIS and other [1], which were used with the second generation of computers. Were developed fisical and mathematical aspects of graphical human-machine interactions, graphical languages GRAPHICS and GEOGRAPHIS and were created corresponding graphival systems GRAPHICS and GEOGRAPHIS using recursive programming method [2]. Such graphical systems in combination with universal languages and systems were used to prepare the Software for first generation graphplotters and graphical monitors-displays EGAT-EO, DGU-2 and DGU-4 .

3.2. 3D - computer graphics.

Nowadays humans interact more with computer-based technology than with hammers and drills. Unlike tools, the visible shape and controls of a computer do not communicate its purpose.

The task of an HMI is to make the function of a technology self-evident. Much like a well-designed hammer fits the user's hand and makes a physical task easy; a well-designed HMI must fit the user's mental map of the task he or she wishes to carry out.

In nearly every technological solution, the effectiveness of the HMI can predict the acceptance of the entire solution by the intended users. Often, as far as consumers are concerned, the HMI is the product - the user's experience with the interface is far more important than the architecture of the internal workings.

HMI effectiveness is measured by a number of components, such as learnability and productivity. These components are sometimes brought together under the title of "usability," also known as quality of use.

The ISO 9241 standard defines three components of quality of use applicable to the design of HMIs:

- Effectiveness - Does the product do what the users require? Does it do the right thing?
- Efficiency - Can the users learn the HMI quickly? Can they carry out their tasks with minimum expended effort, including a minimum of errors? Does it improve the productivity/effort ratio? Does it do things right?
- Satisfaction - Do users express satisfaction with the product? Does the new product reduce stress? Do the end users now have a more satisfying job?

This HMI is characterized by the interaction: Specialist User - Software - Hardware - People (Figure 4).

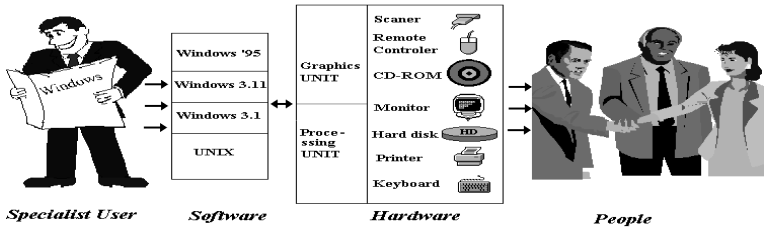


Figure 4. Second type of human-machine interaction

Computer graphics inteaction was based on rastral graphics, 3D-graphics, and 3D-rastral graphics. These types of graphical representation are mostly supported and introduced in every day activity as parts of all types of WINDOWS, UNIX, and its variations for Personal Computers, Minicomputers, Active Ternimals and, partly, for Supercomputers.

Our experiments comprise such Operating Graphical Systems as GRED, GRED-3D, YADRO, COMSIBASIC and other [3], which were used with the third generation of computers. Were developed fisical and mathematical aspects of graphical human-machine interactions, graphical languages GRED and YADRO and were created corresponding graphival systems GRED, GRED-3D, COMSIBASIC, YADRO using extensible programming method [4]. Such graphical systems in combination with universal languages and systems were used to prepare the Software Personal Computers, Minicomputers, Active Ternimals and, partly, for Supercomputers.

3. 3. Adaptable computer graphics.

This HMI is characterized by the interaction People - Software - Hardware - People (Figure 5.) using Processing Units, Graphics Units and Multimedia, Video and Audio Units.

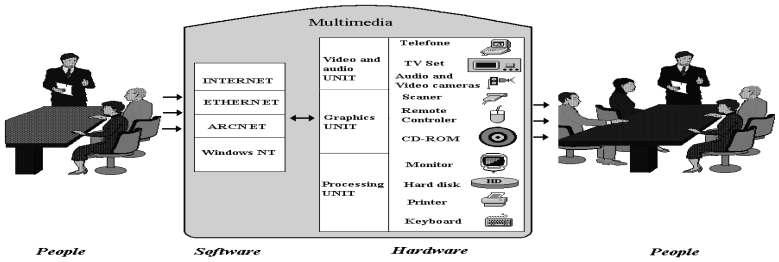


Figure 5. Third type of human-machine interaction

Graphical HMI are supported by Windows NT and its next variations, ArcNet, EtherNet, and INTERNET which support Software for all types of Personal Computers, Minicomputers, Active Ternimals, Mainframe computers , and Supercomputers.

Our experiments comprise YADRO, GRED-3D and SAGRED-3D Graphical Software [5], which were used with the forth generation of computers. Were developed procedural, algorithmical, fisical and mathematical aspects of graphical human-machine interactions, using adaptable programming method [6,7]. Such graphical systems in combination with universal languages and systems were used to prepare Software for Personal Computers, Minicomputers, Active Ternimals and, partly, for Supercomputers.

Computer graphics inteaction was based on developed rastral graphics, 3D-graphics, 3D-rastral graphics with texting, ilumination, omogen coordinates, Bezier surfaces, transformations and normal vectors procedures, models, modules and algorithms.

4. Modern evolution of Computer graphics.

4.1. Next Generation Graphics & Thunderbolt I/O Technology

Apple Announces (May 3, 2011) New iMac With Next Generation Quad-Core Processors, Graphics & Thunderbolt I/O Technology [E-1]: http://money.msn.com/business-news/article.aspx?Feed=BW&Date=20110503&ID=13507465&Symbol=US:AAPL

Apple® today updated its signature all-in-one iMac® with (1) next generation quad-core processors, (2) powerful new graphics, (3) groundbreaking high-speed Thunderbolt I/O

technology and a (4) new FaceTime® HD camera (Figure 6).

Starting at $1,199, the new iMac is up to 70 percent faster and new graphics deliver up to three times the performance of the previous generation.*(Testing conducted by Apple in April 2011 using preproduction iMac configurations. For more information visit:: www.apple.com/imac/features.html.)

Figure 6. Business Wire

"Our customers love the iMac's aluminum enclosure, gorgeous display and all-in-one design," said Philip Schiller, Apple's senior vice president of Worldwide Product Marketing. "With next generation quad-core processors, powerful new graphics, Thunderbolt technology and a FaceTime HD camera, we've made the world's best desktop even better."

The new iMac features quad-core Intel Core i5 processors with an option for customers to choose Core i7 processors up to 3.4 GHz. These next generation processors feature an integrated memory controller for an amazingly responsive experience and a powerful new media engine for high-performance video encoding and decoding. With new AMD Radeon HD graphics processors, the new iMac has the most powerful graphics ever in an all-in-one desktop.

iMac is the first desktop computer on the market to include groundbreaking Thunderbolt I/O technology. The 21.5-inch iMac has a single Thunderbolt port while the 27-inch model features two ports for even greater expansion. Developed by Intel with collaboration from Apple,

Thunderbolt enables expandability never before possible on an all-in-one computer. Featuring two bi-directional channels with transfer speeds up to an amazing 10Gbps each, Thunderbolt delivers PCI Express directly to external high performance peripherals such as RAID arrays, and can support FireWire® and USB consumer devices, and Gigabit Ethernet networks via adapters. Thunderbolt also supports DisplayPort for high resolution displays and works with existing adapters for HDMI, DVI and VGA displays. Freely available for implementation on systems, cables and devices, Thunderbolt technology is expected to be widely adopted as a new standard for high performance I/O.

iMac includes a built-in FaceTime HD camera and Apple's innovative FaceTime software for crisp, widescreen video calling the whole family can enjoy. The new camera supports high definition video calls between all FaceTime HD-enabled Macs and standard resolution calls with iPad® 2, iPhone® 4, the current generation iPod touch® and other Intel-based Macs. The iMac continues to feature its signature aluminum and glass design, gorgeous IPS LED-backlit high resolution display, SD card slot and comes with Apple's innovative Magic Mouse or Magic Trackpad.

Every Mac comes with Mac OS® X Snow Leopard®, the world's most advanced operating system, and iLife®, Apple's innovative suite of applications for creating and sharing great photos, movies and music. Snow Leopard builds on more than a decade of innovation and includes the Mac App Store℠ for finding great new apps for your Mac. iLife '11 features iPhoto® with stunning full screen views for browsing, editing and sharing photos; iMovie® with powerful easy-to-use tools to transform home videos into fun theatrical trailers; and GarageBand® with new ways to improve your playing and create great sounding songs.

4.2. NVIDIA Quadro® 400 graphics processing unit.

New NVIDIA Quadro 400 (April 5, 2011) Empowers Designers and Engineers With Up to 10 Times Better Performance [E-2]: http://money.msn.com/business-news/article.aspx?Feed=MW&Date=20110405&ID=13269752&Symbol=US:NVDA

NVIDIA announced today the NVIDIA Quadro® 400 graphics processing unit (GPU), which is a new professional graphics solution that puts the power of the GPU in the hands of designers and engineers. Built for use with professional applications, such as Autodesk AutoCAD, the NVIDIA Quadro 400 GPU provides up to (1) 5X faster performance over high-end consumer gaming cards; it also

gives up to (2) 10X improvement when running industry leading CAD/CAM applications. Priced at just $169, the Quadro 400 GPU also (3) offers excellent power efficiency, consuming less than 35 watts, and its low-profile footprint means it offers the flexibility to fit into any workstation, including small form-factor systems. With 512 MB of DDR3 memory, the Quadro 400 processor enables professionals to (4) interact with a wide range of design models. It also (5) provides high visual fidelity, featuring a 30-bit (10-bits per color) color engine with a dynamic range of over one billion color variations. Quadro 400 (5) drivers are optimized and certified on leading professional applications.

"Designers and engineers, whether designing the largest assemblies or smallest components, rely on Quadro," said Jeff Brown, general manager, Professional Solutions Group, NVIDIA. "The Quadro 400 is the right tool to help ensure that job gets done the right way, especially when it comes to running professional apps like Autodesk AutoCAD."

Additional features of the new Quadro 400 GPU include: (6) Unified Driver Architecture - Guarantees forward and backward compatibility with professional application software drivers, and simplifies upgrading to a new solution; (7) Hardware 3D Window Clipping- Accelerated clip regions enable faster data transfer between a window and the frame buffer to improve overall graphics performance; (8)High-Quality Display Connectivity - Drives ultra-high-resolution panels, producing phenomenal image quality, supporting two active connectors, including dual-link DVI with up to 3840 x 2400 resolution @ 24Hz on each panel, and DisplayPort (DP) with up to 2560 x 1600 resolution; (9) NVIDIA® Mosaic™ Technology- Enhances workspace across up to eight displays (using one card per two displays), enabling seamless taskbar spanning, as well as transparent scaling of any application. Works over multiple displays or a single high-resolution display, and with NVIDIA nView® desktop management software.

The NVIDIA Quadro 400 processor also supports NVIDIA 3D Vision™ and 3D Vision Pro active shutter glasses 3D technology that delivers crystal-clear, stereoscopic 3D visualization for the most immersive 3D experience, ranging from desktop workstations to collaborative work spaces.

4.2.1. Designed, Built and Engineered by NVIDIA to the Highest Standards of Quality

As with all Quadro professional graphics cards, the Quadro 400 is designed, built and warranted by NVIDIA to provide industry-leading performance and reliability when running professional applications. Companies consistently certify Quadro professional graphics solutions for their users whose livelihoods depend on them.

4.2.2. Availability and Pricing

The Quadro 400 ($169 MSRP, USD) is available immediately for the HP Z800, Z600, and Z400 Workstations, and for all Fujitsu CELSIUS workstations. It will be available later this month and next on select Lenovo ThinkStation D20, C20, S20 and E30 models. It's also available from NVIDIA Quadro channel partners including PNY Technologies in North America and Europe, ELSA in Japan, and Leadtek in Asia Pacific.

For more information about NVIDIA Quadro Professional Graphics Solutions, please visit www.nvidia.com/quadro.

4.3. Video Editing Requirements of Creative Professionals.

LSI MegaRAID Controllers (April 12, 2011) Help Rain Computers Meet Demanding Audio and Video Editing Requirements of Creative Professionals [E-3]: http://money.msn.com/business-news/article.aspx?Feed=PR&Date=20110412&ID=13298439&Symbol=US:LSI

LSI 6Gb/s RAID controllers deliver balanced system performance, premium features and proven reliability for Rain's digital audio and video workstations. LSI Corporation LSI today announced that Rain Computers has chosen LSI® MegaRAID® 6Gb/s SATA+SAS RAID controller cards for (1) integration with its new Venturi Video + Graphics Workstations. The high-end I/O performance and reliability of LSI MegaRAID controllers allow Rain Computers to (2) deliver systems for some of the world's most demanding audio and video editing environments, including customers such as Cirque du Soleil, The Walt Disney Company, the new Conan O'Brien Show and the U.S. Olympic Committee.

"Digital audio and video editing professionals demand workstations that don't allow their compute-intensive environments to interfere with the creative process," said Bill Paschick, founder and chief architect, Rain Computers. " Our Venturi platform is designed to balance power, stability and compatibility, and this can only be achieved by integrating technologies that meet

these same standards. Based on our rigorous testing and qualification processes, LSI MegaRAID controllers proved to be the only RAID products on the market that excelled in each of these critical areas."

Rain's Venturi workstations are: (3) turnkey, high-performance video and audio production computer systems designed for use with applications such as Adobe Creative Suite, Avid Media Composer and AutoCAD; (4) Venturi runs a finely tuned, 64-bit version of Windows 7 Professional and custom BIOS that boosts performance and prevents glitches and dropouts; (5) Venturi workstations are optimized for high-speed video throughput and 2D and 3D rendering.

Rain Computers selected the LSI MegaRAID SAS 9260-4i four-port, PCI Express® 2.0 controller for integration with Venturi systems based on its high transactional I/O performance capabilities, rich feature set, rock-solid reliability and competitive price. The MegaRAID SAS 9260-4i controller, featuring the LSISAS2108 6Gb/s SAS RAID-on-Chip (ROC), helps enable Rain customers to take full advantage of the mulitcore processing power of the Venturi platform. Using the LSI MegaRAID SAS 9260-4i controller, multiple streams of high sample-rate audio with bit depths of 24 or 32 are tracked into the Rain Venturi system. The streams are then filtered and mixed on a PC platform using all the required plug-ins. The Venturi system helps enable a perfect balance of power, stability and compatibility for today's complex and demanding digital audio and video editing applications.

"Access to digital content is essential to meeting audio and video editing deadlines and to avoiding costly project delays," said Brent Blanchard, director of worldwide channel sales and marketing, LSI. "The I/O performance, proven reliability and assured interoperability provided by LSI MegaRAID controllers, together with Rain's high-performance workstations, are helping creative professionals bring their visions to life on time and on budget." Additional information about the LSI MegaRAID controller and Rain Computers' audio and video editing solution is available at http://www.lsi.com/DistributionSystem/User/AssetMgr.aspx?asset=56767

Conclusion

The volume of Knowledge Based and Conscience societies' new MicroSystem industry will be huge-producing at least two orders of magnitude more units than the PC industry. For every PC, there will be thousands of other kinds of systems built around single-chip computer architecture with its interconnection bus on dug, complete with processor, memory hierarchy, I/O (including speech) firmware, and platform software (Figure 7). With more powerful processors, firmware will replace hardware.

Generation	Platform (logic, memories, O/S)	User interface and control	Network infrastructure
The beginning (direct and batch use) (1951)	the computer, vacuum tube, transistor, core, drum and magnetic tape	card, paper tape direct control evolving to batch O/S	none originally-computer was stand-alone
…		…	
Distributed PCs and workstations (1981)	microprocessor PCs and workstations, floppy, small disk	WIMP (windows, icons, mouse, pulldown menus)	WAN, LAN
…		…	
One info dial tone: Phone, videophone, TV, and data (2010)	Video-capable devices of all types	video as a primary data type	Single high-speed network access; home net
Anticipatory by "observing" user behaviour (2020)	room monitoring, gesture	vision, gesture control	Home net
Body net: vision, hearing, monitoring, control, comm., location (2025)	artificial retina, cochlea, glasses for display	implanted sensors and effectors for virtually every part of a body	Body network, gateway to local IR or radio nets everywhere
Robots for home, office and factory(2025)	general purpose robot; appliances become robots	radar, sonar, vision, mobility, arms, hands	IR and radio LAN for home and local areas

Figure 7. New computer classes and their enabling components

The MicroSystem industry will consist of: (1) customers building MicroSystems for embedded applications like automobiles, room- and person-monitoring, PC radio, PDAs, telephones. Internet TV boxes, videophones, smart refrigerators; (2) about a dozen firms that manufacture

MicroSystems; (3) custom design companies that supply "core" IP and take responsibility for the systems; (4) existing computer system companies that have large software investments tied to particular architectures and software; (5) IP companies that supply designs and are paid royalties: ECAD companies that synthesize logic and provide design services (e.g. Cadence, Synopsis); (6) circuit wizards who design fast or low-power memories (e.g., VLSI Libraries), analogue for audio (also a DSP application), radio and TV tuners, radios, GPS, and micro-electromechanical systems (MEMS); (7) varieties of processors from traditional RISC to DSP and multimedia; (8) computer-related applications that require much software and algorithm understanding such as communications protocols and MPEG; (9) proprietary interface companies like RAMbus developing proprietary circuits and signalling standards (old style IP).

References:

[1] D. Todoroi, S. Pereteatcu, L. Romanciuc. *The Computer Graphics Language Guide.* // MOLDBOOK Press, Chisinau, 1980 .- 253 p

[2] D. Todoroi. *The BESM Recursive Programs' System.*// Ghiprotis Press, Moscow, 1967. - 33 p.

[3] S. Pereteatcu, P.Zabolotnai, D. Todoroi. *The YADRO Kernel Computer Graphics System. Parts 1, 2, 3.* // MOLDNIINTI Press, Chisinau, 1985. - 66 p.

[4] D. Todoroi. *The Extensible Computer Graphics Tools. //* Radio and Telecommunication Press, Moscow, 1983. - 208 p.

[5] Yu. Lugnicov, V. Morozov, D. Todoroi. *The Mini - Macro Computer CAD/CAM Complexes*. // Informtechnics Press ,Moscow, 1991, - 196 p.

[6] D. Todoroi. *Computer Science. The Adaptable Programming. The Basic Conceptions*. // ASEM Press, Chisinau, 1992. - 76 p.

[7] D. Todoroi, S. Nazem, T. Jucan, D. Micusha. *Transition to a Full Information Society: Stage Development.* // Working Paper No. 98-2, UNO, Omaha, USA, March 1998. - 38 p.

[8] http://money.msn.com/business-news/-article.aspx?Feed=BW&Date=20110503&ID=13507465&Symbol=US:AAPL

[9] http://money.msn.com/business-news/article.aspx?Feed=MW&Date=20110405&ID=13269752&Symbol=US:NVDA

[10] http://money.msn.com/business-news/ article.aspx?Feed=PR&Date=20110412&ID=13298439&Symbol=US:LSI

CONSIDERATIONS ON SECURITY MANAGEMENT AND MANAGEMENT SECURITY IN IP COMMUNICATION NETWORKS

Daniel GHEORGHICĂ[*], Victor CROITORU[**]
[*] University POLITEHNICA of Bucharest, Romania, danielg@snt.ro
[**] University POLITEHNICA of Bucharest, Romania, croitoru@adcomm.pub.ro

Abstract. Over recent years there has been acceleration in the use of services based on IP networks and due to the ubiquity of computers and the Internet, their use will grow continuous. Today, IP networks are used to provide many services that require high security. Detection methods, documentation and rejection of security threats must be implemented to optimize performance of security management and therefore of the IP networks.
This paper is based on the results of research in management and security of IP communications networks, conducted by authors during last few years. We proposes two methods to optimize the management of IP network security, a security management model, with matching facilities and real time alerting and a security management assessment model to optimize the performance of IP networks.
Methods and models proposed by the authors provides centralized and coordinated management of all equipment within a security perimeter, regardless of their type and manufacturer, while allowing the automation of business management and development of additional modules. To secure the entire IP network and its security management is necessary also to correlate all the security mechanisms in a network security manager.

Keywords: IP, firewall, security, management, events correlation

1. Introduction

The Internet is an open structure which has the advantage of allowing a large number of network devices to be connected, but it requires a difficult management. A crucial aspect of computer networks, especially Internet communications is the security of shared information.

Today, Internet is used as a provider for many services that require a high level of security. More than ever, organizations need to perform useful tasks via Web services, such as the use of distributed resources and remote management of shared resources etc. Development of wireless networks involves users in a very dynamic and nomadic way. All these operations require remote user access through data communication networks to the information stored in the computer systems. In order to ensure the safety of operations performed by users is essential to ensure information security. Generally security means protection from a potential threat, and in relation to information, the threats can range from simple involuntary alteration to access by unauthorized persons or even destroying of them. Information security is the area dealing with data protection mechanisms that ensure a level of confidence in security and it is correct to say that the level of trust in information security mechanisms depends on the level in which they provide data protection and avoid the risks affecting security. Techniques that ensure information security cover all information, regardless of its nature and it is important to note that the information is valuable especially when it is a subject of exchange or processing between parts [1].

All necessary methods for detecting, documenting and rejection of security threats must be implemented in a coordinated manner to achieve a high performance managed such as to ensure information security [2].

Coordination of these methods is obtained through security policies defined in accordance with: all the directives, regulations, rules and best practices that dictate how an organization manages, protects and distributes information through computer systems [3].

In this paper, the authors propose a model of security management meant to improve performance of IP networks at the organizational level. Security event analysis obtained through the security management system is an important element in ensuring a high security level.

2. IP Networks Management

Network Management is required in order to control and optimize network operations and respond to the users' requests for changes. Management includes setup, monitoring and modification of network functions. For this purpose a series of special functions is needed. To distinguish these functions from the normal functions of the network, we shall call these functions "management functions".

Management functions can be turned to explicit functions either by human operators, or automatically, by dedicated hardware or software modules. In case of human operators responsible for network management, most management functions will be performed at a limited number of command centers. If management functions are

automatically performed, it is possible to distribute hardware and software modules that implement these functions in all systems that are networked.

After SNMP (Simple Network Management Protocol) was established as the basis for internet-working management protocol, its utilization increasingly rose. The term SNMP is used to refer to a collection of specifications regarding network management that include the protocol itself, the definitions of a database and the associated concepts.

The architectural SNMP model for network management (figure 1) is a collection of network management stations and network management elements. Network management stations execute management applications that monitor network elements by sending queries. Network elements have management agents responsible for performing the network management functions requested by the network management stations. Management agents can get access to data about network elements configurations and performance. The data are expressed as variables and are stored in a database called management information base (MIB).

Currently there are defined three SNMP versions i.e.: SNMPv1, SNMPv2 and SNMPv3. Version 2 bring improvements to the first version of the protocol operations and introduce new features. Version 3 adds security to communications and remote configuration capabilities. In terms of security the new features of SNMPv3 include: authentication and privacy and authorization and access control

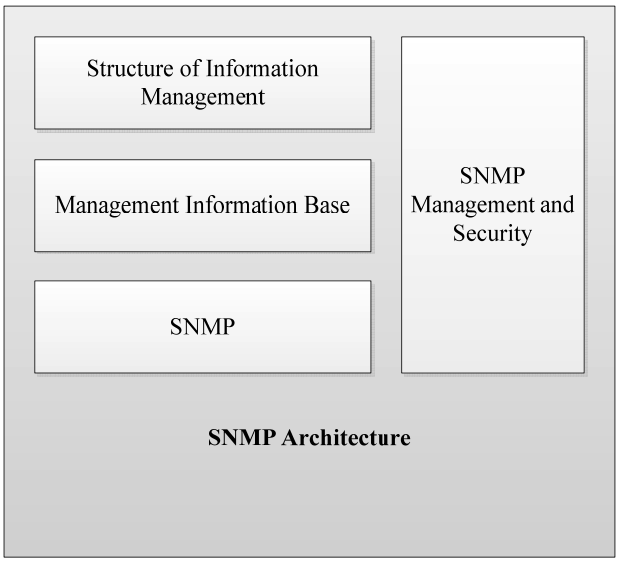


Figure 1 SNMP Architecture

Additionally to the classical SNMP network management, modern IP networks require additional capabilities of setting up or collecting information from the managed devices.

3. Security Management

Like any other network device, a firewall has to be managed by someone. Security policy should state who is responsible for managing the firewall, how will it be managed and the access method.

Management of firewall policy configurations can be complex, error-prone, costly and inefficient for many large networked organizations. Implementing a firewall configuration policy involves either writing low-level command syntax via a Command Line Interface (CLI) or the use of a graphical management console. Typical errors in a firewall configuration policy range from invalid syntax to errors in properly comprehending the configuration, given its scale and complexity. The Graphical User Interface (GUI) is the most commonly used method to configure a firewall in a timely manner, especially amongst inexperienced administrators.

Actual firewall configuration tools allow individual management of the security policy. When the management of different firewall policies is required it must be established one administrative session with each firewall. Each firewall will have its own security policy without any correlation with the policies of firewall from the security area [4].

Design of the sequence of rules in a firewall must assure that these are consistent, complete, and compact. Consistency means that the rules are ordered correctly, completeness means that every packet satisfies at least one rule in the firewall, and compactness means that the firewall has no redundant rules [5].

Firewalls are the first line of defense visible to an attacker and, by design; they are generally difficult to attack directly, causing attackers to often target the administrative accounts on a firewall.

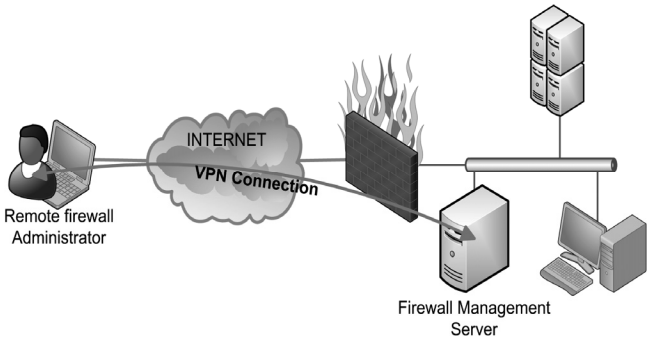


Figure 2 Remote firewall configuration - topology

Firewall policy management model provide platform and a framework for developing secure management systems (figure 2). In [6] is described a system for secured firewall policy management designed using this MVC (Model – View - Controller) model. The proposed model provides a unified top-down view of all network and next-generation firewall policies, from all of the leading vendors. It also supports comparison and analysis of revisions using the vendor's native conventions.

Firewall policy management allows analysis of even the largest, most complex firewall rule bases to identify unused or shadowed rules and objects [7]. Utilization of an analytic model of rules can eliminate security loopholes, improve performance, and ease the maintenance [8].

Taking into consideration the high level of security required by information exchanged within the proposed model of remote firewall management it is necessary to consider a way of assuring this. All the communication channels used inside the model are encrypted using pre private pre-shared keys or SSL (Secure Sockets Layer) encrypted tunnels (figure 3).

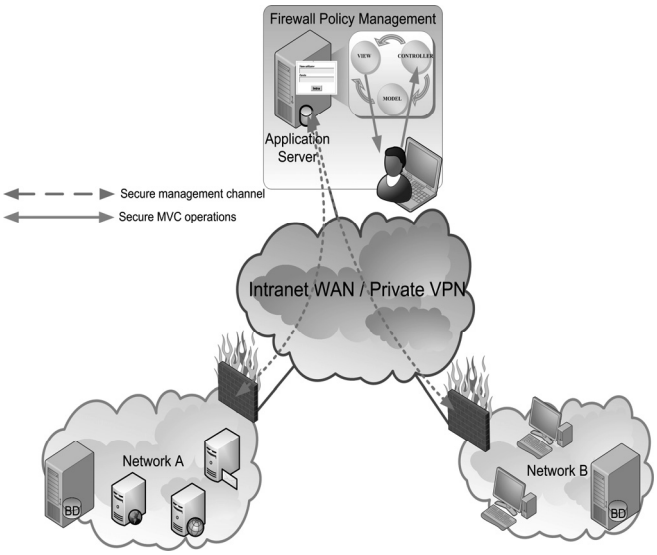


Figure 3 Common usages for secure management model

4. Management Security

Network security monitoring implies a series of sensors in, and around the network. Every firewall produces a continuous stream of audit messages. So does every router and server. IDSs (Intrusion Detection Systems) send messages whenever they notice something. Every other security product generates alarms in some way. These sensors by themselves do not offer security. Only a human has a chance of detecting some anomalous behavior that gives him away, but to be able to do this he need to access all these information in a centralized and correlated manner.

To secure the entire IP network and its security management it is also necessary to correlate all the security mechanisms in a network security manager. This security manager is responsible for collection of security information from managed security network devices, correlation and use of resulted information as an input for security management.

The entire process of collection, correlation and use of security information is provided by the Event Correlation System (ECS) as displayed in figure 4. Collection of security information is performed in a secure manner and consists in gathering of security event for managed IP security. Collected information are then inter-correlated and / or with other security related information gathered from external sources, like Common Vulnerabilities and Exposures (CVE) database or any other security related databases [9].

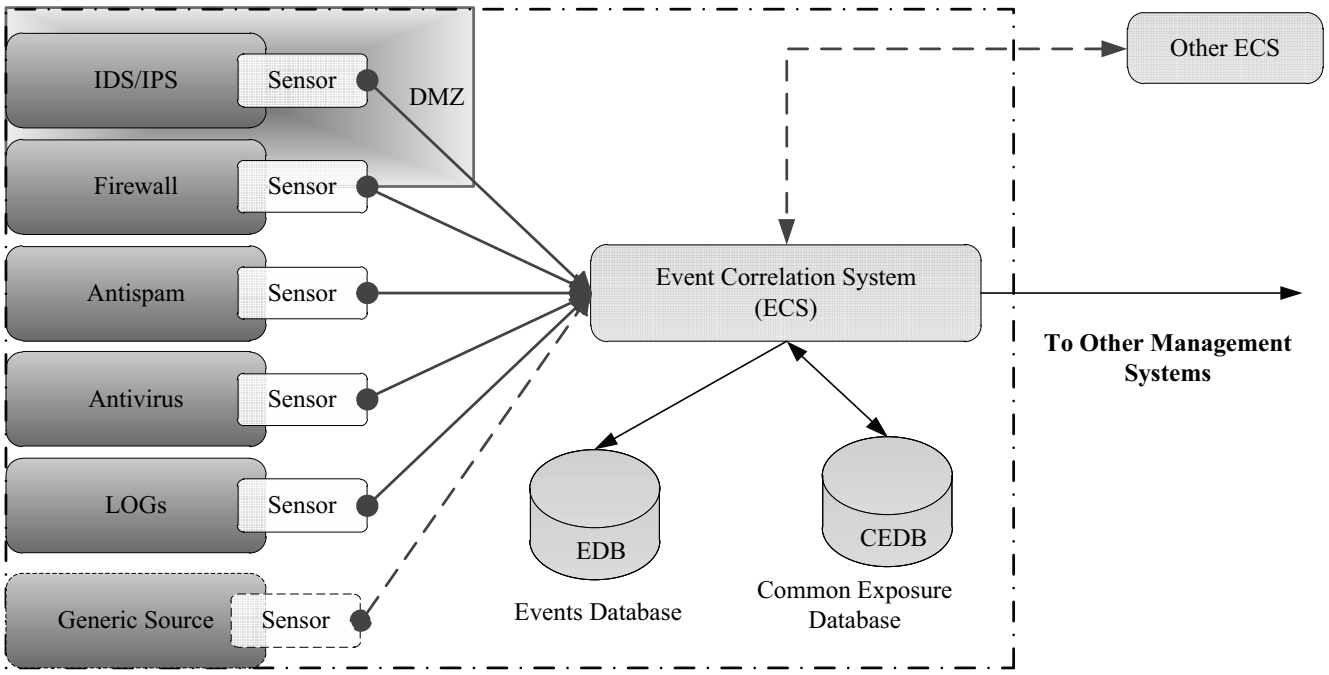


Figure 4 Logical diagram of Event Correlation System

Optionally, the system may decide to notify an external operational management system when security incidents are detected and investigated [10].

In order to optimize the collection of events from different distributed networks, ensuring in the same time the maximum security level, it is advisable to use separate collection systems to limit exposure surface in public networks [11].

Considering the previous assumptions, the proposed model can monitor the overall security of the communications network, but it is possible also to monitor only some key security devices from network [6].

Mandatory requirements of the centralized security monitoring and alerting systems are:

- *modularity* - the system must be able to monitor large-scale networks without a significant impact on performance;
- *scalability* - because the dynamics of technology, it is necessary to permit the possibility of extending the system;
- *parallelism* - the system must allow concurrent monitoring of multiple network elements;
- *notifications* - once identified a potential problem, the monitoring system will alert the appropriate contacts for its immediate remedy, the most important notification mechanisms are: SMS (Short Message Service), SNMP trap, e-mail;
- *security* - monitoring operation requires additional attention in this regard because the monitoring system is a bridge between your monitored network and its managers;

5. Conclusions

The re-perimeterization and the erosion of trust boundaries already happening in organizations is amplified and accelerated by Cloud Computing. Cloud service models employed, operational models, and technologies used to enable Cloud services may present additional risks and requirements to an organization compared to traditional IT solutions [2].

Methods and models proposed by the authors to sustains the Cloud security services of an organization and provide interoperability to identified stakeholders, in order to guideline Cloud activities within an organization.

In the same time, taking into account that Voice over IP SBC (Session Border Controller) works in cooperation with IP firewalls, not affecting the general security policy implemented on them, proposed model of firewall management allows centralized ma

nagement of deployed policies at organizational level [12].

The goal of this model was to develop a universal solution that solves the firewall/NAT problem for VoIP in small business and home environments. It can be used in combination with various operating systems and does not depend on modified clients or a modified IP PBX (Internet Protocol Private Branch Exchange).

References

1. Boehmer, W.: *"Toward a Target Function of an Information Security Management System,"* Computer and Information Technology (CIT), 2010 IEEE 10th International Conference on , pp.809-816, June 2010
2. Kretzschmar, M., Hanigk, S.: *"Security management interoperability challenges for Collaborative Clouds,"* Systems and Virtualization Management (SVM), 2010 4th International DMTF Academic Alliance Workshop on , vol., no., pp.43-49, 25-29 Oct. 2010
3. Fengying W., Caihong L., Lei Z., Xiumei L. - *A comprehensive security policy research on web information system,* IEEE International Conference on Automation and Logistics, 2009, pp.1776-1780
4. Gouda, M.G., Liu, A.X.: *"Structured firewall design"* Computer Networks: The International Journal of Computer and Telecommunications Networking 2007, vol.51, no.4, pp. 1106-1120, New York.
5. Alex X. Liu, *Formal Verification of Firewall Policies*, ICC '08. IEEE International Conference on, Vol. 1, 2008, pp. 1494-1498.
6. Gheorghică D. - „*Contributions to modelling and analysis of communication networks in sight of performance optimization - Security management and management security in IP networks*", PhD thesis, Politechnica University of Bucharest, Bucharest, Romania, 2010, pp. 105-120
7. Khan, B., Khan, M.K., Mahmud, M., Alghathbar, K.S.: *"Security Analysis of Firewall Rule Sets in Computer Networks,"* Emerging Security Information Systems and Technologies (SECURWARE), 2010 Fourth International Conference on , vol., no., pp.51-56, 18-25 July 2010
8. Tapdiya A., Fulp Errin W." *"Towards optimal firewall rule ordering utilizing directed acyclical graphs,"* Proceedings of 18th International Conference on Computer Communications and Networks 2009, pp. 1-6, San Francisco USA.
9. Micki K., Harold F. T., - „*Handbook of Information Security Management*", Auerbach Publications, 2008
10. Boicescu L., Gheorghică D., Croitoru V. – *Monitoring System for IP Networks Security with Multiple Alerting Features* (*Sistem de monitorizare a securității rețelelor IP cu facilități multiple de alertare),* Conferința națională şi expoziția de energetică, CNEE2009, Vol II, Sinaia, 2009, pp. 856-862.
11. Acharya, H.B., Joshi, A., Gouda, M.G.: *"Firewall modules and modular firewalls"* Network Protocols (ICNP), 2010 18th IEEE International Conference on , vol., no., pp.174-182, 5-8 Oct. 2010
12. Constantinescu, M.; Gheorghica, D.; Croitoru, V., "*Secure and flexible method for SBC/firewall management"*, Signals, Circuits and Systems 2009, ISSCS2009, International Symposium on , vol., no., pp.1-4, 9-10 July 2009

MECHNANICAL CHARACTERISTICS OF AESTHETIC NITINOL ARCHWIRES

Camelia, Szuhanek[1], T., Fleser[2]
[1] Faculty of Dental Medicine, "Victor Babes" University of Medicine and Pharmacy Timisoara, [2]Mechanical Engineering Faculty, POLITEHNICA University of Timisoara ,
camelia_fleser@yahoo.com, trfleser@yahoo.com

Abstract. During the last decades, the number of adult patients requiring orthodontic treatment has increased. Although ceramic brackets were introduced, the wire used during orthodontic treatment was still visible. Coating metallic archwires with Teflon or epoxy materials is currently the solution for this aesthetic problem.
Our aim was to investigate the mechanical properties of coated superelastic archwires from different producers and to compare them with the characteristics of conventional archwires.
A bending test was used in order to evaluate the elastic properties of the investigated samples. Experimental results were statistically processed in order to emphasize the average values, the amplitude (R) and the mean square deviation (S).
Results showed that ultraesthetic coated archwires produced lower values (81%), in loading and unloading compared with uncoated wires of same nominal size.

Keywords: NiTi orthodontics wires; elasticity; friction

¶

1.Introduction

An expectation of beautiful smiles at the end of orthodontic treatment is a primary concern to each patient, but is also equally concerned with appearance while undergoing treatment. Generated are based on the broadening effects jaw, creating space between your teeth, that their displacement. Many attempts have been made by manufacturers to meet this demand.
Orthodontic springs are included in any type of device, fixed or mobile, are actually elastic wires through which apply orthodontic forces on teeth.
The NiTi materials in the form of wire, fall within this category, have gained significant use in orthodontics. The respective alloys are employed in two different structural states resulted from heat processing. The structural state is correlated to the functional scope. The use of intelligent materials such as the shape memory alloys in the medical field ensures the possibility of designing and practical achievement of certain cosmetic dentistry works with special advantages regarding the enhanced biocompatibility, superelasticity, the effect of the shape memory, resistance against corrosion and wear, etc., which leads to very favourable functional and aesthetic effects. Consequently, the social impact upon the numerous patients with malfunctions of their braces is extremely high [1, 2, 3, 4]. The intelligent materials have physical and mechanical characteristics which can be modified via metallurgical factors, respectively through the design of the tensioning device, being explicitly included in the primary mathematical models which describe the materials mentioned [5, 6, 7]. The shape memory alloys, such as the Ni-Ti alloys, have the characteristic of superelasticity which is around significant higher than that of stainless steel. Superelasticity refers to an unusual characteristic of certain metals of resisting to a high plastic deformation.
Another important finding is that some wires showed different levels of resistance according to the test that they were submitted. This study allows a direct comparison of different archwires to assist the choice to choose the one with lowest level in regard to bending resistance[8].

Since the introduction of the superelastic archwires the use based on the theory of applying light continuous force has been indicate. Frecvent had use the rectangular superelastic archwire since the initial phases of the treatment. Tridimensional control of the teeth could be range but also, using wires with circular cross sections would delivery optimum forces of resistance to sliding.
The bracket – wire high friction is due to the roughness of the bracket interface which slows the sliding of the archwire through the bracket. This clinical problem can be managed by using coated superelastic archwires brackets with smoother slot surfaces i.e. A high variety of products is now available on the market, using this particular design feature.

The purpose of this research is to evaluate the behavior and the resistance by using circular superelastic NiTi wires , protected and unprotected surface with plastic material.

2.Materials and methods

Experimental study aimed NiTi wire material: uncoated state (one) with a diameter of 0.387 mm and coated with Teflon (two variants) with a diameter of 0.403 mm. The initial length of a complete orthodontic arch was 115 mm.

Orthodontic wire coating teflon layer significantly reduces the coefficient of friction between wire and bracket. Depending on the physical and mechanical thickness of the deposited layer that is expected to some stiffening of the wire.

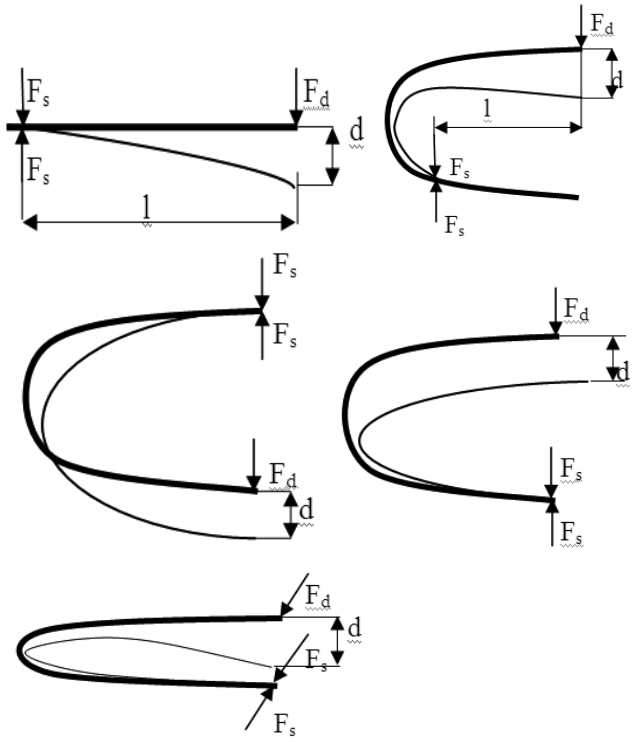
Use of NiTi wires has gained ground because of the significant benefits, compared with stainless steel wires, or ferrous alloys:

- high initial shape memory up to 8%
- very good shape memory / features superelastice after thermomechanical treatment,
- high ductility (60% possibility of cold work)
- excellent performance against corrosion and friction,
- relatively high electrical resistance,
- biomedical compatibility.

The wires used in the experimental program are consistent with current orthodontic specifications [9, 10, 11].

Applications of wire bending is most common in orthodontic applications. The development of the forces applied to teeth by bending moments developed based orthodontic wire orthodontic treatment success. Consequently, the experimental study was aimed at highlighting the dependencies between displacements and forces for five types of requests associated with bending, chosen as the most common practical applications (Figure 1) simple bending (1), closing semiarcului (2), the opening spring (3), closing spring (4), lateral bending and torsion (5).

Forces acting on the wire restraining analyzed by clamping (Fs), and that was the input parameter of deformation (DF). This was ensured by direct application of mass bran. Free length of the call for simple bending (a) was l = 45 mm. Every type of wire analyzed groups was measured displacement



1) 2) 3) 4) 5)

Figure 1. Common practical applications: simple bending (1), closing semi-arc (2), opening spring (3), closing spring (4), lateral bending and torsion (5).

(d).

Results movements (d) measured on each of the 10 components of each type of wire (three types) were statistically processed in order to emphasize the average values, the amplitude (R) and the mean square deviation (S).

3. Results and discussion.

The graphical representation emphasizes for the five groups of samples almost linear dependencies between the deformation induced by the load. The results of measurements of movements / deformations for the set of uncoated state wires are presented in Figure 2, in conjunction with the arrangements for application in Figure 1.

The results of measurements of displacements / deformations for two sets of wires protected are presented in figures 3 and 4, in conjunction with the arrangements for application in Figure 1.

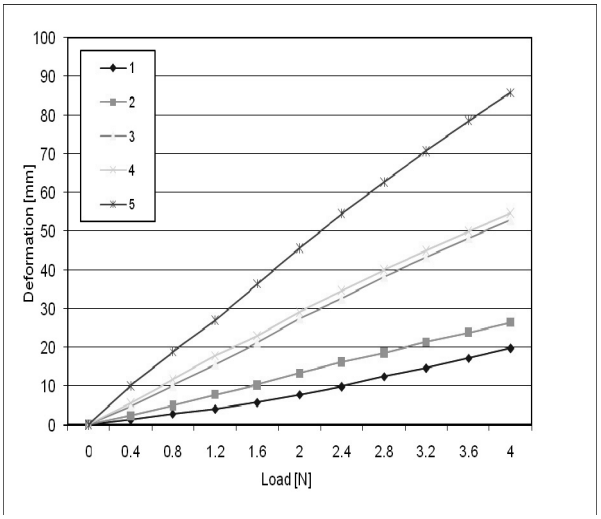


Figure 2. Dependence of deflection under load for the set of uncoated state wires

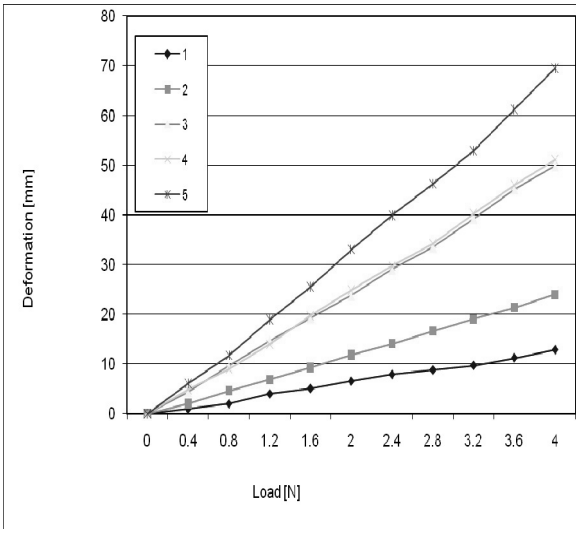


Figure 3. Dependence of deflection under load for the set (a) of uncoated state wires

It is noteworthy elastic behavior of wire analyzed based on the linearity of the dependence between the forces and displacements induced demand. The results mean elasticity, amplitude and mean square deviation are shown on the application fields applied (Table 1).

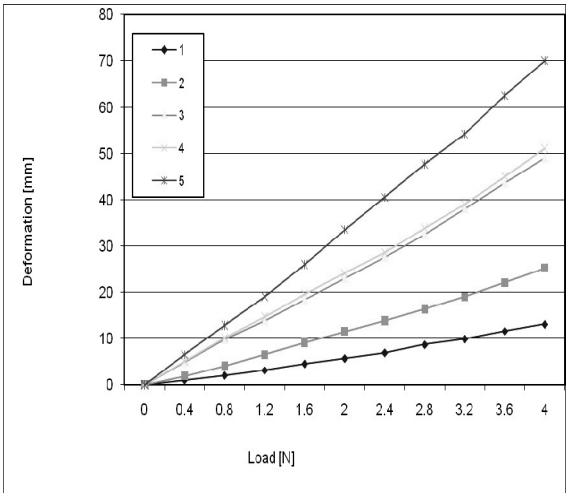


Figure 4. Dependence of deflection under load for the set (b) of uncoated state wires

Tabelul 1. Experimental results

Nr.	Set of wi-res	Req u-est (fig.1)	Average elasticity E/mm/N/	Ampli-tude R /N/mm/	Mean square deviation (S)
1	Un	1	412	35	3,4
2	Coa-	2	645	59	6,1
3	ted	3	1315	125	10,9
4		4	1418	140	15,4
5		5	2293	225	20,9
6	I	1	305	30	2,9
7	Coa-	2	572	55	5,9
8	ted	3	1181	115	10,5
9		4	1239	125	13,1
10		5	1642	159	17,0
11	II	1	283	26	3,1
12	Coa-	2	568	52	6,0
13	ted	3	1190	106	10,8
14		4	1244	127	12,4
15		5	1691	162	17,9

The previous graphs show the significant dependencies depending on how the application of orthodontic arch, and the slope of the straight lines is conclusive proof in this regard. The wires were analyzed according to the most rigid application of simple bending (item 1, Figure 1). Wire elasticity subject to requests 3 and 4 (see Figure 1) is similar, in fact bow closure request was submitted, that opening in elastic behavior.

Horizontal positioning of orthodontic arch at one end of the consolidation and application request from the other end of the generated bending and torsion (requesting 5 in Figure 1). Behavior proved curved wire having the highest elasticity.

Average values of elasticity analysis shows the effect of strengthening due to the deposit layer of teflon. The set of wires protected with additional layers had an average elasticity of about 81% of the set of bare wires.

Amplitude (R) stands at about 10% to characterize the scattering of individual strains under the applied effects of wire. However, the standard deviation (S) stands at about 1% of reading. An overall analysis of statistical parameters indicate that lots of wires subjected to experiments are homogeneous in terms of assessing elasticity.

4.Conclusions

a. Orthodontic springs are included in any type of device, fixed or mobile, and materials in the form of NiTi wire, unprotected or protected with plastic Within this category fall, Have gained Significant use in Orthodontics.

b. The experimental study was focused on three sets of standard wires, to highlight dependencies between movements and associated forces for five types of requirements, the most common practical applications: a simple bending, semiarcului closing, opening and closing the arch and lateral bending torsion.

c. The set of wires were protected by additional layers of the average elasticity of about 81% of the set of bare wires.

d. The statistical parameters (amplitude R, the standard deviation S) reduced the values determined, shows that lots of wires subjected to experiments are homogeneous in terms of assessing elasticity.

Acknowledgement: This work was supported by CNCSIS –UEFISCSU, project number PNII – IDEI 1738/2008-2011.

Refernces

[1]. Pelton AR, Medical uses of nitinol. *Materials Science Forum, Stöckel D & Duerig TW*, 2000, P.327-328: 63-70.

[2]. O'Leary JP, et al.:The Use of Ni-Ti in the Homer Mammalok, in *Engineering Aspects of Shape Memory Alloys, Duerig TW*, et al. (eds), Boston, Butterworth-Heinemann, 2005, p 477,.

[3]. Musialek J, Filip P, Nieslanik J.: Titanium-nickel shape memory clamps in small bone surgery. *Arch Orthop Trauma Surg* 2008, p.341-344.

[4]. Szuhanek, Camelia, Fleser T.: Mechanical Caracteristics for NiTi Wires in Orthodontic Used. Proc. 11th WSEAS international conference on biology and chemistry. Iasi, Univ. G.Enescu, Romania, Pages: 44-48, 2010. ISBN ~ ISSN:1790-2769 , 978-960-474-194-6. Publisher: World Scientific and Engineering Academy and Society (WSEAS) . Stevens Point, Wisconsin, USA. www.wseas.org.

[5]. Szuhanek, Camelia, Faur, N., Glavan, Florica, Cernescu, A., Fleser, T.: Numerical analysis of stress and strain distribution during orthodontic treatment with space closure. *Proc. Ninth International Conference New Trends in fatigue and fracture, Journal of the Society for Structural Integrity and Life, Beograd*, 2009, ISSN1451-3749.

[6]. Szuhanek, Camelia, Faur, N., Glavan, Florica, Cernescu, A., Fleser, T.: Finite element analysis of stress and strain in orthodontic miniimplants. *Proc. Ninth International Conference New Trends in fatigue and fracture, Journal of the Society for Structural Integrity and Life, Beograd, 2009*, ISSN1451-3749.

[7]. Szuhanek, Camelia, Faur, N, Florica, Glavan, Cicala, E., Fleser, T.: Numerical analysis of mechanical stress induced by orthodontic forces in root apex. *UPT Scientific Bullettin, Mechanical Serie, fasc. 1, 2009*, p.63–67, ISSN 1224-6077.

[8]. Azeredo R., G.: Evaluation of the behavior of Nickel-Titanium (Niti) wires in the 1st and 2nd order movements [Dissertação de Mestrado]. Araraquara: Faculdade de Odontologia da UNESP; 2007).

[9]. SR EN 10002-1/2002 Metal materials. Traction test. Part 1: Test method at air temperature.

[10]. SR ISO 7801:1993 Metal materials. Wire. Alternating bending test.

[11]. ANSI/ADA No.32 – Orthodontic Wires.

MECHANICAL PROPERTIES OF CERAMIC ORTHODONTIC BRACKETS

Camelia, SZUHANEK[1], T., FLEŞER[2]
[1] Faculty of Dental Medicine, "Victor Babes" University of Medicine and Pharmacy, Timisoara,
[2]Mechanical Engineering Faculty, POLITEHNICA University of Timisoara ,
e-mail: camelia_fleser@yahoo.com, trfleser@yahoo.com

Abstract. As the number of adult patients increases in orthodontic practice, the demand for esthetic appliances has also raised. Despite the esthetic effect, some disadvantages with these appliances include low fracture toughness and increased frictional resistance between metal archwires and ceramic brackets.This article provides an up-to-date evaluation on the mechanical characteristics of ceramic brackets.
Keywords: orthodontic brackets, ceramic, mechanical characteristics.

1.Introduction

A beautiful smile at the end of orthodontic treatment is a primary concern to every patient, who is also equally concerned with appearance while undergoing treatment. The brackets manufacturers have understood these objectives have developed a large number of esthetic appliances.

During the early 1970s, plastic brackets were marketed as the esthetic alternative to metal brackets. These polycarbonate brackets quickly lost favor because of discoloration and slot distortion caused by water absorption. This led manufacturers to modify the plastic brackets by reinforcing the slots with metal and ceramic fillers. Despite these alterations, the clinical problems like distortion and discoloration persisted.

As the desire of the aesthetics goal, the patients realized that natural colored ceramic brackets had many advantages over traditional polymer and metallic brackets because they can provide natural hue like human teeth as well as excellent wear resistance. Two types of ceramic brackets, such as single crystal (sapphire) and polycrystals, have been widely used in commercial orthodontics market. In the 80's, research have led to the clinical use of ceramic polycrystalline and monocrystalline sapphire materials. The use of ceramic brackets raise issues regarding bracket adhesion to dental surface, low tenacity, high friction in contact with the orthodontic wire[1, 2, 3].

Single-crystal ceramic brackets are manufactured by an entirely different process. It is manufactured by heating aluminum oxide to temperatures in excess of 2100^0C. The molten mass is cooled slowly, and the bracket is machined from the resulting crystal.

Orthodontic manufacturers purchase these large single crystals and mill them into the shapes and dimensions of various brackets, using ultrasonic cutting techniques, diamond cutting, or a combination of the two. After milling, the sapphire crystals are heat-treated to remove surface imperfections and to relieve stresses induced by the milling operations.

The primary advantage of single-crystal manufacturing is the elimination of possible stress-inducing impurities or imperfections. The disadvantage is the difficulty and added expense of milling the third-hardest known material. This involves the development of new technology, with its inherent new problems. Production of polycrystalline brackets is less difficult, and hence these brackets are more readily available at present.

In a technical way, ceramic has a polycristalyne structure, while the saphire is monocrystalin, which allows for a better clarity. The saphire is an ά –bioceramic allumina, a unique synthetised crystal which have been used for more than 10 years in implantology. The clinical success in of more than 95%. It is also bioinert and biocompatible.

The orthodontic treatment with metallic brackets were mainly the only option we had in the past. Until recently, the ceramic brackets were considered the most esthetic treatment in our way for a nice and clear smile. Today, the sapphire brackets put in balance the mechanics control and the social appearance of the patient.

The patient's comfort is assured by the esthetic design and the anatomic shape and design. The biocompatibility is very high, while the brackets colour remains the same through the treatment (figure 1). The bracket base has high retention characteristics, in order to improve the bracket adhesion. Bracket debonding will not raise problems of degradation or fissures, due to the high mechanical resistance.

The sapphire has mechanical and physical properties that makes it different than other esthetic bracket material, such as polycristaline ceramics. The polycristalline braackets have high mechanical resistance, but they are fragile at debonding and fracture very quickly. Their resistance at dinamical loads is also quite low. Saphire brackets enjoy a higher resistance to statical loads,

although their structure is still fragile, comparing with metal ones.

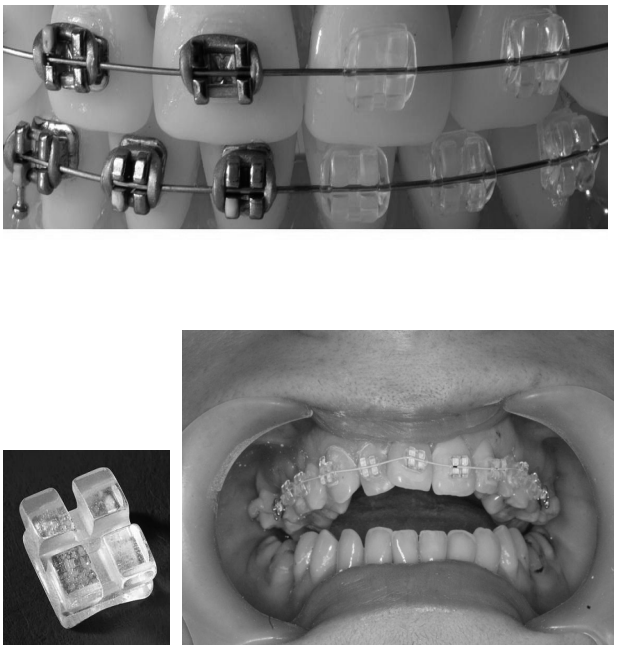


Figure 1. The esthetic sapphyre system(intraoral view).

Practice has revealed significant degradation of steel wire in contact with bracket slot, due to the relatively small movements and low frecquency of activations during orthodontic treatment. Meanwhile, the bracket slot distorsion has lower values than of the archwire. This phenomena is dependent on the initial state of surface and the significant wide toughness of contact materials. The roughness of bracket slot can have a more negative effect on the wire than can the wire on the slot.

This effect can be lowered by quality finishing the surfaces in contact and covering them with low friction materials.

The physical properties of ceramics which are important to the orthodontics include hardness, tensile strength and fracture toughness or brittleness. Based on these background, the objective of our experimental program was a complexe evaluation of ceramic brackets mechanical properties.

2.Material and methods

Ceramic brackets are composed of aluminum oxide. Polycrystalline alumina & monocrystalline alumina are the two most common varieties. The most apparent difference between polycrystalline and single-crystal brackets is in their optical clarity [2].

Monocrystalline brackets--manufacturing process is manufactured by heating aluminum oxide to temperatures in excess of 2100^0C. The molten mass is cooled slowly and the bracket is machined from the resulting crystal.

Polycrystalline brackets is manufactured by blending aluminum oxide particles with a binder, the mixture can be formed into a shape from which a bracket can be machined (sintering process). Temperatures above 1800^0C are used to burn out the binder and fuse together the particles of the molded mixture. Then it is heat treated to remove surface imperfections and relieve stresses created by the cutting operation[2].

Optical properties and strength are incompatible for polycrystalline ceramics. The larger the ceramic grains, the greater the clarity or translucency. However, the material tends to become weaker when the grains reach a size of about 30 microns.

The main advantage of the polycrystalline manufacturing process is its ability to mold brackets-a relatively inexpensive operation that yields large quantities. The disadvantages of this molding process are the presence of structural imperfections at grain boundaries or of trace amounts of impurities. Impurities or slight imperfections can serve as foci for crack propagation under stress.

An alternative method of making polycrystalline brackets is injection molding. This process does not require the brackets to be machined and thus eliminates structural imperfections created by the cutting process.

Single-crystal ceramic brackets are manufactured by an entirely different process. Orthodontic manufacturers purchase these large single crystals and mill them into the shapes and dimensions of various brackets. After milling, the sapphire crystals are heat-treated to remove surface imperfections and to relieve stresses induced by the milling operations.

The experimental programe included two groups. The first one was formed of 15 sapphire brackets, while the second group consisted of the same number of polycristaline ceramic brackets. Table 1 shows the mechanical and physical properties of the materials used in brackets manufacturing[4, 5, 6, 7, 8, 9].

For a model used in making ceramic bracket, have been published features in Table 2 / 11 /.

The experimental program had in mind the specifications of the standards ISO 11405-2003, ISO 14971 - 2007, ISO 10993 -1. Bracket bonding was consistent with their manufacturers specifications (glue Blugloo, Ormco).

The research techniques included: universal machine for mechanical tests, impact test apparatus, apparatus for abrasion testing, device for determining hardness. Conducting experiments required the design and use of devices to install and support, tailored to the configuration and dimensions of the bracket.

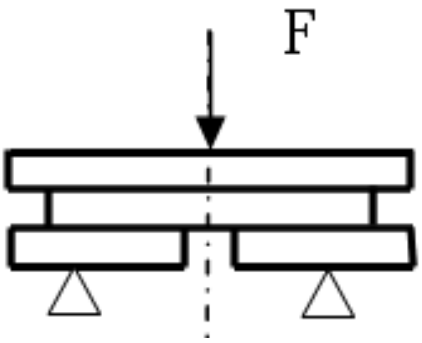
Table 1. Mechanical and physical characteristics of saphire and ceramic bracket materials[4, 5, 6, 7, 8, 9].

Nr.	Characteristic	U.M.	Ceramic	Sappfire
1	Tensile strength	MPa	120-200	180-270
2	Compressive strength	MPa	110-200	170-230
3	Flexural strength	MPa	160-360	270-420
4	Hardness	Mohs	8	9
5	Coefficient of thermal expansion	Gr. -1	8 – 6	8 – 6
6	Thermal conductivity	Kcal/m.h.grad	10-20	12-25
7	Electrical Resistivity	Ω.cm	990-910	1012-1013
8	Density	g/cm3	3,1-3,3	3,7-3,8

Table 2. Physical and mechanical ceramic brackets[10].

Caracte-ristics	Green density	Sintered grain size	Sintering tempera-ture	Sintered density	Com-paction force	Elasticity modulus	Hardness (Vickers)	Abrasion resis-tance	Fracture toughness
U.M.	%	nm	°C	g/cm3	MPa	GPa	GPa	nm/h	MPam0,5
Valure	60	500	1500	>3,95	150	390	>20	5	3,84

¶Empty space [Times New Roman 11p, single]



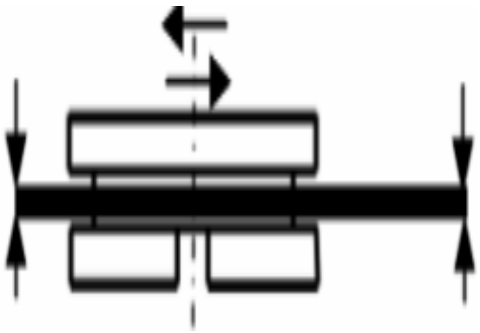


Figure 3. Mechanical testing scheme.

Frictional wear test was carried out by positioning an orthodontic wires 0.4 mm diameter channel in the bracket, tense. Relative displacement in the dry state was at a frequency of 0.5 Hz with amplitude of 4 mm, the duration of 10,000 cycles.

The results recorded on each of the tests performed statistically Were Processed in order to emphasize the Average values (AV), the Amplitude (R) and the Mean Square Deviation (S). Some features have not been determined due to inconclusive statistical results of the measurements values in Table 3.

3.Results and discussion

Examination of the initial optical state exhibits were noted particularly high surface finish, ie very low surface roughness. The design of these areas is attractive.

This is not favored at the expense of possible fracture initiation concentrators due to roughness of surface tension. It appears that cross-channel edges have radii less than 0.1 mm, which is a fragile material geometric concentrator acute tension. The effect is to favor low-energy fracture.

From the point of view of those observations, do not differ from those of sapphire ceramic brackets.
Table 3 shows the results of mechanical tests in the program included experimental.

Table 3. The results of mechanical tests

Nr.	Testing	U.M.*	Ceramic brackets**			Sappire brackets**		
			AV	R	S	AV	R	S
1	Bending	MPa	170	15	4	305	24	3
2	Impact bend	J	2,9	0,9	0,2	2,1	0,4	0,1
3	Mass loss from friction							
4	wear-wire	Gr.	0,003			0,001		
5	-bracket	Gr.	0,002			-		
6	Hardness,	Mohs	7,5	0,5		9	0,5	
7	Force of debonding	MPa	12	4	0,7	16	5	0,3

* U.M. refer only to media and amplitude values in the table, ** Average values (AV), Amplitude (R) Mean Square Deviation (S).

The comparative assessment of values, that worked, it appears more favorable levels of use of the bracket features of sapphire compared to those of ceramics. Also, uniformity of results, defined as the amplitude of individual values is also in favor of sapphire bracket. The situation is confirmed in the parts of the population on mean square deviation.

I noticed the high stresses for breaking the bracket bending test. What is known about the vulnerability of the ceramic materials such requests to shocks, was recovered by low values of toughness. Fracture surface appearance was full fragile. Orthodontic ceramics is processed at high temperatures and pressures, affecting the crystal lattice. Under these conditions favoring the fragile behavior. Toughness ceramics is 2.5 - 5% of the steel used in orthodontics. Is noted ceramics ceramics crystal fragility higher compared with the polycrystalline [6, 7].

Polycrystalline alumina (ceramic brackets) presents higher fracture toughness than single-crystal alumina(sapphire brackets). Bracket surface roughness on the surface energy dramatically reduces cracking. This is one reason for the high level requirements for surface finish.

An important physical property of aluminum oxide ceramic bracket is extremely high hardness. This adds a sapphire brackets advantage compared to those of ceramic polycrystals.

Polycrystalline ceramics brackets have a higher coefficient of friction than monocrystalline ceramic (Sapphire). This is due to off their rougher and more porous surface and this is most likely the result of their lower surface roughness. Mass loss was negligible in sapphire bracket.

Bracket degradation caused by friction effects of loss of large amounts of mass on orthodontic wires in contact with the ceramic bracket, compared to wire braces tested in contact with sapphire. The explanation is found mainly on the state of surface finish of the bracket channels, but also by the fact that the couple sapphire bracket-wire friction coefficient is lower than polycrystalline ceramic-wire torque.

The brittle nature of ceramic brackets has resulted in a higher incidence of bracket failure (fracture) during debonding. Ceramic compounds, unlike metals, are also susceptible to crack propagation caused by minute imperfections or material impurities. High-strength ceramics can fail relatively easily when cracks or imperfections allow for local concentrations of stresses. On the other hand, mechanical detachment of the sapphire bracket of generally less than those of ceramic fracture. The difference is correlated with the mechanical strength of sapphire more favorable position compared to polycrystalline ceramic.

4.Conclusions

a.Researches have highlighted the role of determining the level of surface finish geometric edges with direct operational role, the toughness, abrasion behavior.

b.Construction inevitably polycrystalline ceramic lattice defects. Network oxide atoms permitre no position limits and internal stress redistribution, the impact on fragile behavior.

c.The sappfire brackets were more homogenous and structurally embodied claim for mechanical characteristics caused by lower values of amplitude and

mean square deviation compared to the same conditions, the behavior of polycrystalline ceramics.

Acknowledgement: This work was supported by CNCSIS –UEFISCSU, project number PNII – IDEI 1738/2008-2011.

References

1. Ashok Kumar Jena, Ritu Duggal, A. K. Mehrotra: *Physical Properties and Clinical Characteristics of Ceramic Brackets: A Comprehensive Review.* Trends Biomater. Artif. Organs, Vol 20 (2), pp 123-145, (2007) http://www.sbaoi.org.

2. Gautam, P., Valiathan A.:*Ceramic brackets: in search of an ideal!* In Trends in Biomaterials and Artificial Organs, New York, Jan, 2007.

3. Brantley, W., Eliades T.: *Orthodontic Materials. Scientific and Clinical Aspects*. Geprg Thieme Verlag, Stuttgart, ISBN 31-31-125281-2 (GTV).

4. Johnson, G., Mary P. , Kula, W., Katherine : *Fracture Strength of Ceramic Bracket Tie Wings Subjected to Tension*. Angle Orthodontist, Vol 75, No 1, 2005, p. 95-100.

5. Eliades T., Lekka, M., Eliades, G., Brantley, W.,A.Ş: *Surface characterization of ceramic brackets: a multitechni,que approach.* Am J Orthod Dentofac Orthop 1994; 105: 10-18.

6. Iwasa, M., Brandt R., C.: *Fracture toughness of single crystal alumina.* In: Kingery WD, editor. Structure and properties of MgO and Al2O3. Advances in ceramics. Vol. 10. Columbus: American Ceramic Society; 1986: 767-78.

7 Kusy, R., P.Ş.: *Morphology of polycrystalline aluminum brackets and its relationship to fracture toughness and strength.* Angle Orthod 1988: 58: 197-203.

8 Omana, H., M., Moore, R., N., Bagby, M., D.: *Frictional properties of metal and ceramic brackets.* J Clin Orthod 1992; 26: 425-432.

9. Kusy, R., P., Whitley, J., Q.: *Coefficients of friction for arch wires in stainless steel and polycrystalline alumina bracket slots: I, the dry state.* Am J Orthod Dentofac Orthop 1990; 98: 300-312.

10. x x x Nanoe Incubateur Centrale Paris. Achatenay, e-mail: contact@nanoe.com.

11. Mihai, Laurenția, Lelia, Mihăilescu, Maria, Slăvescu D., D.,D.: *Alumina and zirconium implants biocompatibility* . Revista Română de Stomatologie, vol LV, nr. 4, 2009, p. 268-271.

EXPERIMENTAL INVESTIGTION OF THE FRETTING PHENOMENON-DEPENDENCE OF NUMBERS CYCLES

Ştefan GHIMIŞI
Constantin Brâncuşi University of Târgu Jiu, Romania
ghimisi@utgjiu.ro

Abstract: *Fretting damage is often the origin catastrophic failures or loss of functionality in many industrial applications. Considered as a plague for modern industry, fretting is encountered in all quasi-static loadings submitted to vibration and thus concerns many industrial branches. The main parameters were reported to be amplitude displacement, normal load, frequency, surface roughness and morphology, and residual stresses. The present paper argues that adhesion forces and elastic deformation in the contact zone may contribute significantly to the relative displacement during fretting of metals. Keywords: fretting, wear, experiment*

1. Introduction

Fretting is now fully identified as a small amplitude oscillatory motion which induces a harmonic tangential force between two surfaces in contact. It is related to three main loadings, i.e. fretting-wear, fretting-fatigue and fretting corrosion.

The main parameters were reported to be amplitude displacement, normal load, frequency, surface roughness and morphology, and residual stresses. More recently fretting has been discussed using the third-body concept and using the means of the velocity accommodation mechanisms introduced by Godet et al.

Fretting regimes were first mapped by Vingsbo[1]. In a similar way, three fretting regimes will be considered: stick regime, slip regime and mixed regime. The mixed regime was made up of initial gross slip followed by partial slip condition after a few hundred cycles. Obviously the partial slip transition develops the highest stress levels which can induce fatigue crack nucleation depending on the fatigue properties of the two contacting first bodies. Therefore prediction of the frontier between partial slip and gross slip is required.

The type of surface damage that occurs in fretting contact depends on the magnitude of the surface normal and tangential tractions. In existing fretting models the relative displacement is assumed to be accommodated mainly microslip in the contact surface[2],[3].

The present paper argues that adhesion forces and elastic deformation in the contact zone may contribute significantly to the relative displacement during fretting of metals. A simultaneously applied tangential force and normal into contact appears a adhesion force. A tangential force whose magnitude is less equal on greater than the force of limiting friction will not give rise on give rise to a sliding motion. It is determined the energy loss dissipated per fretting cycle.

2.Experimental means

For the study of the fretting phenomenon in case of elastics assemblages spring slides with multiple sheets, I used the experimental stall from fig.1.[4],[5].
The stall permits testing for one slide and for spring slides with multiple sheets, too.

2.1. Description of the stall

On the rigid support the elastic lamella (6) is assembling through the agency of the superior plate (4) and of the screws (1).
The assemblage is made through the agency of 8 balls (4 balls inferior and 4 superior balls) who assure a point contact between the ball and the lamella.
The elastic lamella (6) oscillates because of the rod crank mechanism with eccentric (8).This mechanism is actioned with the electrical engine assuring the necessary conditions for producing the fretting phenomenon.
The contact is charged with the assistance of 4 screws (1) through the agency of some helicoidally springs (2) and through the agency of some radial-axial bearings with conic rolls.
The helicoidally springs beforehand standard permit a charge with a normal and known force, the presence of the radial-axial bearings assuring the eliminate of friction between the screw and the superior plate.

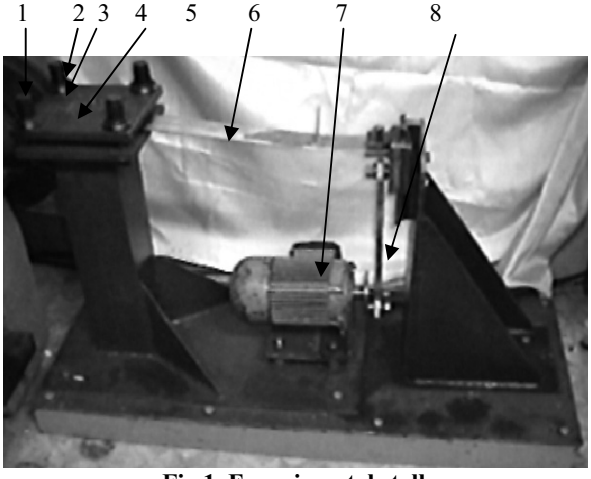


Fig.1. Experimental stall

The stall can be used for the testing at fretting of some couples by different materials. This stall can be adapted for study of the lamellar springs with many sheets.

The lamellas used in experiments have the dimensions 560x56x2 mm and are realized by spring steel having hardness 55 HRC.

The balls are spring balls and have 19 mm in diameter. The lamella is supported in inferior side on 4 balls (fig.2) in superior side the charge of the contact is made through the agency of 4 balls. The rod-crank mechanism permits adisplace at the end (extremity) of the 20 mm lamella and can modify this displace by changing of the system eccentricity (Fig.3). The system is actioned through the agency of electrical engine having revolution of 750 rot/min.

Fig.2 Inferior side

Fig.3.The system excentricity

Helping with this experimental stall we can made fretting tries for normales and different forces for different numbers of solicitation cycles.
We obtained different wear traces corresponding fretting wear. So, we find the dependence of the normal charging force, and we can compare the different fretting traces by comparing of different fretting zones for certain conditions of contact.

Therewith we can compare the theoretical results previously presented with the experimental results. Traces wear obtained was assumed with a video camera and processing on the computer. The displacement at the contact level was determined, like we shown previously helping with the video camera and computer.

The determination of displacement was made for the two ranges of balls.

In the table 1. are the traces wear obtained for a normal charcing of 150 N on the each screw.

For comparing the traces wear obtained with the theoretical results obtained for the fretting phenomenon we determined the central area and the annular adjacent area, and the results are in the table 2 for the front balls and in the table 3, for the back balls. In fig.4. and 5 are the dependence of the wear traces by the cycles numbers for a normal force by 150 N and for the two position of the balls in front and back.

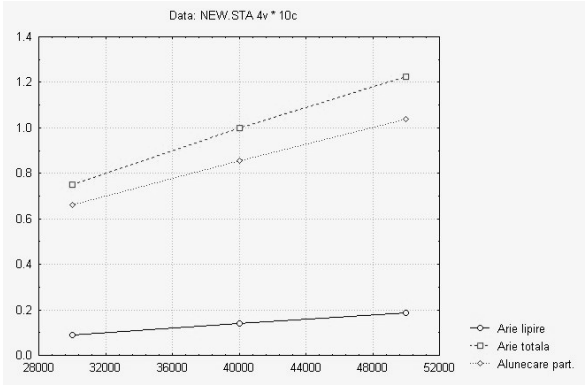


Fig.4. The dependence of the wear traces by the numbers of cycles for F= 150N; in front

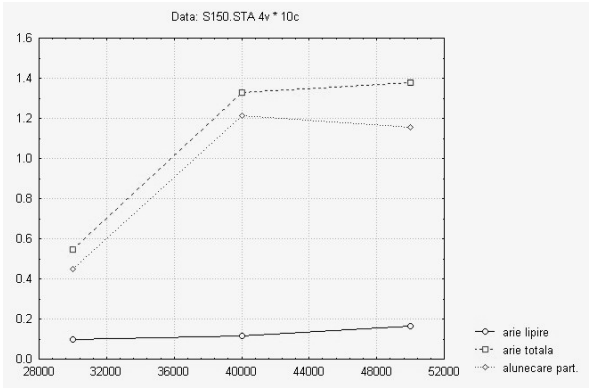


Fig.5. The dependence of the wear traces by the numbers of cycles for F= 150N;back

In fig.6. and 7 are the dependence of the partial sliding by the cycles numbers for a normal force by 150 N and for the two position of the balls in front and back.

Table 1

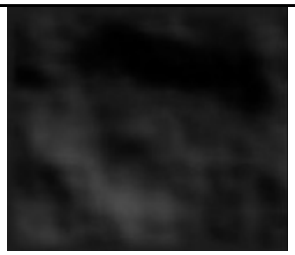
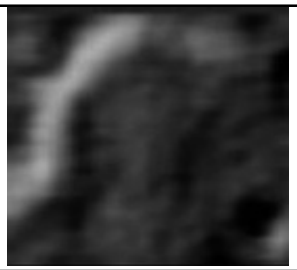
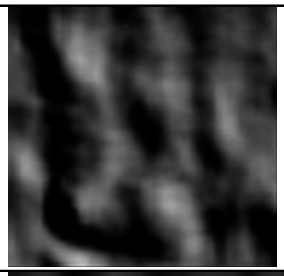
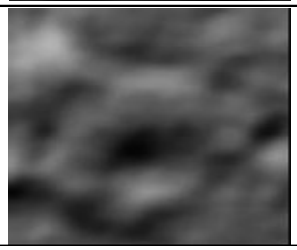
Number of cycles	Pozition of balls	
	face	back
30000		
40000		
50000		

Table 2

Nr. crt.	Loading [N]	Number of cycles	Area central [mm^2]	Radius central [mm]	Area ext. [mm^2]	Radius ext. [mm]	Area annular [mm^2]
1	150	30000	0.09087	0.17007	0.75040	0.4887	0.65953
2	150	40000	0.14207	0.21265	0.99770	0.5635	0.85563
3	150	50000	0.18636	0.24356	1.22522	0.6245	1.03886

Table 3

Nr. crt.	Loading [N]	Number of cycles	Area central [mm^2]	Radius central [mm]	Area ext. [mm^2]	Radius ext. [mm]	Area annular [mm^2]
1	150	30000	0.09610	0.17489	0.54559	0.4167	0.44949
2	150	40000	0.11547	0.19172	1.32867	0.6503	1.21320
3	150	50000	0.16672	0.23037	1.37761	0.6622	1.21089

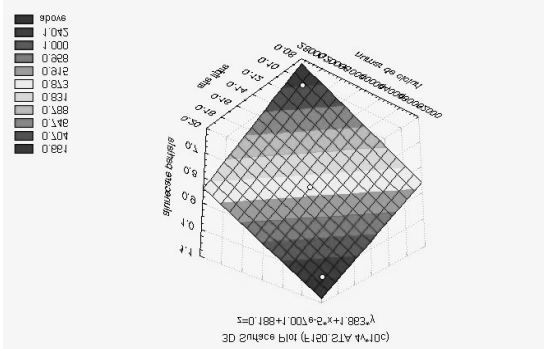


Fig.6 Partial sliding from F=150N - front

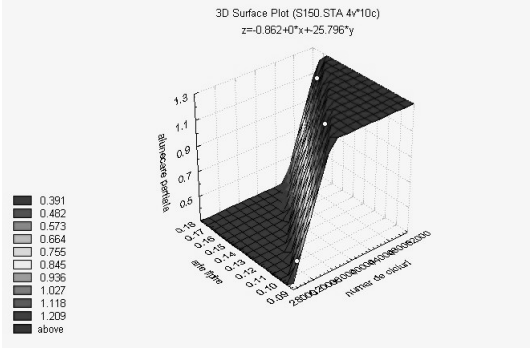


Fig.7 Partial sliding from F=150N - back

In fig.8, 9 and 10 are the dependence of the partial sliding by the cycles numbers for a normal force by 150 N

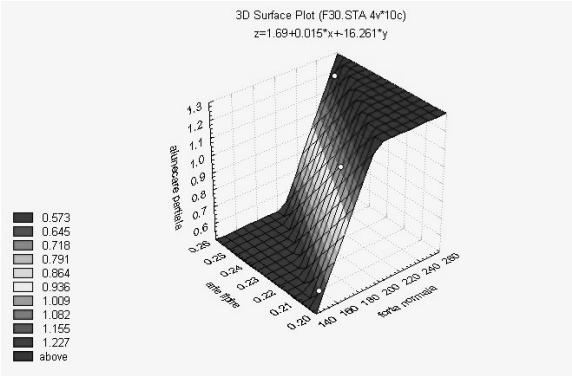


Fig.8 Partial sliding from Nc=30000 cycles

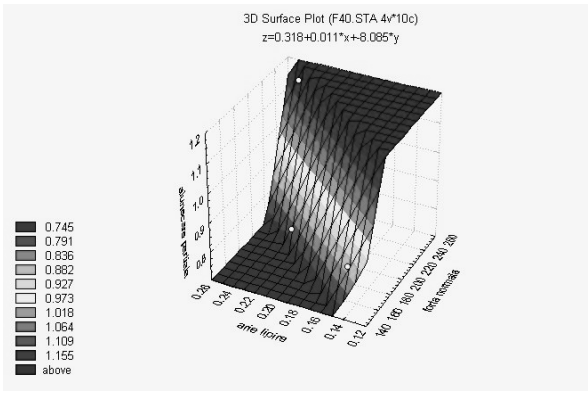


Fig.9 Partial sliding from Nc=40000 cycles

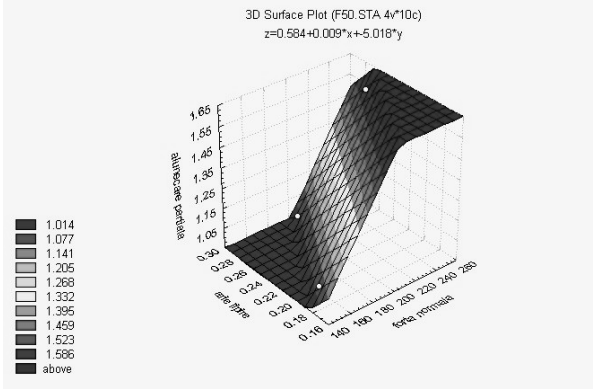


Fig.10 Partial sliding from Nc=50000 cycles

3.Conclusions

The experimental stall permits realization of the experimental tries for the study of fretting. We can determine the different size of the fretting areas and we can compare these with the theoretical results.

Can be made considerations for existence of one friction coefficient who is variable between the surfaces corresponding by one fretting contact.

References

[1] O.Vingsbo and M.Soderberg,*On fretting maps*,Wear, 126 (1988) 131-147

[2] D.W.Hoeppner,*Mechanisms of fretting fatigue and their impact on test methoda development*,ASTM-STP 1159(1992) 23-32

[3]. Fouvry, S., Kapsa, Ph, Vincent, L.,1995,*Analysis of sliding behaviour for fretting loadings: determination of transition criteria*,*Wear*,185 p. 35-46

[4]. Ghimisi, S., 2000, *An elastic-plastic adhesion model for fretting*,*15* Th.Symposium "Danubia Adria", Bertinoro, Italia, p.181-183

[5].Ghimisi.S. *These of doctorate*. University Politehnica Bucharest, 2000

SCR SYSTEM APPLYED ON OFF ROAD VEHICLE TO REDUCE NO_x

Ramon-Mihai BALOGH[(1)], Ioana IONEL[(1)], Dan Simion STEPAN[(1)], Nicolae LONTIŞ[(1)],
(1)"Politehnica" University of Timişoara, Mihai Viteazu bulevard, Faculty of Mechanic, Romania,
baloghramon@gmail.com

Abstract: It is known that the transport occupies one of leading places in terms of chemical pollution caused by gases produced by diesel engines. Presently the scientific community is focussing on the reducing of environmental pollution, which affects directly or indirectly on human health. The main concern of scientists is to determine levels of pollution and finding new ways to reduce pollution, particularly chemical pollution.

The paper presents the NO_x mechanism, SCR system as the most used aftertreatment method and results from the test made on an off road diesel engine differently loaded.

Keywords**:** off road vehicle, environment, pollution, pollutants.

1. **Introduction**

Once with the emergence of steam engine and followed by diesel engine, the transport sectors have registered an exponential development. From here the main concern of chemical pollution and their effects on environment and human health. The scientists are locking for new methods to reduce chemical pollution produced by existent engines and to develop new engines and technologies that correspond to the present pollution norms.

2. **European pollution norms**

The European emission standards for new nonroad diesel engines have been structured as Stage I...IV standards. The main regulatory steps were [1]:

Stage I/II. The first European legislation to regulate emissions from nonroad (off-road) mobile equipment was promulgated on December 16, 1997 [*Directive 97/68/EC*]. The regulations for nonroad diesels were introduced in two stages: Stage I implemented in 1999 and Stage II implemented from 2001 to 2004. The equipment covered by the standard included industrial drilling rigs, compressors, construction wheel loaders, bulldozers, nonroad trucks, highway excavators, forklift trucks, etc.

Stage III/IV. Stage III/IV emission standards for nonroad engines were adopted by the European Parliament on 21 April 2004 [*Directive 2004/26/EC*], and for agricultural and forestry tractors on 21 February 2005 [*Directive 2005/13/EC*].

Stage III standards-which are further divided into Stages IIIA and IIIB-are phased-in from 2006 to 2013, Stage IV (Tabel 1) enter into force in 2014. Stage III/IV legislation applies only to new vehicles and equipment; replacement engines to be used in machinery already in use (except for railcar, locomotive and inland waterway vessel propulsion engines) should comply with the limit values that the engine to be replaced had to meet when originally placed on the market.

The implementation data from tabele 1 refer to the *market placement* data. For all engine categories, a sell-off period of two years is allowed for engines produced prior to the respective market placement date. The dates for *new type approvals* are, with some exceptions, one year ahead of the respective market placement date .

Table 1. Stage IV Standards for Nonroad Engines [1]

Cat.	Net Power kW	Date	CO	HC	NO_x	PM
			g/kWh			
Q	$130 \le P \le 560$	2014.01	3.5	0.19	0.4	0.025
R	$56 \le P < 130$	2014.10	5.0	0.19	0.4	0.025

Stage III/IV standards also include a limit for *ammonia* emissions, which must not exceed a mean of 25 ppm over the test cycle.

Stage III B standards introduce PM limit of 0.025 g/kWh, representing about 90% emission reduction relative to Stage II. To meet this limit value, it is anticipated that engines will have to be equipped with particulate filters. Stage IV also introduces a very stringent NO_x limit of 0.4 g/kWh, which is expected to require NO_x aftertreatment.

The particular engine modes and their weighting factors for B-type (11 mode) test cycles for off-road vehicles are presented in Table 5.

Tabel 5. Weighting Factors of B-Type ISO 8178 Test Cycles[1]

Mode number	1	2	3	4	5	6	7	8	9	10	11
Torque, %	100	75	50	25	10	100	75	50	25	10	0
Speed	Rated speed					Intermediate speed					Low idle
	Off-road vehicles										
Type	0.15	0.15	0.15	-	0.10	0.10	0.10	0.10	-	-	0.15

C1											
Type C2	-	-	-	0.06	-	0.02	0.05	0.32	0.30	0.10	0.15

Notes:

- Engine torque is expressed in percent of the maximum available torque at a given engine speed
- Rated speed is the speed at which the manufacturer specifies the rated engine power
- Intermediate speed is the speed corresponding to the peak engine torque.

The ISO 8178 is an international standard designed for a number of non-road engine applications. It is used for emission certification and/or type approval in many countries worldwide, including the USA, European Union and Japan. It is actually a collection of many steady-state test cycles (type C1, C2, D1, etc.) designed for different classes of engines and equipment[1].

3. NO_x production due the combustion of engines

Nitrogen oxide can be binary compound of notrogen and oxigen, or mixture betwen them like: nitric oxide (NO), nitrogen dioxide (NO_2), nitrous oxide (N_2O), nitrate radical (NO_3), dinitrogen trioxide (N_2O_3), dinitrogen tetroxide (N_2O_4) and dinitrogen pentoxide (N_2O_5). In atmospheric chemistry, air pollution and related fields, nitrogen oxides refers specifically to NO_x (NO and NO_2).

The NO_x are produce during combustion, especially at high temperature, mechanism that was descovered for the first time by Zeldovich in 1946. The mechanism is describe by the folowing elementar reactions [2]:

$$O_2 \rightarrow 2O \quad (1)$$

$$N_2 + O \rightarrow NO + N \quad (2)$$

$$O_2 + N \rightarrow NO + O \quad (3)$$

$$OH + N \rightarrow NO + H \quad (4)$$

The equations (2),(3) and (4) are known as the extended Zeldovich mechanism: N_2 in the presence of elementary oxygen (O) reacts and results NO and N. The next step reaction is that the resulting molecular nitrogen (N) reacts with O_2 and results NO and O, and the chain reaction starts again. Nitric oxide from combustion originates from two sources: atmospheric nitrogen (N_2 – is the most important source in diesel engines) and organic nitrogen in the fuel (N_{fuel}) [2,3].

The nitrogen atoms released at reaction (2) are then oxidized to nitric oxide mainly by a hydroxyl radical (OH) reaction (4). Reaction (2) has a very high activation energy and is the factor limiting of the reaction rate and is also extremely sensitive to temperature. For this reason the nitric oxide formed according to the Zeldovich mechanism is commonly known as **thermal NO**.

The thermal NO formation rate on Otto engines is not significant on temperature below 1700 K, but became strongly accelerated on temperature over 2000 K by λ=1,1 when the equilibrium concetration is reached. This rate can be reduce by lowering and controlling the temperature by direct steam injection into the cylinder dilution of the intake air with re-circulated exhaust gases, and humidification of the intake air with steam, late injection [1, 2].

The proportion of NO_2 from total NO_x emissions to the gasoline engine is 1-10% and from diesel engines is 5-15%. Inside the engine, NO_2 and OH radicals are obtaining from NO by reaction with HO_2. The most likely equation is:

$$NO + HO_2 \rightarrow NO_2 + OH \quad (5)$$

At ambient temperature, the chemical equilibrium is almost completely to NO_2. The NO is reacting with ozone in the presence of light and therefore the equilibrium will be establish after a few hours or days – depending on the environmental conditions – established [2].

Prompt NO. Fenimore showed in the 1970s that not all nitric oxide formed in, especially, substoichiometric hydrocarbon flames could be explained by Zeldovich mechanisms. He suggested that the nitrogen in the combustion air reacts to NO through another mechanism, which is initiated by a reaction between N_2 and hydrocarbon radicals (CH_i):

$$N_2 + CH \rightarrow HCN + N \quad (6)$$

If oxygen is present, the hydrogen cyanide (HCN) and the nitrogen atom (N) produced in the reaction react further to nitric oxide through several reaction phases. The main reaction sequence is:

$$HCN \xrightarrow{+O} NCO \xrightarrow{+H} NH \xrightarrow{+H} N \xrightarrow{+O_2,+OH} NO \quad (7)$$

The formation of nitric oxide is usually very fast, and the nitric oxide formed is therefore called prompt NO. In contrast to thermal NO, fast NO depends only slightly on temperature. In diesel engines, the contribution of prompt NO to the total NO emission is estimated to be minor, below 5% [3].

Nitrous oxide NO. According to the third mechanism for reaction of molecular nitrogen to nitric oxide presented in the 1970s, atomic oxygen (O) and N_2 form an unstable gas (N_2O, „laughing gas") according to the following reaction:

$$O + N_2 + M \rightarrow N_2O + M \quad (8)$$

where M represents any gas component.

Furthure more, the „laughing gas" formed reacts again, either back to N_2 or to NO, depending on conditions. When the air ratio and temperature increase, the formation of nitric oxide also increases. The main reaction to nitric oxide is then[3]:

$$N_2O + O \rightarrow 2NO \quad (9)$$

Fuel NO. From fuel-nitrogen (HCN) the most important NO formation route is the reaction (2.6). Fuel NO is slightly dependent on temperature, and nitric oxide is easily formed from fuel-nitrogen at low temperatures too, below 1100 K [3].

From this NO forming methods, the most important is thermal, the others have relatively minor importance.

4. NO_x reduction methods

4.1. General aspects

Emissions from internal combustion engines are not only harmful concentrations or amounts, but because they are emitted at ground level, then the imminent approach of human habitat.

Compounds are formed in the exhaust gases contribute to air pollution, globally and locally, directly or indirectly causing chemical chain reactions in the atmosphere. Very dangerous are greenhouse gases with influence on climate change, with unpredictable consequences on the environment, climate and quality of life [4].

4.2. Selective catalytic reduction of NO_x

Nitrogen oxides or NO_x are chemical oxides that are produced during combustion at high temperatures. The two elements, nitrogen and oxygen typically do not react with each other at normal temperatures, but when high temperature combustion occurs, the elements combine to form this toxic oxide. The release of these toxins into the atmosphere is considered major contributors to air pollution, and for industries and manufacturers of internal combustion engines, NO_x reduction is now a legal necessity.

The most used aftertreatment method to reduce NOx level is Selective Catalytic Reduction or SCR using NH3 discovered in 1957. At that time it was discovered that the reductant (such as urea), is injected and mixed with the gases before entering the catalyst chamber and reacts, reaction takes place as the gases pass through the DOC (Pt catalyst) chamber and SCR Catalyst (Figure 1).

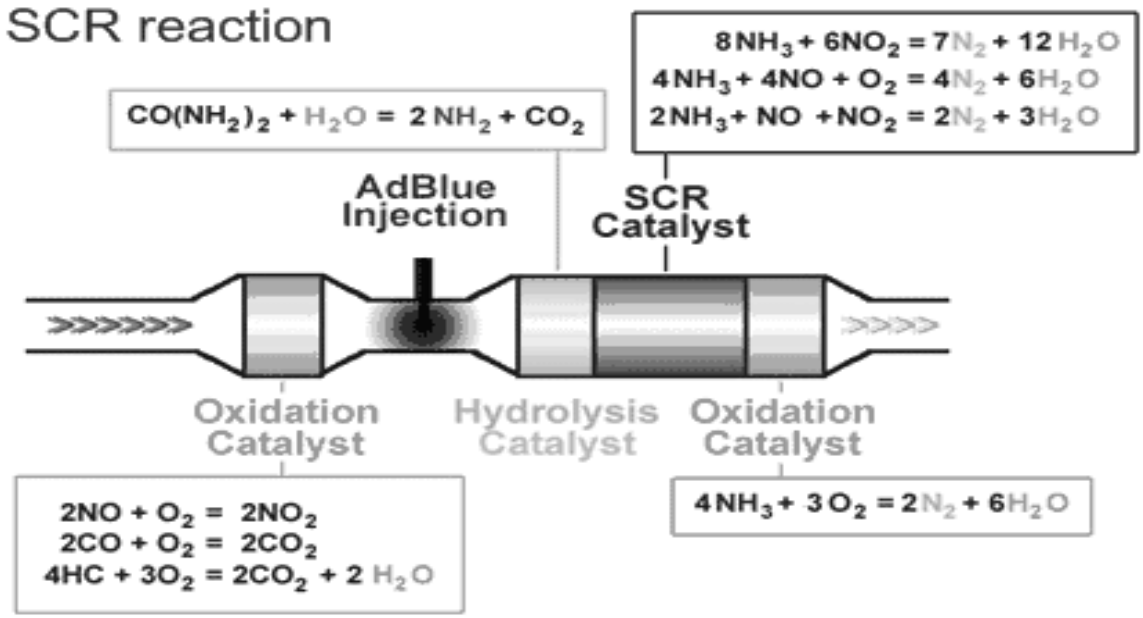


Figure 1. 3 ways SCR reaction mecanism[5]

Once it is in the catalyst a chemical reaction takes place to separate the nitrogen and oxygen. The result is that instead of NOx, these operations are now releasing Nitrogen(N_2) and Water(H_2O) into the atmosphere, both of which are harmless [1].

The major desired reaction during this proces are[7]:

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O \quad (10)$$

$$2NO_2 + 4NH_3 + O_2 \rightarrow 3N_2 + 6H_2O \quad (11)$$

$$NO + NO_2 + 2NH_3 \rightarrow 2N_2 + 3H_2O \quad (12)$$

$$8NH_3 + 6NO_2 \rightarrow 7N_2 + 12H_2O \quad (13)$$

Betwen desired reactions there is and some undesirable reaction that produce a powerful grenhouse gas such as N_2O [7]:

$$2NH_3 + O_2 \rightarrow N_2O + 3H_2O \quad (14)$$

$$2SO_2 + O_2 \rightarrow 2SO_3 \quad (15)$$

$$2NH_3 + SO_3 + H_2O \rightarrow (NH_4)_2SO_4 \quad (16)$$

$$NH_3 + SO_3 + H_2O \rightarrow NH_4HSO_4 \quad (17)$$

The reaction for urea instead of either anhydrous or aqueous ammonia is:

$$4NO + 2(NH_2)_2CO + O_2 \rightarrow 4N_2 + 4H_2O + 2CO_2 \quad (18)$$

The injected amount of amonia can be wasted by catalytic oxidation to elemental nitrogen(19) or NO (20):

$$4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O \quad (19)$$

$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O \quad (20)$$

this two reactions are nonselective reactions[7].

The ideal reaction has an optimal temperature range between 350 ºC and 450 ºC, but can operate from 225 to 450 ºC with longer residence times (figure 2).

The minimum effective temperature depends on the various fuels, gas constituents and catalyst geometry. Other possible reductants include cyanuric acid and ammonium sulfate.

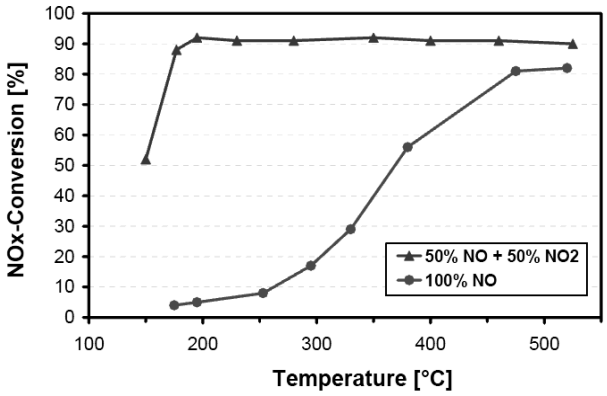


Figure 2. Influence of NO_2 on the SCR performance, alpha = NH_3/NO_x-ratio = 0.9 [6]

At temperatures below about 100-200 ºC, the amonia can also react with the NO_2, producing explosive NH_4NO_3:

$$2NH_3 + 2NO_2 + H_2O \rightarrow NH_4NO_3 + NH_4NO_2 \quad (21)$$

This reactions can be avoid by never allowing the temerature to fall below about 200 ºC. The tendence for formating of NH_4NO_3 can be also minimize by metering into the gaz stream less than the recise amount of NH_3 necesary to react stoichiometrically with the NO_x (1 to 1 ratio), doing this there is a little excess NH_3 that can "slip" out of the reactor [7].

Using modern SCR methods it is now possible to remove 70 to 95% of the nitrogen oxides that are released into the environment.

5. Experimental results

The tests have been made on diesel enigine from an off road vehicle equiped with SCR catalysta nd AdBlue injection system. The tests have been made in two diferent steps of speed and torque: first one at 1900 [rpm] and 450 [Nm] and the second one at 1500 [rpm] and 550 [Nm]. The results are presented in figure 3.

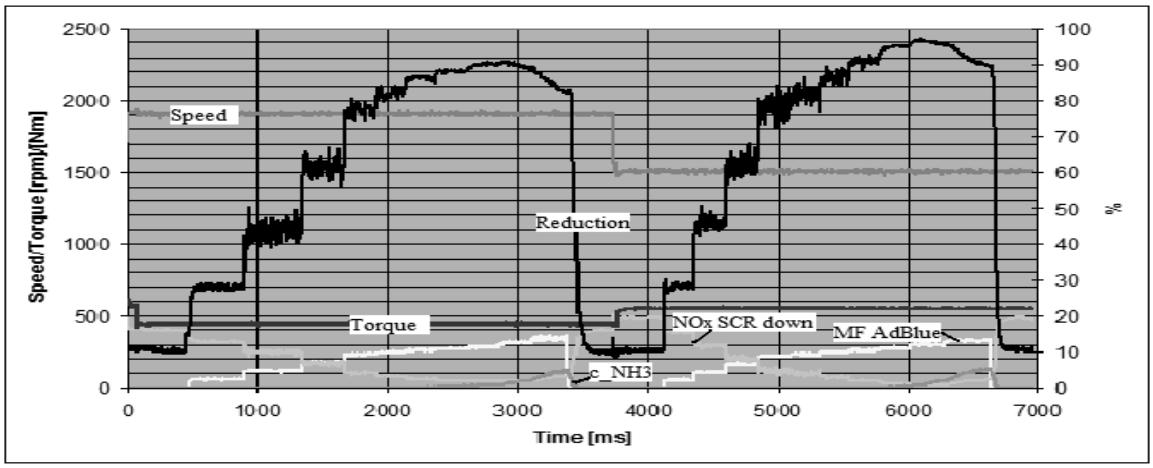


Figure 3. Engine working parameters, emissions and AdBlue dosage

The AdBlue dosage starts progressively from α (NH_3/NO_x-ratio) 0 up to 1,1 with the following steps: 0,2; 0,4; 0,6; 0,8; 0,85: 0,9; 0,95; 1 with the correspondent mass flow of AdBlue - MF AdBlue [mg/s]. From figure 3 can be observed that maximum reduction was 91% respectively 96%, after this points NH_3 brakes throught catalist (c_NH_3) with a significant increase of NO_x concentration NO_x SCR down [ppm].

References:

[1] http://www.dieselnet.com/standards/eu/ld.php
[2] Klaus Mollenhauer, Helmut Tschöke, Handbuch Dieselmotoren, ISBN 978-3-540-72164-2 Springer Berlin Heidelberg New York
[3] Docent Pia Kilpinen, Åbo Akademi Process Chemistry Group Laboratory for Industrial Chemistry, Wärtsilä, NO_x emission formation in marine diesel engines – towards a quantitative understanding
[4] N.Lontis, PhD theses: Theoretical and experimental researches on cogeneration engine, using bio-fuels, ISSN:1842-4937, Timişoara, 2008
[5] http://www.myturbodiesel.com/1000q/audi-q7-tdi-dpf-faq.htm
[6] Dipl.-Ing. Wilfried Müller, Dr.-Ing. Paul Spurk, Dr. rer. nat. Stephan Eckhoff, Dr.-Ing. Susanne Philipp, Dr.-Ing. Thomas Kreuzer, Dr. rer. nat. Jürgen Leyrer Umicore AG & Co. KG, Hanau, Synergies in the NOx-Aftertreatment for Diesel Engines and Gasoline Engines with Spray Guided Direct Injection, Internationales Wiener Motorensymposium 2007.
[7] Ronald M. Heck, Rpbert J. Ferrauto, *Catalytic air pollution control*, ISBN 0-442-01782-0

PHYSICS, CHEMISTRY

FIZICĂ, CHIMIE

STUDY OF NONLINEAR ELASTIC DEFORMATION OF QUANTUM-CRYSTALS

Thi Hoa NGUYEN[1)] and Valeriu DAMIAN[2)]

[1)]Faculty of Fundamental Science - University of Transport and Communications- Hanoi- Vietnam

Email: hoanguyen_1974@yahoo.com

[2)]Faculty of Mechanic- University "Dunarea de Jos" – Galati - Romania

Email: valeriu_damian@yahoo.fr

Abstract: The primary purpose of this paper was to develop analytical results which obtained by the statistical moment method for nonlinear elastic deformation of quantum-crystals. The relation of the normal stress σ and the plastic strain ε is obtained. The influence of the temperature on the stress-deformation curve is investigated. The obtained results are applied to the quantum-crystals: Xenon Xe, Argon Ar and Krypton Kr and compared with experimental data. The numerical results are shown to agree well with the experimental data.

Keywords: non-linear elastic deformation, quantum-crystals, stress-deformation curve.

1. Introduction

Researching on the elastic and nonlinear elastic deformation of materials is a very important problem of solid state physics. In recent years, this problem is interested by many researchers [1-3]. In these works, the authors presented the non-linear elastic deformation conditions, and the relation between the stress and the normal strain is given in the form of tensors.

In this paper, we present a new theoretical scheme on the elastic and non-linear elastic deformation of quantum-crystals based on the statistical moment method (SMM). We obtain the analytical expressions for the dependence of the stress σ_l on the strain ε, the maximum stress σ_{lmax} corresponding to the plastic strain ε_p. The theoretical results are applied to Xe, Ar and Kr crystals and compared with the experimental data; the stress- strain curves of these quantum-crystals at various temperatures are determined.

2. Theory of nonlinear elastic deformation for quantum-crystals

2.1. Stress - strain relation for nonlinear elastic deformed quantum-crystals

It is known that the stress σ is usually a function of two variables: the deformation rate $u = d\varepsilon / dt$ and the strain ε. If the deformation process is carried out in the condition of the constant deformation rate, the stress σ achieves the maximum value at the plastic strain ε_p. Some authors have used the stress- strain relation in the form of power-law functions multiplication as [4]

$$\sigma = \sigma_o \left(\frac{\varepsilon}{\varepsilon_o}\right)^n \left(\frac{u}{u_o}\right)^m \qquad (1)$$

where σ_o, ε_o, u_o, m and n are constants for each crystal. And the tensile stress- strain curve for the non-linear elastic deformation can always be described by [2]

$$\sigma = \sigma_o + K.\varepsilon^m, \qquad (2)$$

where K and m are constants for a given crystal.

Let us study the nonlinear elastic deformation of quantum-crystals in the condition of constant deformation rate. For the nonlinear elastic deformation process of quantum-crystals, we present the dependence of the stress σ on the strain ε as

$$\sigma = \sigma_o.\varepsilon^{\alpha}. \qquad (3)$$

with σ_o and α are constants. It is noted that the relation between the real stress σ_l appearing in the deformated sample and the stress on an area unit of sample σ is

$$\sigma_l = \frac{\sigma}{1+\varepsilon}. \qquad (4)$$

From eqs. (3) and (4) we obtain

$$\sigma_l = \sigma_o \frac{\varepsilon^{\alpha}}{1+\varepsilon}. \qquad (5)$$

Since the plastic strain ε_p corresponding to the maximum real stress σ_{lmax} is determined by $\frac{\partial \sigma_l}{\partial \varepsilon} = 0$, one can find the following relations

$$\varepsilon_p = \frac{\alpha}{1-\alpha} \text{ and } \sigma_{l\max} = \sigma_o \frac{\varepsilon_p^{\alpha}}{1+\varepsilon_p}. \qquad (6)$$

2.2. Strain energy density

The strain - energy density (SED) has been used by Sih [5] and Nernat- Nasser [6] for plastic deformation crystals.

In the present paper, the strain-energy density is given as

$$SED = \Psi_P^* - \Psi^* \tag{7}$$

where Ψ^*, Ψ_P^* are the free energy of a volume unit of system without deforming and with deforming by the external force P, respectively. The free energy Ψ^* of system is given by [7]

$$\begin{aligned} \Psi^* &= \Psi / v, \\ \Psi &= u_o/2 + 3\theta [x + \ln(1 - e^{-2x})] \\ u_o &= \sum_i \varphi_{io}(r_i), \; x = \frac{\hbar\omega}{2\theta} , \end{aligned} \tag{8}$$

where the terms of eq. (8) given the harmonicity contribution of the thermal lattice vibrations and the sum of the effective pair interaction energies, u_o. In expression (8), the second-order vibrational constant, k, is defined by

$$k = \frac{1}{2}\sum_i \left(\frac{\partial^2 \varphi_{io}}{\partial u_{ix}^2} \right)_{eq} \equiv m_0\omega^2 \tag{9}$$

where φ_{io} is the effective interaction energy between the zero-th and i-th atoms and r_i is the equilibrium position of the i-th atom, u_i its displacement. The sum of the effective pair interaction energies, u_o, the harmonic parameter, k, depend on the nearest neighbor distance a

$$a = a_O + y_O , \tag{10}$$

here a_o is the nearest neighbor distance at T = 0K and y_o- the displacement corresponding to the case without external force P [8]. The free energy Ψ_P^* of the deformed quantum-crystal has the form similar to the expression (8) but the sum of the effective pair interaction energies, u_o, and the parameter k depend on the nearest neighbor distance a_p of the deformed quantum-crystal as

$$a_P = a_{oP} + y , \tag{11}$$

where a_{oP} is the nearest neighbor distance at T= 0K in the case of external force P, $y = \langle u_i \rangle_P$ averaging atomic displacement of the nonlinear elastic deformed quantum-crystal with external force P

$$y = y_o + A_1 P + A_2 P^2, \tag{12}$$

where A_1 and A_2 are determined as in [7]. Since

$$a_{oP} = a_o (1 + \varepsilon) \tag{13}$$

the nearest neighbor distance a_p can be written in the approximation form

$$a_P \approx a_o (1 + \varepsilon) + y_o + A_1 P = a + a_o\varepsilon + A_1 P. \tag{14}$$

It is noted that the relation between the stress σ appearing in the deformed sample on an area unit of sample and the external force P is $P = \sigma S$. Using the formula of the Young's modulus E [8]

$$E = \frac{a_{op}}{A_1 S} \tag{15}$$

we have

$$A_1.P = A_1\sigma S \approx A_1\varepsilon ES = \varepsilon a_{op} . \tag{16}$$

From (14) and (16), it is easy to obtain

$$a_P \approx a + a_o\varepsilon + a_o (1 + \varepsilon).\varepsilon. \tag{17}$$

In the case of nonlinear elastic deformation, the strain $\varepsilon << 1$, we can expand the free energy $\Psi_P(\varepsilon)$ in terms of the strain ε. In second- order approximation the free energy Ψ_P has the form.

$$\Psi_p = \Psi + \left(\frac{\partial \Psi_p}{\partial \varepsilon} \right)_T \times \varepsilon + \frac{1}{2}\left(\frac{\partial^2 \Psi_p}{\partial \varepsilon^2} \right)_T \times \varepsilon^2 . \tag{18}$$

Therefore, the strain-energy density of the deformated quantum-crystals is given as

$$f(\varepsilon) = \frac{\Psi}{v_p} + \left(\frac{\partial \Psi_p}{\partial \varepsilon} \right)_T \times \frac{\varepsilon}{v_p} + \left(\frac{\partial^2 \Psi_p}{\partial \varepsilon^2} \right)_T \times \frac{\varepsilon^2}{2v_p} - \frac{\Psi}{v}, \tag{19}$$

where $v = \frac{\sqrt{2}}{2} a^3$, $v_p = \frac{\sqrt{2}}{2} a_p^3$ for f.c.c crystals.

Using eqs. (8), (17) and (19) we find the expression of the strain-energy density

$$\begin{aligned} f(\varepsilon) = \Psi\left(\frac{1}{v_p} - \frac{1}{v} \right) + \frac{2\varepsilon a_{0p}}{v_p}\left(\frac{\partial \Psi_p}{\partial a_p} \right)_T + \\ \frac{\varepsilon^2}{2v_p}\left\{ \left(\frac{\partial^2 \Psi_p}{\partial a_p^2} \right)_T \times (2a_{0p})^2 + \left(\frac{\partial \Psi_p}{\partial a_p} \right)_T \times 2a_0 \right\} . \end{aligned} \tag{20}$$

Recently there has been intense interest in developing simple model interatomic potentials, which would permit the direct calculation of the structural and thermodynamic properties of complex system. Pair potentials have long been used to describe rare-gas atoms, simple metals, quantum-crystals and highly ionic systems. In present paper we take the effective pair interaction energy in crystalline systems as the power law, similar to the Lennard-Jones potential

$$\varphi(r) = 4\varepsilon^* \left[\left(\frac{\sigma^*}{r} \right)^{12} - \left(\frac{\sigma^*}{r} \right)^6 \right], \tag{21}$$

where the potential parameters such as σ^* and ε^* are determined to fit experimental data (e. g., the cohesive energy and elastic modulus). Using the effective pair potentials of eq. (21), it is straigh forward to obtain the interaction energy u_o and the parameter k in the quantum-crystal as

$$\begin{aligned} u_o = \sum_i \varphi_{io}(r_i) = 4\varepsilon^* \left(\frac{\sigma^*}{a} \right)^6 \left[A_{12} \left(\frac{\sigma^*}{a} \right)^6 - A_6 \right], \\ k = \frac{4\varepsilon^*}{a^2} \left(\frac{\sigma^*}{a} \right)^6 \left[265,298 \left(\frac{\sigma^*}{a} \right)^6 - 64,01 \right]. \end{aligned} \tag{22}$$

where A_{12}, A_6 are the structural sums for the given crystal [8].

If putting

$$\Psi_p^* - \Psi^* = f(\varepsilon) = C\sigma\varepsilon \tag{23}$$

we realize that $f(\varepsilon)$ is a function achieving the maximum value at the plastic strain $\varepsilon = \varepsilon_p$. In eq. (23), C is a proportional coefficient deriving from the experimental data. Therefore, we can easy obtain the maximum value of the stress σ_{max} as

$$\sigma_{max} = \frac{f_{max}}{C\varepsilon_p}, \text{ and } \sigma_{l\,max} = \frac{\sigma_{max}}{1+\varepsilon_p} . \quad (24)$$

Using eq.(23) and the value of $\sigma_{0.2}$ is investigated based on experimental data for crystals, we can determine the coefficient ratio C as

$$C = \frac{f(\varepsilon_{0.2})}{\sigma_{0.2}.\varepsilon_{0.2}}, \quad (25)$$

where $\varepsilon_{0.2} = 0.2$ %.

From eqs.(6), (20) and (24), one can calculate the constants σ_o and α. Hence for the non-linear elastic deformed quantum-crystals the dependence of the stress σ_l on the strain ε is obtained by eq.(5).

3. Numerical results and discussion

In order to apply the theoretical calculation in section 2 for Xenon Xe, Argon Ar and Krypton Kr quantum-crystals, we used the pair interaction potentials (21). The potential parameters are listed in Tab. 1.

With the aid of eq. (10), the increase of the nearest neighbor distance with increasing temperature is calculated. These results are presented in Fig .1.

After investigating the function of the strain-energy density $f(\varepsilon)$ (20), we can find the plastic strain ε_p corresponding to the maximum value $f_{max} = f(\varepsilon_p)$.

From eqs.(25), (6) and (24) we calculate the values of σ_{max} and constants α and σ_o. The dependence of the stress σ on the strain ε for the nonlinear elastic deformation process of quantum-crystals (5) is calculated. These results are presented in Fig .2.

The decrease of the stress σ with increasing temperature arises from the thermal lattice expansion and the anharmonic effects are included through the explicit volume dependence of the vibrational frequency and the temperature dependence of the free energy.

The statistical moment method (SMM) calculations are performed by using the effective pair potential for quantum-crystals. In general, we have obtained good agreement between our theoretical calculations and experimental values.

Table 1. Experimental values of potential parameters σ^*, ε^* and mass of atom m_0 for quantum-crystals [11]

Crystals	ε^*/k_B (K)	σ^* (A^0)	m_0 (u)
Ar	119,8	3,405	39,9624
Kr	178,0	3,590	83,9120
Xe	231,1	3,9609	131,9042

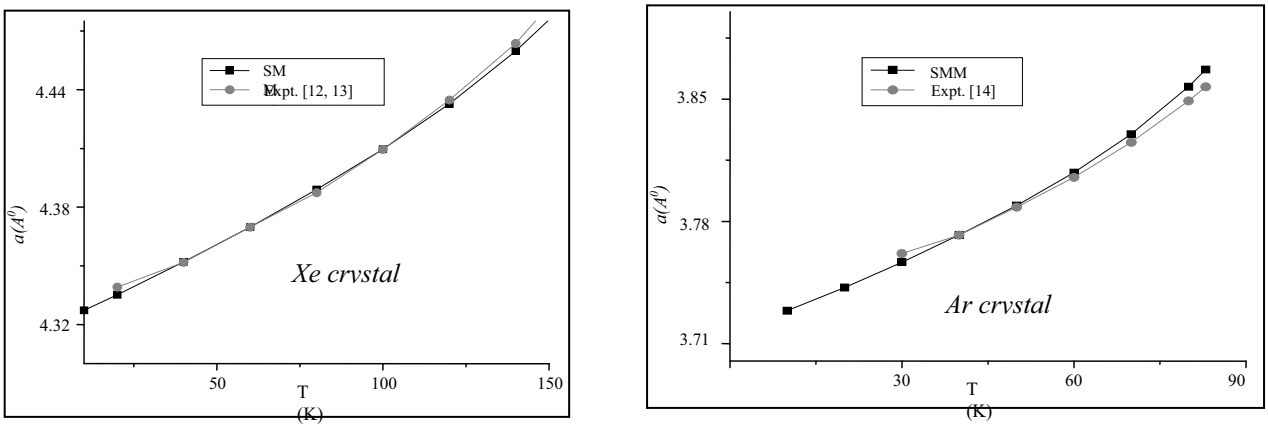


Figure 1. The dependence of the nearest neighbor distance a on the temperatures T of Xe and Ar crystals.

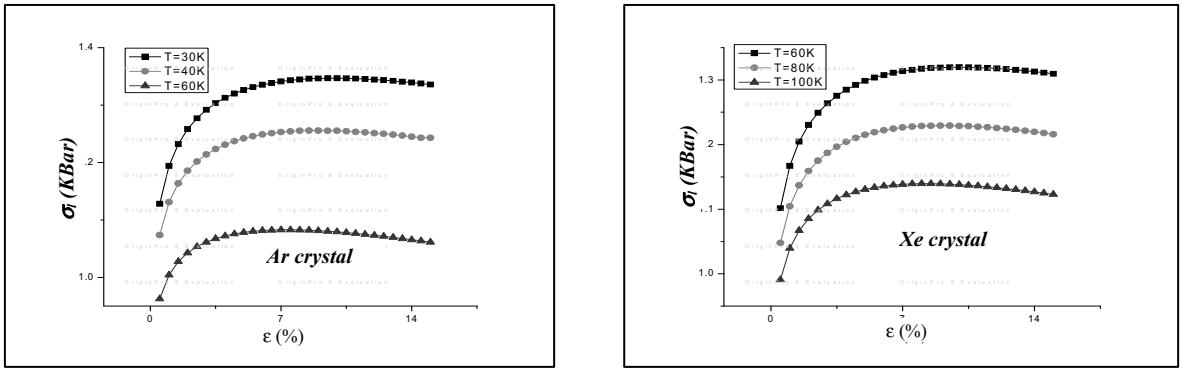


Figure 2. The dependence of stress σ_l on the strain ε for nonlinear elastic deformed quantum-crystals at various temperatures T

References

1. M.E. Kassner, M.T. Perez-Prado, K.S. Vecchio., Mater. Sci. Eng, A319-321 (2001), 730-734.
2. P. Merle, F. Fouquet and J. Merlin., Mater. Sci. Eng, 35 (1978), 171; 50 (1981), 215-220.
3. S. Carlsson and P.L. Larsson., Acta mater, 49 (2001), 2193-2203.
4. A. Nadai., Theory of flow and fracture of solid, vol.2, Moscow, World Publishing house (1969). 201-222, 654-669(in Russian).
5. G.C. Sih and E. Madenci., *Prediction of Failure in Weldments- part 1: Smooth Joint,* Theoretical and applied fracture mechanics, Vol.3 (1985), 23-29.
6. S. Nernat-Nassen., *Overview of the basic progress in Ductile fracture,* Transactions fourth International Conference on structural mechanics in reactor Technoogy (SMIRT-4), San Francisco, August (1977),12/1-11.
7. N. Tang and V.V. Hung, phys. Stat. Sol. (b). Vol.149 (1988),511-519.
8. Vu Van Hung et al., Communications in Physics, Vol.14, No.3, (2004),185.
9. M.N. Mazomedov, J. Fiz., Khimic, 61 (1987) 1003 (in Russian).
10. L.V. Tikhonov, V.A. Kononenko, G.I. Prokopenko, V.A. Raphalovxki., Mechanical properties of metals and alloys, Kiev Naukova Dumka (1986) (in Russian).
11. Carlos P. Herero and Rafael Ramirez, Phys. Rev. Lett., 86, 4568, 14 May 2001
12. D.R. Sears and H.P. Klug – J. Chem. Phys., 37, 3002 (1962).
13. P.A. Benzuglyi, L.M. Tarasenko and O.I. Baryshevski, Fiz, Tverd, Tela, 13, 2393 (1971).
14. V.A. Ralinovich, A.A. Vasserman, V.I. Medostup, L.S. Veksler – Teplofizicheskie svoistva neona, argona, kriptona iksenona, Moskva – 1976.

NEW OPTICAL MATERIALS BASED ON CHALCOGENIDE GLASSES

M.S.Iovu, V.G.Benea, I.A.Cojocaru, E.P.Colomeico, V.E.Tazlavan, M.A.Iovu

Institute of Applied Physics, Academy of Sciences of Moldova,
Str. Academiei 5, MD-2028 Chisinau, R. Moldova
e-mail Mihail.iovu@phys.asm.md

Abstract: Nowadays chalcogenide glasses are well known as multifunctional materials with specific electrical and optical properties, for their potential applications in microelectronics and optoelectronics as ovonic devices, passive and active optical elements, components of the photonic structures and recording media of high density. Chalcogenide glasses (As-Se, As-S-Se, As-Sb-S, Ge-As-Se) are characterized by the wide region of glass formation, high glass transition temperatures (T_g=300÷400 ^{0}C) and thermal stability. These glasses are of considerable interest also due to high values of refractive index (n=2.4÷2.65), high nonlinearities (n_2=2.5·10^{-17} cm^2/W) for g-$As_{15}Ge_{35}Se_{50}$, and optical transmission at 1.55 μm, that makes them suitable for photonic applications. Chalcogenide glasses are sensitive to the external illumination and exhibit reversible and irreversible photoinduced effects. These effects are used for fabrication of different registration media, diffractive structures, waveguides, photonic structures, and optical amplifiers. The arsenic chalcogenide films usually become darkened under light irradiation in the region of the fundamental absorption edge. The changes of the optical constants (absorption coefficient α, optical band gap E_g, and refractive index n) of the investigated materials under the ionization irradiation and heat treatment was evaluated.

Keywords: Chalcogenide glasses, amorphous films, optical absorption, refractive index, holography

1.Introduction

Chalcogenide glasses of As-S-Se and Ge-As-Se systems are characterized by the widest region of glass formation in comparison to other ternary chalcogenide compounds, high glass transition temperatures (T_g=300÷400 ^{0}C) and thermal stability. These glasses are of considerable interest also due to high values of refractive index (n=2.4÷2.65) [1], nonlinearities (n_2=2.5·10^{-17} cm^2/W for g-$As_{15}Ge_{35}Se_{50}$ [2]) and optical transmission at 1.55 μm, that makes them suitable for photonic applications. Chalcogenide glasses are sensitive to the external illumination and exhibit reversible and irreversible photoinduced effects. These effects are used for fabrication of different registration media, diffractive structures, waveguides, photonic structures, and optical amplifiers [3-6]. The glasses $Ge_xAs_xSe_{2-x}$ are widely investigated, especially its thermally properties [7,8]. It is well known that the optical properties (absorption coefficient α, refractive index n, optical band gap E_g) depend on the glass composition and on the mean coordination number <r>. In this paper we report the experimental results on some optical properties of amorphous $Ge_xAs_xSe_{1-2x}$ thin films ($0.05 \le x \le 0.30$). From the transmission spectra was calculated the absorption coefficient α, refractive index n, and the optical band gap E_g. It was shown that some peculiarities in the dependences of the optical constants (α, n, E_g) versus mean coordination number <r> for $Ge_xAs_xSe_{1-2x}$ glasses take place in the reversibility window. The variety of light-induced structural transformations in amorphous chalcogenide films is rather wide and attracts scientific as well as technical interest [9,10]. As the composition of a glass determines both the structural units and the mean coordination number of the amorphous solid, the effect of the composition in glassy systems Ge-As-Se on the degree of photostructural transformations has been studied. Furthermore, the fact that the composition induced changes in photodarkening kinetics, presents special interest as regards the recent photodarkening model [11]. This model takes into account the layered cluster structure of a chalcogenide glass as well as the photoexcited charge carriers in extended states, which are responsible for photodarkening.

2. Experimental

The glassy samples of the As-S-Se and $Ge_xAs_xSe_{1-2x}$ ($0.05 \le x \le 0.30$) were prepared by conventional melt quenching method. Thin film samples of thickness d=0.5÷3 μm were prepared by flash thermal evaporation in vacuum of the synthesized initial glasses onto glass substrates held at T_{subs}=100 ^{o}C. For optical transmission

spectra measurements a UV/VIS (λ=300÷800 nm) and 61 NIR (λ=800÷3500 nm) Specord's CARLZEISS Jena production were used. For calculation of the optical constants from the transmission spectra, the computer program *PARAV-V1.0* (www.chalcogenide.eu.org) was used [12]. To initiate photostructural transformations in thin film samples, as a source of light exposure, a continuous He-Ne lasers *(*λ=630 nm*,* *P*=0.6 mW and λ=*540* nm, *P*=0.75 mW) were used.

3. Results and discussions

Figure1 represents the typical absorption spectra for two amorphous $Ge_xAs_xSe_{1-2x}$ thin film samples (x=0.07 and x=0.25). Increasing of Ge and As content in the $Ge_xAs_xSe_{1-2x}$ glassy system shift the Urbach tail in the red region of the spectrum. In some cases for some glass compositions, depending of mean coordination number <r>, the shift of the absorption edge can take place in the short wave region.

From the transmission spectra $T=f(\lambda)$, using the expressions $\alpha = \frac{1}{d}\ln\frac{(1-R)^2}{T}$, $n = \frac{\lambda_m \lambda_{m-1}}{2d(\lambda_{m-1}-\lambda_m)}$ and the dependence $(\alpha\ h\nu)^{1/2} = A(h\nu - E_g)$, was calculated the absorption coefficient α, the refractive index n, and the value of the optical band gap E_g respectively. Here d – is the thickness of the sample, R – the reflection, λ_m, λ_{m-1} – the minimum and maximum of the interference in the transmission spectra, A - is a constant.

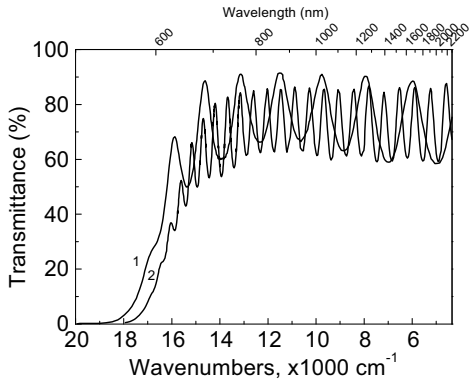


Figure1. The transmission spectra for two amorphous $Ge_xAs_xSe_{1-2x}$ thin film samples x=0.07 (1) and x=0.25 (2).

The light exposure with the integrated light shifts the absorption edge in the high energy region, and leads to an increasing of the optical band gap E_g, and decreasing of the refractive index n. As result of light exposure the optical band gap is changed by the value of ΔE_g=0.01 eV, and the refractive index by the value of Δn=0.141 (λ=700 nm), respectively. The same effect was observed also for the $Ge_{33}S_{67}$ thin films, where as result of light exposure the optical band gap was increased from E_g=2.68 eV up to E_g=3.06 eV, and to decreasing of the refractive index from n=2.16 up to 2.08, respectively [13]. This is so called photobleching effect in calcogenide glasses. In contrast, for the amorphous $As_{45}S_{15}Se_{40}$ thin films the light exposure decrease the optical band gap E_g and increase the refractive index n.

The dispersion curves $n=f(\lambda)$ for all thin films of the investigated compositions of the glassy $Ge_xAs_xSe_{1-2x}$ system are presented in [14]. In the present work the main attention is done to investigation of variation of optical constants of the amorphous $Ge_xAs_xSe_{1-2x}$ thin film in dependence of the annealing temperature (T_{an}=15÷140 ^oC). Figure2 represents the dependence of the absorption coefficient α versus annealing temperature T_{an} for amorphous $Ge_{0.25}As_{0.25}Se_{0.50}$ thin film. With increasing of the annealing temperature T_{an}, the absorption coefficient α decrease. At the same time, increasing of the annealing temperature T_{an} increase the optical band gap E_g (Figure3).

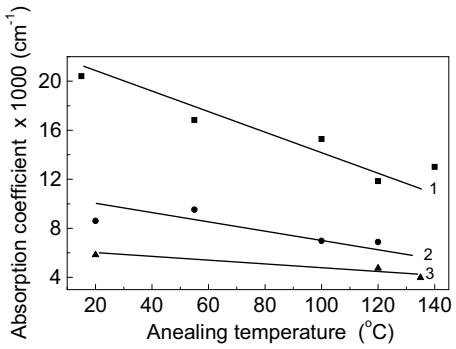


Figure 2. The dependence of the absorption coefficient α versus annealing temperature T_{an} for amorphous $Ge_{0.09}As_{0.09}Se_{0.82}$ (1), $Ge_{0.18}As_{0.18}Se_{0.64}$ (2), and $Ge_{0.25}As_{0.25}Se_{0.50}$ (3), thin films.

Figure4 represents the dispersion curves of the refractive index $n=f(\lambda)$ for amorphous $Ge_{0.25}As_{0.25}Se_{0.50}$ thin films annealed at different temperatures T_{an}. Increasing of the annealing temperature T_{an} decrease the refractive index n. The dependence of the refractive index n versus annealing temperature T_{an} for amorphous $Ge_{0.09}As_{0.09}Se_{0.82}$ (1), $Ge_{0.18}As_{0.18}Se_{0.64}$ (2), and $Ge_{0.25}As_{0.25}Se_{0.50}$ (3) thin films is presented on Figure5. For amorphous $Ge_{0.09}As_{0.09}Se_{0.82}$ (curve 1) and $Ge_{0.18}As_{0.18}Se_{0.64}$ (curve 2) films this dependence is very weak, in contrast with the same dependence for amorphous $Ge_{0.25}As_{0.25}Se_{0.50}$ (curve 3) films, for which $\Delta n/\Delta T_{an}$=4.8·10^{-3} 1/^{o}C. In the region of the annealing temperatures T_{an}=20-100 ^{o}C the optical band gap Eg increase with the annealing temperature and the value $\Delta E_g/\Delta T_{an}$=(1.15÷1.27)·10^{-4} eV/^{o}C, and slightly decrease with the increasing of Ge concentration in the $Ge_xAs_xSe_{1-2x}$ glassy system. For the $As_{45}S_{15}Se_{40}$ the annealing at high temperatures decrease the optical band gap ($\Delta E_g/\Delta T_{an}$=-5.8·10^{-4} eV/^{o}C), and firstly decrease the refractive index ($\Delta n/\Delta T_{an}$=-9.2·10^{-4} 1/^{o}C), and then increase it.

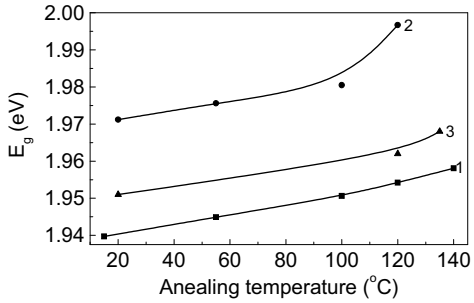


Figure3. The dependence of the optical band gap E_g versus the annealing temperature T_{an} for amorphous $Ge_{0.09}As_{0.09}Se_{0.82}$ (1), $Ge_{0.18}As_{0.18}Se_{0.64}$ (2), and $Ge_{0.25}As_{0.25}Se_{0.50}$ (3), thin films.

The relaxation of the relative optical transmission T/T_0 for amorphous exposure for amorphous $Ge_{0.07}As_{0.07}Se_{0.86}$ thin films in the co-ordinates $T(t)/T(0)$ versus t is shown in Figure6, when excited with He-Ne laser (λ=630 nm). This dependence describes the excess of absorbance induced by light absorption during the exposure.

At a constant light intensity the presented dependences characterize the decay of the film optical transmittance with the increase of the dose of absorbed photons. To obtain a unified basis for comparison of the transmission relaxation $T(t)$ curves we used so called stretched exponential presentation for the relaxation curves in the form:

$$T(t)/T(0) = A_0 + A\exp[-(t-t_0)/\tau]^{(1-\beta)}.$$

Here t is the exposure time, τ is the apparent time constant, $A=1-A_0$ characterizes the "steady-state" optical losses due to photodarkening, t_0 and A_0 are the initial coordinates, and β is the dispersion parameter ($0<\beta<1$). The parameters of the stretched exponential for all $Ge_xAs_xSe_{1-2x}$ samples were calculated by computing fitting of the experimental points.

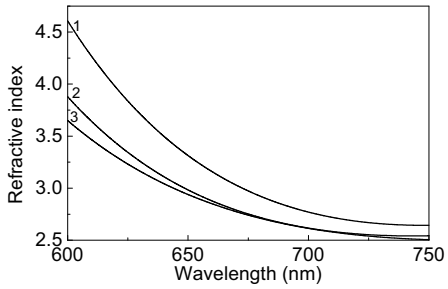


Figure 4. The dispersion curves of the refractive index n for amorphous $Ge_{0.25}As_{0.25}Se_{0.50}$ thin films annealed at different temperatures T_{an}, °C: 1-20; 2-120; 3-135.

In the novel model proposed for explanation of photodarkening in a-$As_2Se(S)_3$ the photoexcited charge carriers in extended states are considered as responsible for photodarkening [11]. Unlike to the previous conceptions the new model takes into account the layered cluster structure of a chalcogenide glass. According to this model, during exposure the layer is negatively charged due to capture of photoexcited electrons, and repulsive forces are built between the layers.

These forces cause enlargement of the interlayer distance (leading to photoexpansion) and slip motion along the layers. This process alters interaction of lone-pair electrons between the layers leading to photodarkening effect. This model was successfully used for explanation the photodarkening phenomena in amorphous As-Se films doped with metals [15-17].

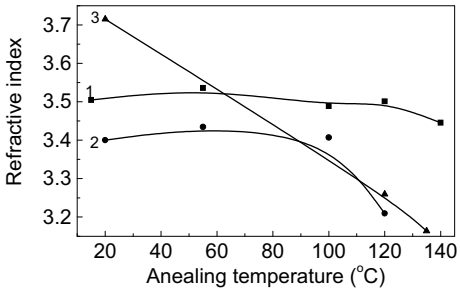


Figure 5. The dependence of the refractive index n versus annealing temperature T_{an} for amorphous $Ge_{0.09}As_{0.09}Se_{0.82}$ (1), $Ge_{0.18}As_{0.18}Se_{0.64}$ (2), and $Ge_{0.25}As_{0.25}Se_{0.50}$ (3), thin films.

The photodarkening phenomenon in chalcogenide glass films under illumination has no plain explanation up to now in spite of detailed investigation and a series of models advanced for interpretation of it. The red shift of the absorption edge indicating the narrowing of the optical gap of the film at photodarkening, is believed to be due to broadening of the valence band, the top of which is formed mainly by states of lone-pare electrons of the chalcogen atom.

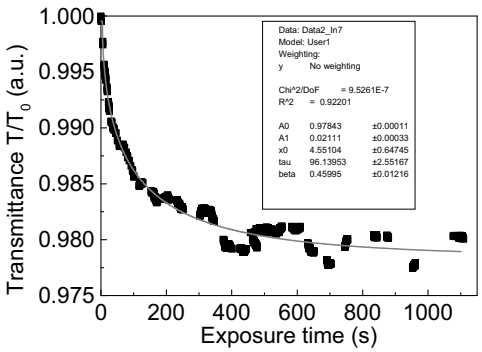


Figure 6. Excess absorbance induced by light absorption during the light exposure for amorphous $Ge_{0.07}As_{0.07}Se_{0.86}$ thin films.

The non-monotony dependence of the parameters of the stretched exponential for $Ge_xAs_xSe_{1-2x}$ samples is connected with the transition towards from 2D to 3D network with increasing the concentration of Ge (Figure7). In our previous works [14,15] it was shown that the tin

impurity in As_2Se_3 strongly affect the network of the host glass inducing changes in both short-range as well as medium-range order, in particular they exert significant influence on the structural layers and the character of their relative motion.

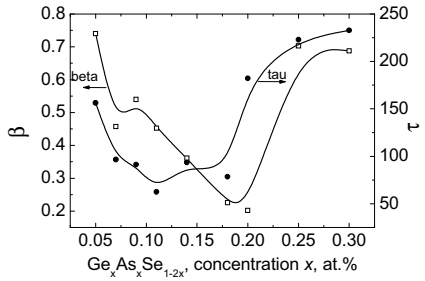


Figure 7. The dependence of the parameter β and τ of the stretched exponential versus composition of amorphous $Ge_xAs_xSe_{1-2x}$ thin films.

Creation of clusters such as $SnSe_2$ type lowering the density of the typical for AsSe lone-pair defects (D-centers), the charge state of the layers also is lowering, and the photodarkening phenomena is quenched. Probable the four-coordinated Ge in $Ge_xAs_xSe_{1-2x}$ glasses play the analogue role, and influence the photodarkening parameters.

4.Summary

The optical transmission spectra of of amorphous $Ge_xAs_xSe_{2-x}$ (x=0.05÷0.30) thin films was measured. From the transmission spectra the optical constants (absorption coefficient α, refractive index n and the optical band gap Eg) for the amorphous $Ge_xAs_xSe_{1-2x}$ thin films were evaluated. It was established a non monotony dependence of the optical parameters vs. mean coordination number Z. The experimental results show, that the optical band gap E_g decreases, while the refractive index n increases with the increasing of the concentration of Ge and As in the $Ge_xAs_xSe_{2-x}$ glassy system. The light exposure and the annealing at high temperatures increase the optical band gap E_g and decrease the absorption coefficient α and the refractive index n of the investigated amorphous films.

Relaxation of the relative optical transmission $T(t)/T(0)$ of the amorphous $Ge_xAs_xSe_{1/2x}$ thin films in dependence of the exposure time t also was investigated. It was shown that under the light exposure with He-Ne laser (λ=630 nm) all investigated amorphous $Ge_xAs_xSe_{1-2x}$ films exhibit photodarkening effect. Increasing of Ge and As content in the glassy $Ge_xAs_xSe_{1-2x}$ system increase the photodarkening. The kinetics of photodarkening process in amorphous $Ge_xAs_xSe_{1-2x}$ thin films is described by stretched exponential function $T(t)/T(0) = A_0+A\exp[-(t-t_0)/\tau]^{(1-\beta)}$.

Aknowledgment

The work is supported by the Institutional Project no. 11.817.05.03A and UKR-MD bilateral Project no. 10.820.05.05/UF.

References

[1]. Y.Ruan, R.A.Jarvis, A.V.Rode et al. *Optics Communications* 252, 39-45 (2005).

[2]. J.T.Gopinath, M.Soljačić, E.P.Ippen et al. *J. of Applied Physics* 96(11), 6931-6933 (2004).

[3]. E.M.Vogel, M.J.Weber, D.M.Krol, *Physics and Chemistry of Glasses,* 32(6), 231-254(1991).

[4]. A.Zakery, S.R.Elliot, *Journal of Non-Crystalline Solids,* 330(1-3), 1-12 (2003).

[5]. M.H.R.Lankhorst, B.W.S.M.M.Ketelaars, R.A.M.Wolters. *Nature Materials*, 4(4), 347-352 (2005).

[6]. I.Blonskyi, V.Kadan, O.Shpotyuk, M.Iovu, I.Pavlov. *Optical Materials,* 32, 1553-1557 (2010).

[7]. T.Qu, D.G.Georgiev, P.Boolchand, M.Micoulaut. *Proceedings of Materials Research Society Symposium*, 754, CC8.1.1-CC8.1.12 (2003).

[8]. O.Shpotyuk, M.Hyla, V.Boyko, R.Golovchak. *Physica B*, 403, 3830-3837 (2008).

[9]. Non-crystalline materials for optoelectronics. Series: Optoelectronic Materials and Devices, V.1., Eds. G.Lucovsky & M.Popescu, INOE Publishing House, Bucharest, 2004.

[10]. Semiconducting Chalcogenide glasses. II. Properties of Chalcogenide glasses. Series: Semiconductors and Semimetals, V. 79, Eds. R.Fairman & B. Ushkov, Elsivier Academic Press, 2004.

[11]. Y.Kuzukawa, A.Ganjoo, K.Shimakawa. *Phil. Mag. Letters*, 77(3), 153-158 (1998).

[12]. A.Ganjoo, R.Golovchak. *Journal of Optoelectronics and Advanced Materials,* 10(6), 1328-1332 (2008).

[13]. J.Tasseva, K.Petkov, D.Kozhuharova, Tz.Iliev. *Journal of Optoelectronics and Advanced Materials,* 7(3), 1287-1292 (2005).

[14]. V.Benea, Mihail Iovu, E.Colomeico, Maria Iovu, I.Cojocaru, O.Shpotyuk. *Proceedings SPIE, Advanced Topics in Optoelectronics, Microelectronics, and Nanotechnologies V,* Eds. Paul Schiopu & George Caruntu, Vol. 7821, Paper 782109, 3 December 2010, ISBN: 9780819483300, DOI: 10.1117/12.882071.

[15]. M.S.Iovu, S.D.Shutov, M.Popescu. *J. of Non-Crystalline Solids* 299-302, 924-928 (2002).

[16]. P.Boolchand, D.G.Georgiev, M.S.Iovu, *Chalcogenide Letters* 2(4), 27-34 (2005).

[17]. M.S.Iovu, P.Boolchand, D.G.Georgiev. *Journal of Optoelectronics and Advanced Materials* 7(2), 763-770 (2005).

[18] A. Zakery, S. R. Elliott. *Optical nonlinearities in chalcogenide glasses and their applications*. Springer Publisher, 2007, p. 199.

[19] Y. Wang, P. Boolchand, M. Micoulaut. *Europhys. Lett*., 52, 633-639 (2000).

[20] M. F. Thorpe, D. J. Jacobs, M. V. Chubynsky, J. C. Phillips. *J. of Non-Crystall. Solids*, 266-269, 859-866 (2000).

ANALYTICAL COMPARISON BETWEEN VAPOR COMPRESSION AND CRYOGENIC FREEZING

Valeriu DAMIAN[*], Cristian Iosifescu[*] and Thi Hoa NGUYEN[**]

* Faculty of Mechanical Engineering - "Dunarea de Jos" University, Galati, Romania,
Email: valeriu.damian@ugal.ro
** Faculty of Fundamental Science - University of Transport and Communications- Hanoi- Vietnam
Email: hoanguyen_1974@yahoo.com

Abstract: The paper presents for the two main freezing methods an analytical comparison of freezing duration, energy consumption, mass loss and frozen products quality. Information on cryogenic freezing (for pork meat products and berries) was taken from the experiments carried out using the cryogenic freezer from the Refrigeration systems Laboratory.
Cryogenic freezing can be used both separate but also combined with classical (vapor compression) refrigeration, either upstream or downstream to that. The combination of these two methods aims to join the advantages of each freezing method: low cost and large production capacity of vapor compression systems, but also short freezing duration and high quality of frozen products of cryogenic freezing.

Keywords: cryogenic freezing, liquid nitrogen, freezing duration, energy consumption, mass loss.

1. Introduction

In order to freeze a product, this has to be put in contact with a colder medium having a temperature much lower than its freezing temperature, and kept in this medium long enough to reach the desired temperature in its entire mass. Basically, cooling can be done in two ways: using a refrigeration system with a phase change fluid (mechanical refrigeration) or using a phase change cryogenic fluid (liquid nitrogen or CO_2) that evaporates (cryogenic refrigeration in an cryogenic freezer, shown in fig 1.).

For most of the frozen food products, the losses of cellular juice occurring at thawing represents a negative quality indicator, this leads to a loss of product firmness, taste and even flavor.

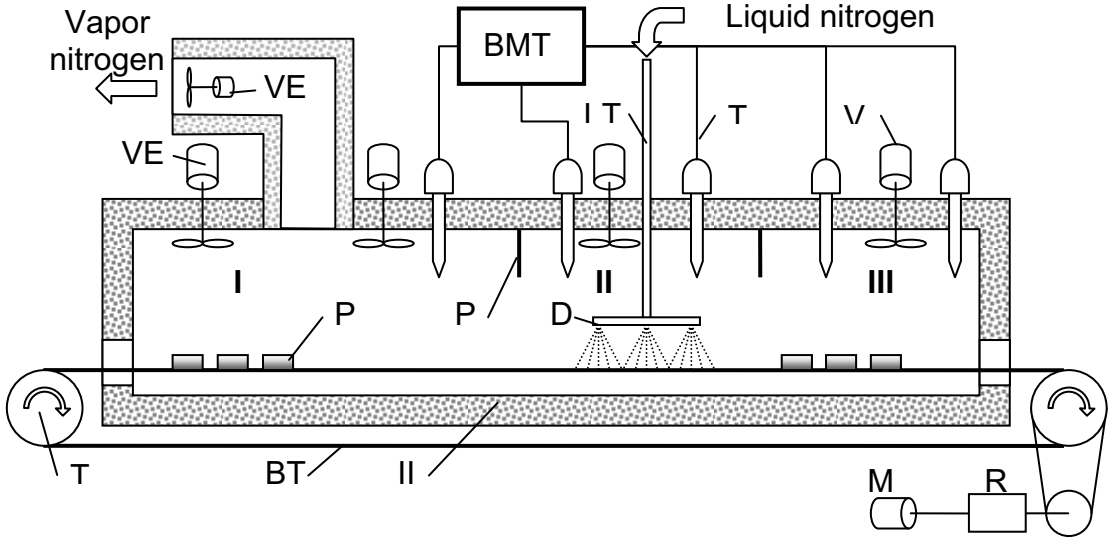


Figure 1 Liquid nitrogen Cryogenic freezer.
M - electric motor; P - product; BC - belt conveyor; R - worm reducer; F - fan; EF - vapor exhaust fan; N - nozzle; SW - separating wall; TL - nitrogen transfer line; D - drum; T -thermo resistance; TC - thermocouple; TMU - temperature measuring unit; PC - computer; I - pre-cooling area; II - freezing area; III - sub-cooling area

At SLOW FREEZING, where intercellular

crystallization prevails, local stress due to large and uneven crystals induces tissue deformation, disruption and piercing of cellular walls. Due to the osmotic pressure gradient, concentrated juice from inside the cell migrates outwards to intercellular space, thus dehydrating the cell, and leading when thawing to large juice losses, that drains through the continuous network of cellular spaces [8].

At FAST FREEZING, where intracellular crystallization prevails, the result is a uniform microcrystalline structure, both inside and outside the cells, leading to much weaker local stress and smaller pressure gradient, having as an effect less damaging structural modifications of the tissues. When thawing juice losses are smaller, cell membrane remaining intact (unpierced) [2].

2. Comparison elements between the two freezing methods

2.1 Freezing duration

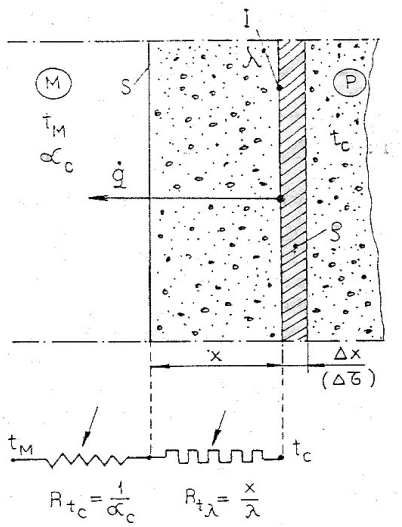


Figure 2 Freezing process.

Freezing duration is the time required for cooling the product from the environment temperature to a final temperature of -18 °C, at its thermal core. The thermal core of a product is the point with the highest temperature at the end of the de freezing process. For a product subject to freezing (fig. 2) in an environment having temperature $\mathbf{t_M}$, freezing temperature being $\mathbf{t_c}$, elementary freezing time for a $\mathbf{\Delta x}$ thickness layer, is [8]:

$$\Delta\tau = \frac{\Delta x \cdot \rho \cdot \Delta i}{t_c - t_M}\left(R_{t,c} + R_{t,\lambda}\right) \qquad (1)$$

where:

$R_{t,\lambda}$ = x/λ (mm K/W → m^2K/W) - conductive thermal resistance of the x thickness layer;

$R_{t,c}$ = $1/\alpha_c$ (m^2K/W) - superficial heat transfer thermal resistance;

α_c (W/m^2K) - convection heat transfer coefficient;

Δi (kJ/kg) - product's enthalpy change, of the Δx thickness layer;

λ (W/mK) - thermal conductivity of the freezing product.

Influence of the temperature difference (t_c - t_M): starting freezing temperature, t_c, is slightly different from one product to another, so the de freezing duration of the product layer is much shorter the lower the environment cooling temperature, t_M, is. Usage of cryogenic fluids (N_2 şi CO_2) is advantageous from this point of view, because these fluids allow easily reaching of temperatures t_M much lower than the ones obtained using of the mechanical refrigeration.

Influence of thermal resistances ($R_{t,c}$ and $R_{t,\lambda}$). For a short freezing duration, these resistances have to be as small as possible. This results from:

- small thickness, x, so the freezing product has to be thin and dispersed in the cooling environment;
- large thermal conductivity, λ (but this parameter cannot be influenced);
- large convection heat transfer coefficient, α_C. This means a high ventilation velocity (thus energy consumption) for freezing in air. Spraying a product with liquid nitrogen has the advantages of both a low temperature of the cooling environment, but also a high heat transfer superficial coefficient. It can be noticed that, during freezing, $R_{t,c}$ is almost constant, event though $R_{t,\lambda}$ increases with the thickness of the frozen layer x.

2.2 Energy consumption

The lower the cooling environment temperature (t_M) is, the shorter the freezing duration, but, on the other hand, the higher energy consumption. There will be compared three refrigeration systems having the same imperfection degree compared to an ideal refrigeration system.

The coefficient of performance (COP) for the three cases, using the formula for the reversed Carnot cycle, is:

$$\varepsilon_f = \frac{T_M}{T_K - T_M} = \frac{\Phi_0}{P_C} \qquad (2)$$

T_K = 308.15 K (t_K = +35 °C) – absolute temperature of the cold reservoir.

For the cold reservoir we consider:

T_{M_1} = 233.15 K (t_{M_1} = -40 °C) – for „mechanical" refrigeration.

T_{M_2} = 194.65 K (t_{M_2} = -78.5 °C) – for liquid CO_2.

T_{M_3} = 77.15 K (t_{M_3} = -196 °C) – for liquid nitrogen.

The energy consumption ratios of those three systems, for the same refrigeration power, will be the inversed of the one of the coefficients of performance [7]:

1 carbon dioxide:

$$\frac{P_{c_2}}{P_{c_1}} = \frac{\varepsilon_{f_1}}{\varepsilon_{f_2}} = \frac{T_{M_1}}{T_{M_2}} = \frac{T_K - T_{M_2}}{T_K - T_{M_1}} = 1.813 \qquad (3)$$

2 for nitrogen liquid:

$$\frac{P_{c_3}}{P_{c_1}} = \frac{\varepsilon_{f_1}}{\varepsilon_{f3}} = \frac{T_{M_1}}{T_{M3}} = \frac{T_K - T_{M_3}}{T_K - T_{M_1}} = 9.31 \qquad (4)$$

Considering the Planck (8) correlation, for t_c = -1 °C and α = ct., results:

$$\frac{\tau_1}{\tau_2} = \frac{-1-(-78.5)}{-1-(-40)} = 1.99;\ \frac{\tau_1}{\tau_3} = \frac{-1-(-196)}{-1-(-40)} = 5 \quad (5)$$

Conclusions:

For **carbon dioxide**: freezing duration ratio (1,99) is approximately equal to the ratio of coefficients of performance (1,813); therefore, for a 1.813 times increase of energy consumption, the freezing duration decreases by 1.99 times.

For **nitrogen**: the ratio is less favorable, this is for a 9.31 times increase of energy consumption, the freezing duration decreases by 5 times.

2.3 Mass loss

Water loss of a food product depends of:

- a superficial mass transfer coefficient,
- the difference between vapor pressure corresponding to the superficial temperature of the product and the one of the vapor from the cooling environment, and
- time.

One can conclude that [3]:

1) The water loss occurs during: actual freezing, and storage (more significant).

2) The water loss during actual freezing (for a certain α_c) is the smaller, the shorter process duration is (specially the one of pre-cooling), i.e. the lower the cooling environment temperature is.

3) Convection influence is very small, because if a reduced convection lengthens the cooling duration, also water extraction from the product is less intense.

4) Spraying a product with liquid nitrogen (or its brief immersion), leading to a fast freezing, reduces almost to zero mass loss.

5) The real importance of the water loss depends on the product's nature and the way it's cooked.

2.4 Product quality

Coloration

This aspect refers to the natural color of the frozen products, and it matters for sure for the consumer's choice because it's the only accessible criterion. Deterioration of the pigments color is especially related to the internal enzymatic reactions of the product and to the fats oxidation on the product's surface in contact with air. The swiftness of supra-cooling in a low temperature environment creates very quickly a shell of ice that, beside it limits the water loss effects, it represents a shield against the oxygen from air, and also the low temperature inhibits enzymatic reactions.

Besides that, using liquid or carbon dioxide creates an inert environment, avoiding any contact of the product with oxygen; thus, under theses circumstances, the products colors do not fade during supra-freezing.

Taste

One can consider that flavors, proofs of products taste and smell, have the vapor pressure higher than water and consequently, these flavors are better protected if the products are frozen cryogenically.

Structure

The swift crossing of the freezing plateau favors forming of intercellular ice micro-crystals, whose mechanical effect on cells membranes and walls is small. Cryogenic treatment can be an essential stage in a production process, when a massive product has to be shallow hardened for subsequent operations (achieving a high thermal gradient).

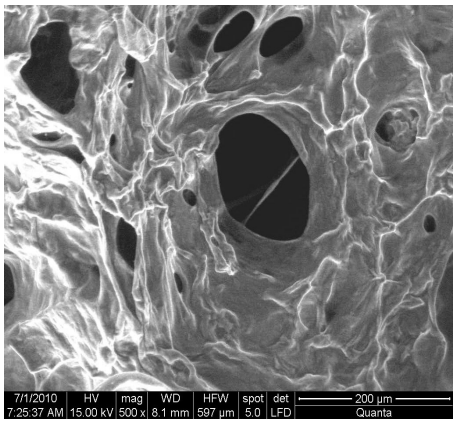


Figure 3 Blueberry frozen classical

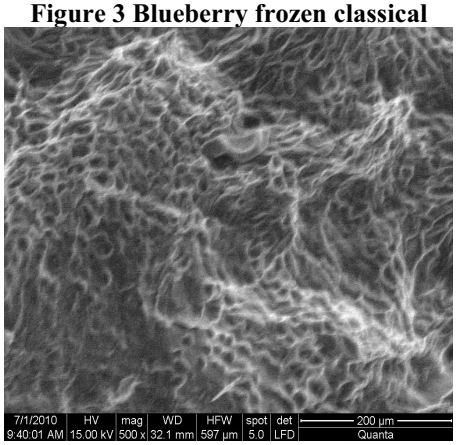


Figure 4 Blueberries thawed (classical)

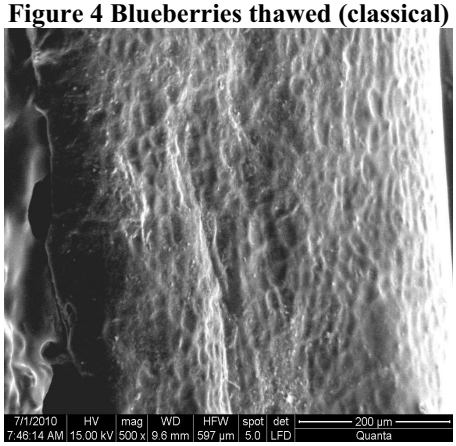


Figure 5 Blueberries frozen nitrogen

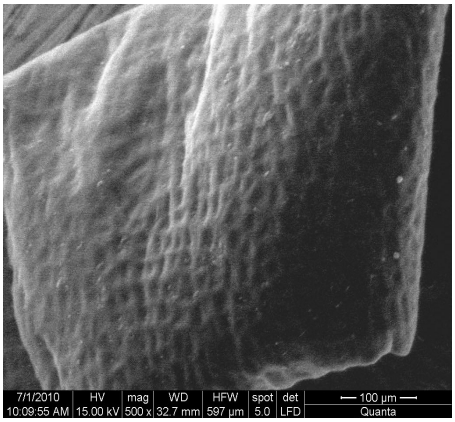


Figure 6 Blueberries thawed (nitrogen)

From a microscopic analysis of the products it can be noticed from Figures 3 to 6 (for some blueberries samples), that using (fast) liquid nitrogen cryogenic freezing, the berries keep their initial fiber shape, because ice crystals are smaller than cells, and therefore do not break them. Using (slow) freezing by mechanical refrigeration, berries fiber are deformed due to the ice crystals that pierce the cells wall.

3. Conclusions

Advantages of freezing using liquid nitrogen are: freezer simple design, short freezing duration, the freezer is rather small and can be easily cleaned, small mass losses for the products, short startup time (a few minutes), investment expenses are 50 % smaller than for classical refrigeration, the freezer can be used for various food products (without any modifications), there are almost no maintenance expenses, the cryogenic freezer can be fully automated, the is no need for defrosting, the high freezing rate makes the formed ice crystals to be small, thus keeping the cells walls integrity and maintaining the initial flavor and taste of the product.

The main disadvantage of this freezing method is the high price of the liquid nitrogen, but considering that the freezing process is just 8,3 % of the price of the product's price, one may overlook this disadvantage. For now mechanical refrigeration is more used, but cryogenic freezing gain ground, competition today being focused more on product's quality, and, from this point of view, the advantages are undeniable.

Findings:

1 Although the price of cryogenic fluids is very high, using cryogenic freezing is economically interesting for annual productions up to 2500 t and in all other cases where markets are not stabilized (startup, product launching, oscillating markets, small batches to make-up product lots, etc.).

2 For larger productions (vegetables), mechanical cooling is the only economic viable solution.

3 There are possibilities to combine the advantages of the two freezing systems: preserving delicate product's quality and reduction of mass losses using „cryogenic" freezing, and respectively, obtaining of large productions using „mechanical" freezing [6].

4 So, we can say that the two methods are not competing on the freezing market; on the contrary, they complement each other very well, each with its own market share depending on annual tonnage, whatever the products nature [7].

References

1. Cavallini, A., Fornasieri, E.: *Impianti di surgelazione per prodotti alimentari*. Istituto di Fisica Tecnica dell'Universita di Padova. Editura CLEUP, Padova, 1987.
2. Porneală, S., s.a.: *Tehnologia utilizării frigului artificial*. Universitatea din Galați, 1986.
3. Monzini, A., Maltini, E.: *Il congelamento rapido. Aspetti tecnici e qualita dei prodotti*. I.V.T.P.A., Milano, 1983.
4. Cleland, A., Earle, R.L.: *Freezing time prediction for foods a simplified procedure* - International Journal of Refrigeration, vol.5, nr.3, pag.134-140, 1982.
5. *** - *ASHRAE Handbook of Fundamentals*, 29.13, 1977.
6. Crivelli, G.: *Il congelamento ad aria - La surgelazione: tecnica del congelamento - Teoria ed applicazioni*. I.V.T.P.A., Milano, 1983.
7. *** - Revue Generale du Froid: nr. 5/1987; nr. 7/1990; nr. 1/1991; nr. 6/1990; nr. 3/1990; nr. 1/1990; nr. 6/1989; nr. 9/1986; nr. 1/1985; nr. 7/1991; nr. 7-8/1988, nr. 3/1979, nr.1/1984.
8. Damian, V., Vasilescu, C.: *Congelarea criogenică a produselor din carne*, Editura EVRIKA, Brăila, 1997, ISBN: 973-97854-5-X ,148 pag.
9. Damian V., Ciufudean C.: *Fuzzy Controller for Liquid Nitrogen Cryogenic Freezer*, The 12th WSEAS International Conference on Automatic Control, Modelling & Simulation (ACMOS '10), ISI, Catania, Sicily, Italy, May 29-31, 2010, pag. 201-206 .
10. Damian V., Iosifescu CR., Coman G., Dragan M., C-TIN O.: *Theoretical and experimental study on cryogenic freezing of berries*, European Conference of systems (ECS'10), Tenerife, Spania, IS I, 30XI-1XII, 2010, ISBN: 978-960-474-250-9, pag. 171-174.
11. Damian, V., Vasilescu, C.: *Aspects concerning the heat exchange in a cryogenic freezer using liquid nitrogen*, FLOWERS 97 Symposium, 1-2 August 1997, Firenze, Italia, pag. 223-227.

MICROSTRUCTURAL ANALYSIS OF MAGNETRON SPUTTERED PT CATALYST ON CARBON CLOTH FOR PROTON EXCHANGE MEMBRANE FUEL CELLS

Denis NEGREA[1], Catalin DUCU[1], Sorin MOGA[1], Viorel MALINOVSCHI[1], Daniela EBRASU[2], Dorel DOROBANTU[3], Marian ENACHESCU[4*]

[1] University of Pitesti – Research Centre for Advanced Materials, Targu din Vale, No 1, 110040 Pitesti, RO
[2] National Research-Development Institute for Cryogenic and Isotopic Technologies - ICIT Rm. Valcea, Uzinei, no.4, Ramnicu Valcea, RO
[3] General Inspectorate of Police, Directorate of Firearms, Explosives and Dangerous Substances, Stefan cel Mare Road 13-15, 020123 Bucharest, RO
[4] University "Politehnica" of Bucharest, Splaiul Independentei nr. 313, Bucharest-060042, RO

Abstract. Proton exchange membrane fuel cells (PEMFC) produce electricity via an electrochemical reaction between hydrogen and oxygen mediated by a proton exchange membrane. At the interface between anode and the electrolyte, the fuel is converted into protons (H^+) and electrons (e^-), a process which is made possible by a catalyst that is typically Pt-based supported by high surface area carbon.

This paper presents the microstructural analysis of magnetron sputtered Pt catalyst on Carbon Cloth (CC) for PEM fuel cells applications. Three types of Pt/CC membranes have been obtained by magnetron sputtering technique with different Pt content (0.2, 0.4 and 0.6 g/cm^2).

By the means of energy dispersive X-ray fluorescence spectrometry (EDXRF) a mapping has been done for each membrane and Pt concentration distribution in surface has been obtained and translated in 3D maps.

Using X-ray diffraction technique, Pt polycrystalline phase has been identified in those membranes having 0.4 and 0.6 g/cm^2 Pt content. By whole pattern fitting taking into account the amorphous phase contribution a microstructural characterization of the active metal has been performed.

Keywords: proton exchange membrane, Pt catalyst, X-ray fluorescence spectrometry, X-ray diffraction

1. Introduction

A fuel cell is an electrochemical power source with advantages of both the combustion engine and the battery. As early as in 1839, Sir William Grove discovered fuel cells by reversing water electrolysis to generate electricity from hydrogen and oxygen using an acid-electrolyte fuel cell. Since then fuel cell technology has evolved substantially. [1]

Among the competing fuel cell technologies, polymer electrolyte fuel cells (PEFCs) are commercially most attractive owing to their quick start-up and ambient temperature operations. [2, 3] PEFCs exhibit high-operational efficiencies with both specific and volumetric energy densities comparable to internal – combustion engines while emitting no pollutants. [4]

A proton exchange membrane (PEM) fuel cell is an electrochemical cell that is fed hydrogen, which is oxidized at the anode, and oxygen that is reduced at the cathode. The protons released during the oxidation of hydrogen are conducted through the proton exchange membrane to the cathode. Since the membrane is not electrically conductive, the electrons released from the hydrogen travel along the electrical detour provided and an electrical current is generated. [5] These reactions and pathways are shown schematically in figure 1.

At the heart of the PEM fuel cell is the membrane electrode assembly (MEA). The MEA is typically sandwiched by two flow field plates that are often mirrored to make a bipolar plate when cells are stacked in series for greater voltages. The MEA consists of a proton exchange membrane, catalyst layers, and gas diffusion layers (GDL). As shown in figure 2, the electrode is considered herein as the

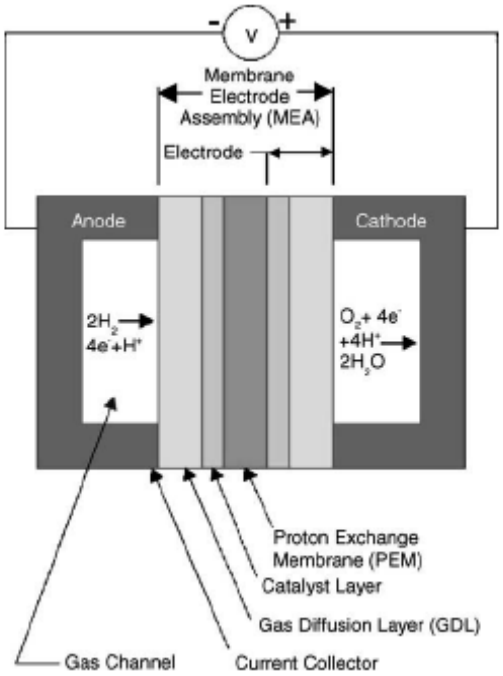


Figure 1. Schematic of a single typical proton exchange membrane fuel cell [5].

components that span from the surface of the membrane to gas channel and current collector.

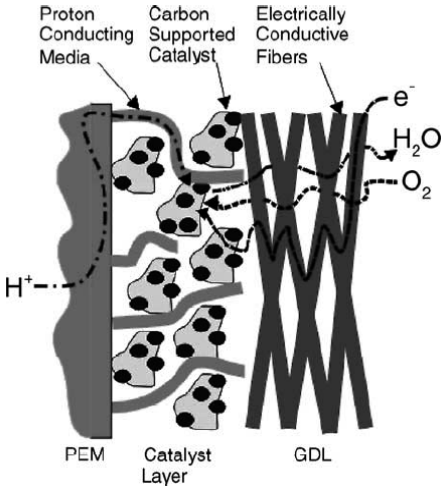


Figure 2. Transport of gases, protons, and electrons in a PEM fuel cell electrode [5].

Protons, electrons, and gases are often referred to as the three phases found in a catalyst layer. Part of the optimization of an electrode design is the attempt to correctly distribute the amount of volume in the catalyst layer between the transport media for each of the three phases to reduce transport losses. In addition, an intimate intersection of these transport processes at the catalyst particles is vital for effective operation of a PEM fuel cell.

The catalyst layer is in direct contact with the membrane and the gas diffusion layer. It is also referred to as the active layer. In both the anode and cathode, the catalyst layer is the location of the half-cell reaction in a PEM fuel cell. The catalyst layer is either applied to the membrane or to the gas diffusion layer. In either case, the objective is to place the catalyst particles, platinum or platinum alloys (shown as black ellipses in Fig. 2), within close proximity of the membrane.

The first generation of polymer electrolyte membrane fuel cells (PEMFC) used PTFE-bound Pt black electrocatalysts that exhibited excellent long-term performance at a prohibitively high cost. [6] These conventional catalyst layers generally featured expensive platinum loadings of 4 mg/cm^2.

A generous amount of research has been directed at reducing Pt loading below 0.4 mg/cm^2 [7, 8]. This is commonly achieved by developing methods to increase the utilization of the platinum that is deposited.

The porous gas diffusion layer in PEM fuel cells ensures that reactants effectively diffuse to the catalyst layer. In addition, the gas diffusion layer is the electrical conductor that transports electrons to and from the catalyst layer. Typically, gas diffusion layers are constructed from porous carbon paper, or carbon cloth, with a thickness in the range of 100–300 μm. The gas diffusion layer also assists in water management by allowing an appropriate amount of water to reach, and be held at, the membrane for hydration.

This paper only presents the analysis of magnetron sputtered Pt catalyst layer on Carbon Cloth (CC) support.

2. Methods used for analysis

2.1 Energy dispersive X-ray fluorescence spectrometry (EDXRF)

More and more, XRF is becoming the universal tool in analytical laboratories including applications traditionally handled using AAS (atomic absorption spectroscopy) or ICP (inductively coupled plasma). The advantages are: nondestructive analysis, none or easy sample preparation, multi-element determination, mapping availability and the possibility to screen completely unknown samples.

With energy dispersive X-ray fluorescence technique (EDXRF), all elements between Na and U can be analyzed. For the elements from Na to Ce, K-lines are used, and for all elements from Pr to U, L-lines are used.

XRF analysis has two components: qualitative and quantitative analysis. Qualitative analysis involves the determination, from the peaks position, of the chemical elements present in the sample. Quantitative analysis involves the determination of the net intensity of the characteristic X-ray radiations associated to the identified chemical elements. By comparing this intensity to the standard one and applying proper corrections, it can be obtained the concentration of the chemical element into the analyzed sample. [9]

The quantitative analysis is supported by the fundamental parameters program. The model applied for these tests uses an iterative association between the spectra deconvolution and the calculation of the sample composition. [10]

2.2 X-Ray diffraction method (XRD)

X-ray diffraction phenomena are of a great interest in the analysis of crystalline materials because the diffracted X-ray beam contains information about the crystalline state's structure of the material subjected to analysis. The dispersion structures are the atoms or atom groups and the diffracted X-ray beam is situated in the same semi-space as the incident one. The maximum interference condition is given by Bragg law:

$$2d_{hkl} \cdot \sin\theta = n \cdot \lambda \qquad (1)$$

(d_{hkl} is the distance between the crystallographic planes (hkl)). Bragg's law is a consequence of the crystal's periodical structure and is independent of its chemical composition and of the atom's placement within the reflection planes. The last terms mentioned are influencing the intensity of the diffracted X-ray beam and are of great interest for determining the relative intensity of different orders diffraction maxims *(n)*. According to the relation mentioned above, Bragg reflection occurs only if $\lambda \le 2d$.

The microstructural characterization by XRD is based on a whole powder pattern fitting (WPPF) refinement method. The function used for pattern fitting is written below:

$$U(A_\alpha, D_\alpha, \varepsilon_\alpha, a_{\alpha k}, A_{am}, B_k, \sigma_0, x_0, t, z) = \\ = \sum \frac{1}{N_i} \cdot \left[N_i - \sum_\alpha A_\alpha \cdot \varphi_\alpha(x_i) - A_{am} \cdot R \cdot N_i^{am} - \sum_k B_k \cdot P_k(x_i) \right]^2 \qquad (2)$$

where α is the crystalline phase number, $\varphi_\alpha(x_i)$ is the phase pattern in x_i point, A_α and A_{am} are coefficients proportional with phase volume fractions, N_i and N_i^{am} are the impulse numbers in the acquisition point i for the analyzed pattern and for the amorphous phase pattern, R is coefficient for recalculation of the experimental intensity in the theoretical one, B_k are the background coefficients, P_k are Legendre polynomials for transforming the whole acquisition interval in the [-1,+1] interval, D_α and ε_α are the crystallite size and average square microstrain for the α phase, $a_{\alpha k}$ are the elementary cell parameters, σ_o is the constant geometrical width of the diffraction line due to the finite length of the detector's incoming slit and to the projection's focus width of the Roentgen tube, x_0 is the zero angle of the detector, t is the sample's surface deviation to the goniometer's axis and z is the radiation penetration depth into the sample. [11]

By WPPF method, the following structural parameters can be determined: lattice parameters for each phase, accurate phase quantification up to crystallite size and strain.

3. Experimental data

3.1 Magnetron sputtering deposition of Pt catalyst on Carbon Cloth support

Three types of Pt/CC membranes have been obtained by magnetron sputtering technique with different Pt content: 0.2, 0.4 and 0.6 g/cm^2 (see table 1).

Table 1. The obtained samples and their characteristics

Sample no.	Sample cod	Amount of magnetron sputtered Pt (g/cm^2)
1	Pt06	0.6
2	Pt04	0.4
3	Pt02	0.2

An ULVAC SBR-1102E magnetron sputtering equipment was used, having 500W power generator, 13,56 MHz working frequency and a 10^{-6} Torr maximum vacuum level.

3.2 EDXRF

The Pt/CC samples were first analyzed with an EDXRF spectrometer in the following configuration: a 30 W-Molybdenum X-ray tube generates a measurement spot with a 2 mm diameter. A Si Drift Detector (SDD) with a resolution of 160 eV (relative to the Mn-Kα line and an input pulse density of 1000 cps) is used as the detector.

For each Pt/CC sample a point scan was made. Separate scans were made on the sample holder and CC suport in order to extract their contribution from the Pt/CC spectra.

3.2 XRD

XRD analysis was performed on a Rigaku Ultima IV system (CuK_α radiation) with Parallel Beam optics.

For the qualitative phase analysis the X-ray diffraction patterns were acquired in Bragg-Brentano geometry, in the 2θ range 33^0-85^0, step width $\Delta 2\theta=0.05^0$ and 5s as counting time. The working voltage was U=40kV and the current used I=30mA.

4. Results and Discussion

4.1 EDXRF qualitative points scan analysis

Pt/CC membranes have been first analyzed by energy dispersive X-ray fluorescence spectrometry in order to confirm Pt deposition on CC support. A brief image of the Pt/CC membranes is presented in figure 3.

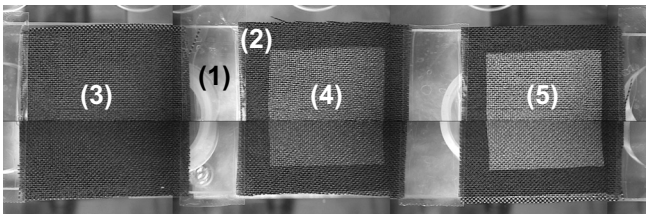


Figure 3. (1) glass sample holder, (2) CC, (3) Pt 0.2 (g/cm^2), (4) Pt 0.4 (g/cm^2), (5) Pt 0.6 (g/cm^2).

The obtained EDXRF spectra are presented in figure 4.

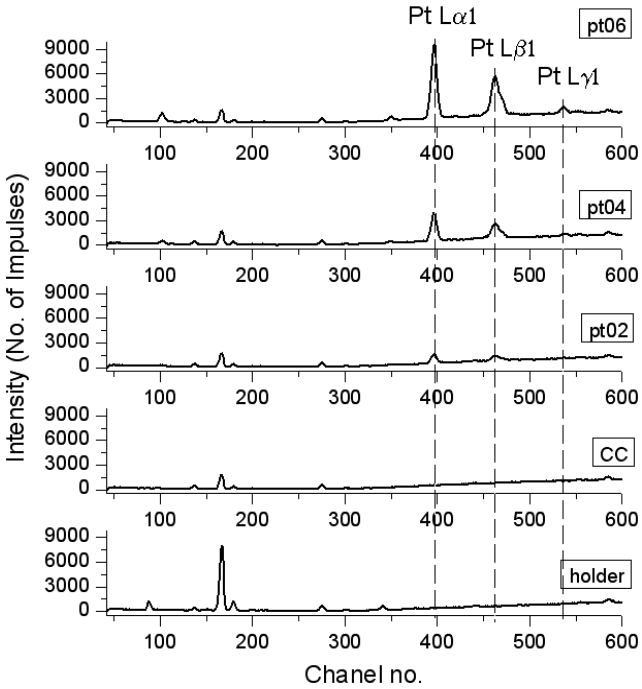


Figure 4. EDXRF qualitative point scan analysis of glass sample holder, Carbon Cloth membrane and magnetron sputtered Pt/CC.

As it can be noticed from EDXRF qualitative points scan analysis the presence of magnetron sputtered Pt is confirmed and its concentration increases gradually from sample Pt02 to Pt06.

4.2 EDXRF mapping analysis

In figure 5 is presented Pt concentration distribution on the surface of CC support for all 3 samples. The concentration maps show a relative uniform distribution of the magnetron sputtered Pt on CC membrane, especially for sample Pt06.

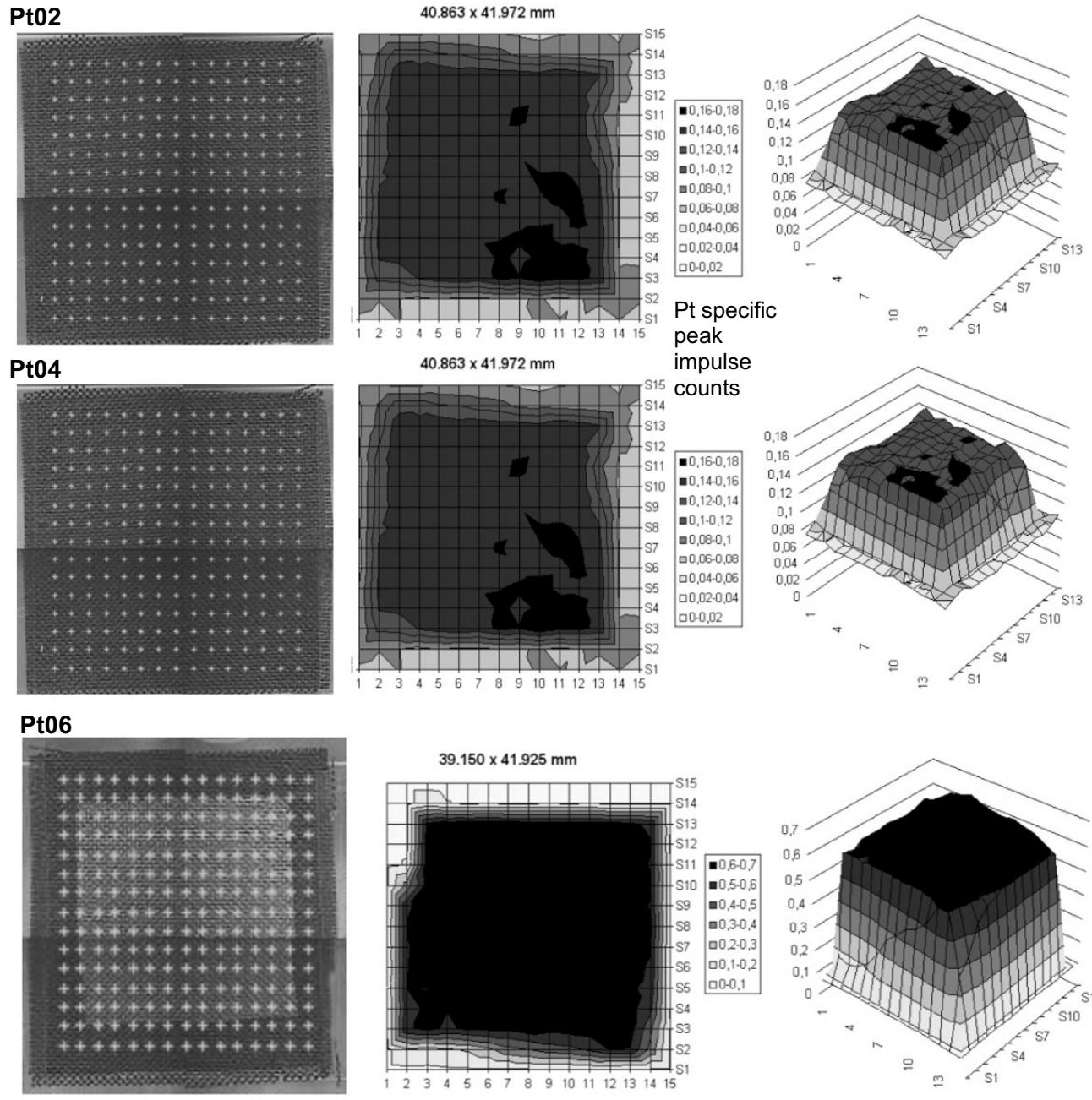


Figure 5. EDXRF surface mapping and translated 3D maps of Pt concentration distribution on CC support for samples Pt02, Pt04 and Pt06.

4.3 XRD qualitative analysis

As it can be seen in figure 6, XRD spectra for sample Pt04 and Pt06 indicate the presence of polycrystalline platinum cubic phase. In sample Pt02 the amount of polycrystalline Pt is below the method's detection limit.

4.4 XRD quantitative analysis

An important development of powder diffraction methods was the introduction of alternative analytical functions to model line profiles. An important consequence was the development of programs using analytical functions to model all reflections in a powder

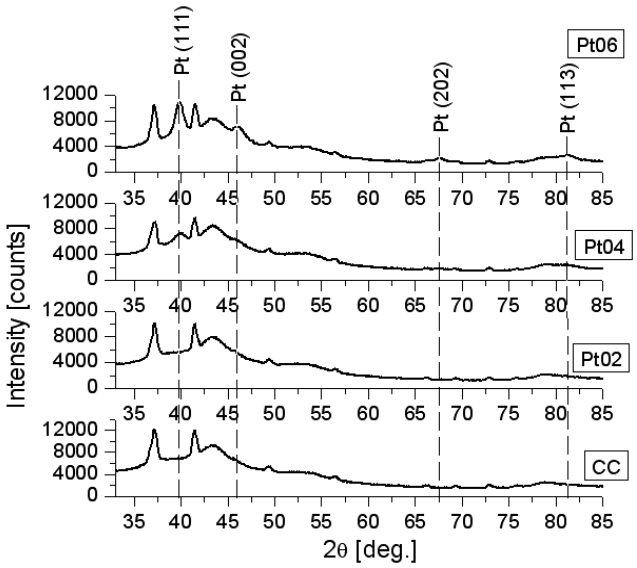


Figure 6. XRD spectra for CC support, Pt02, Pt04 and Pt06 samples.

pattern, to obtain their position, maximum intensity, area breadth and some shape parameter.

We have to mention that the values for the average crystallite size and for the lattice strain are simply fitting parameters in the whole pattern fitting method and that this method is not using an instrumental function. This method allows performing the quantitative phase analysis of the samples. In order to perform the quantitative phase analysis we have collected, in the same conditions, the X-Ray diffraction pattern of the amorphous CC phase. In the whole pattern fitting method, the experimental amorphous pattern is correlated with the polycrystalline phases (e.g., the platinum phase) using a coefficient. This coefficient is depending on the following parameters: theoretical absolute intensity of a standard sample; experimental integral intensity of the same standard sample; linear absorption coefficients of the standard sample and of the identified amorphous phase.

As cinematic standard it was used NIST LaB_6 (111) reflection. The atomic density value of the amorphous phase used in fitting process was 0.08 at/ang^3. The XRD quantitative phase analysis results and microstructural parameters obtained by whole powder pattern fitting of Pt06 and Pt04 spectra are presented in table 2.

Table 2. Microstructural parameters obtained by whole powder pattern fitting of Pt06 and Pt04 spectra

Sample cod	Pt Weight fraction (%)	Lattice parameters (ang.)	Mean crystallite size (ang.)	Mean square microstrain (%)
Pt06	1.1 ± 0.0	3.91883 ± 0.00005	132.5 ± 14.3	0.666 ± 0.022
Pt04	0.4 ± 0.0	3.91814 ± 0.00043	137.5 ± 5.5	1.094 ± 0.056

5. Conclusions

The aim of this paper was to presents the analysis of magnetron sputtered Pt catalyst on Carbon Cloth (CC) for PEM fuel cells applications with the means of X-ray fluorescence spectrometry and X-ray diffraction technique.

Three types of Pt/CC membranes have been obtained by magnetron sputtering technique with different Pt content (0.2, 0.4 and 0.6 g/cm^2).

The EDXRF points scan analysis confirmed the presence of magnetron sputtered Pt in all 3 samples and shows that its concentration increases gradually from sample Pt02 to Pt06. By mapping technique, Pt concentration distribution on the surface of CC support for all 3 samples was achieved. The concentration maps show a relative uniform distribution of the magnetron sputtered Pt on CC membrane, especially for sample Pt06.

The XRD analysis showed the presence of Pt polycrystalline phase in samples Pt06 and Pt04 and, by whole pattern fitting method, the microstructural characteristics for this phase were drawn.

Acknowledgments

Authors recognize financial support from the European Union through the European Regional Development Fund, and from Romanian National Authority for Scientific Research, project POSCCE-O 2.1.2-2009-2/12689/717.

References

[1] Mench M. M., *Fuel cell engines,* New Jersey: Wiley, (2008)

[2] Springer T E, Zawodzinski T A and Gottesfeld S, J. Electrochem. (1991) Soc. 138 2334

[3] Gottesfeld S and Zawodzinski T Adv. Electrochem. Sci. Eng. 5, (1997), p. 195
[4] Grant P, Nature, (2003) 424 129
[5] S. Litster, G. McLean, *PEM fuel cell electrodes,* Journal of Power Sources 130, (2004), p. 61–76
[6] M.S. Wilson, J.A. Valerio, S. Gottesfeld, *Low platinum loading electrodes for polymer electrolyte fuel cells fabricated using thermoplastic ionomers*, Electrochim. Acta 40 (1995) 355–363.
[7] G.S. Kumar, M. Raja, S. Parthasarathy, *High performance electrodes with very low platinum loading for polymer electrolyte fuel cells*, Electrochim. Acta 40 (1995), 285–290.
[8] M.S. Wilson, *Membrane catalyst layer for fuel cells*, U.S. Pat. No. 5,234,777 (1993).
[9] Eugene P. Bertin, *Principles and Practice of X-Ray Spectrometric Analysis*. Plenum Press - New York – London, (1970)
[10] René E. Van Grieken and Andrzej A. Markowicz, *Handbook of X-Ray Spectrometry,* Second Edition, Marcel Dekker Inc. NY, (2002)
[11] E. V. Shelekhov and T. A. Sviridova, Programs for X-ray analysis of polycrystals, Metal Science and Heat Treatment, (2000), Vo1. 42, Nos. 7 8

DEPOSITION OF THE POROUS TITANIA FILMS BY PLASMA ELECTROLYTIC OXIDATION OF TITANIUM SUITABLE FOR BIOMEDICAL APPLICATION

Maria Magdalena DICU[1], Catalin DUCU[1,2], Sorin MOGA[1,3], Denis NEGREA[1,3], Dorel DOROBANTU[4], Marius ENACHESCU[5*]

[1] University of Pitesti, Research Center for Advanced Materials, Targu din Vale, No 1, 110040 Pitesti, Romania,
[2] SC Global Research SRL, Argesului, No 4A, 110151 Pitesti, Arges, Romania,
[3] SC Dune Nanomat Center SRL, Argesului, No 4A, 110151 Pitesti, Arges, Romania,
[4] General Inspectorate of Police, Directorate of Firearms, Explosives and Dangerous Substances, Stefan cel Mare Road 13-15, 020123 Bucharest, Romania,
[5] University "Politehnica" of Bucharest, Splaiul Independentei, No 313, Bucharest-060042, Romania.

Abstract. This paper is concerned with the surface modification of titanium by the plasma electrolytic oxidation method (PEO) in the solution which contains Ca and P. During the oxidation treatment, the titanium sample was immersed in electrolytic solution containing calcium acetate monohydrate ($((CH_3\text{-}COO)_2Ca\cdot H_2O)$) and sodium biphosphate dihydrate ($NaH_2PO_4\cdot 2H_2O$) in distilled water. The morphological microstructure and chemical composition of the anodic oxide layer formed on the surface was examined by scanning electron microscopy (SEM) and an energy dispersive X-ray spectroscopy (EDX) attached to the SEM was performed, respectively. The crystalline structure of the anodic oxide layer formed on the titanium surface was examined by X-ray diffraction techniques (XRD).

The anodic oxidation changes not only the titanium surface topography but also the chemical composition and physical properties of the surface layers.

The XRD pattern obtained for the oxidized samples show that the oxide layer is principally composed of anatase TiO_2 and rutile TiO_2. The ratio between these forms is variable.

The quality of titania coating and the ratio anatase/rutile depend by parameters, such as voltage, time, etc. High quality coatings can be formed using properly selected deposition parameters.

Keywords: titanium, PEO, titania, coatings, biomaterials, SEM, EDX.

1. Introduction

Plasma electrolytic oxidation (PEO) is a relatively convenient and effective technique to deposit ceramic coatings on the surfaces of titanium and its alloys. Using this technique to deposit biocoatings on titanium and its alloys has received much attention in recent years.

PEO is capable of producing highly ordered oxides with a porous morphology [1]. The technique has attracted increasing attention in recent years [2-7], because of various advantages such as improved adhesion of oxides, protection against corrosion, good apatite forming ability and mechanical/chemical properties of oxides and the absence of size/shape restrictions of samples.

PEO can produce a porous, relatively rough, and firmly adherent titanium oxide film on titanium implants. The porous nature of the anodized films enhances the anchorage of the implants to the bone and opened up the possibility of the incorporation and release of antibiotics around the titanium implants. Additionally, PEO ceramic coatings usually exhibit good interface bonding with substrates.

To achieve improved bioactivity, PEO has been used to prepare TiO_2 coatings in different acid or alkaline electrolytes [8,9]. Some researchers also have tried to prepare porous TiO_2 coating containing Ca and P ions in calcium and phosphate electrolytes [10,11].

Such PEO coatings can provide good corrosion resistance and biochemical stability in the complex environment of the human body. It is expected to be applied in artificial bone joints and dental implants.

Titanium possesses excellent mechanical properties and biocompatibility. Various surface treatments like mechanical treatment, electrochemical treatment (anodizing), heating, laser treatment, ultrapassivation, nitriding, ion implantation, ceramic coating through thermal oxidation (rutile mainly), plasma coatings, calcium phosphate coatings have been all studied to achieve desired surface properties. Since interactions between cells and titanium implants occur at their interfaces, surface characteristics of titanium are essential. Despite the excellent biocompatibility of thin native oxide film on titanium implants, native titanium oxide is known to seldom bond chemically to bone tissue and is often presented as an inert ceramic biomaterial [12]. Several *in vitro* and *in vivo* studies showed the effect of coating composition on Ti surface: deposited rutile and anatase

compared to natural TiO_2 show enhanced bone-like precipitation at the surface in simulated body fluids [13].

Titanium and its thin naturally formed oxide film are known to be bio-inert, therefore, unlike other bioactive materials such as bioglasses and calcium phosphate ceramics, titanium forms osteointegration at the interface of titanium and tissue, instead of bone-bonding. In the field of dentistry, smooth-surface titanium implants inserted into facial bones performs very well [14]. However, in skeletal bones, smooth titanium implants usually tend to be encapsulated by fibrous tissue and show only weak bonding to the bone in animal experiments even under unloaded conditions [15-16].

2. Material and methods

2.1. Sample preparation

Grade II (pure) titanium plates for the PEO process were 14mm×16mm×3mm in size. The chemical composition of titanium is: Fe 0.105 %; C 0.011 %; O 0.175 %; N 0.006 %; H 0.0005 % and Ti remains.

Prior to PEO treatment, the titanium plates were polished using #200 – #1000 SiC sandpaper gradually, degreased and cleaned in an ultrasonic bath with ethyl alcohol and distilled water, successively.

2.2. PEO process

The PEO equipment was design and manufactured at the University of Pitesti within Research Center for Advanced Materials. The experimental set-up consists of: an insulated stainless steel electrolyte cell with a stirrer and a pulsed bipolar DC power supply. The titanium plate was used as anode, while a stainless steel cell was used as cathode. The electrolyte in the electrolyte cell was an aqueous solution containing 0.13 mol/l calcium acetate monohydrate ($(CH_3\text{-}COO)_2Ca\cdot H_2O$) and 0.06 mol/l sodium biphosphate dihydrate ($NaH_2PO_4\cdot 2H_2O$) in distilled water.

PEO was carried out at an applied voltage of 430 V for 20 and 30 min. During the oxidation, the temperature of electrolyte was less than 50°C. After the PEO treatment, the samples were washed with distilled water and dried at room temperature.

2.3. Characterization of oxide layer

The surface morphology of treated surfaces was observed on a Scanning Electron Microscope (SEM, Low-vacuum Inspect S – FEI Company). The elemental composition was studied with energy dispersive X-ray spectrometer (EDX, Genesis-XM2) incorporated into the scanning electron microscope. EDX was performed at an acceleration voltage of 20 kV.

The X-ray diffraction (XRD) measurements were performed on a Rigaku Ultima IV system (CuK_α radiation) with Parallel Beam optics. The divergence angle of emitted beam from the multilayer mirror is approximately 0.05^0. This kind of optics is suitable for analysis because of increased beam intensity and significant reduction of instrumental aberrations.

For the qualitative phase analysis the X-ray diffraction patterns were acquired in Bragg-Brentano geometry, in the 2θ range 20^0-73^0, step width 0.05^0 and 5s as counting time. Also, grazing incidence geometry was used to obtain surface structural information by measuring the PEO coatings under small incidence angle. The angle of the incident beam was fixed at 1° and the X-ray diffraction measurements were recorded in the same 2θ range.

3. Results and discussion

Plasma electrolytic oxidation has also been employed in order to modify the surface of titanium and its alloys intended for use as biomaterials, or for improving the mechanical properties of these materials.

Usually, porous and rough surface morphology was believed to be preferable choice for biomaterials. Pores in the film not only favour the anchorage of implants to bone, but also act as nucleation sites for bone tissue.

The XRD patterns of PEO treated samples are shown in figure 1.

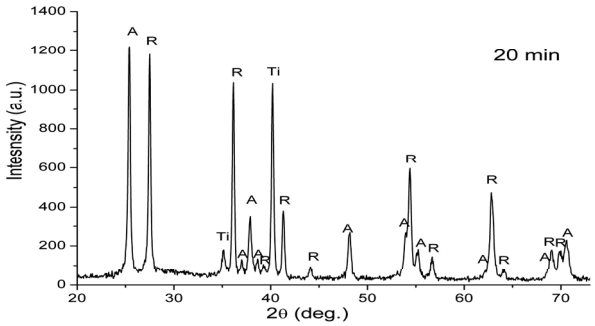


Figure 1. XRD pattern of the PEO sample at 430 V for 20 min

The film formed with PEO was a titanium oxide (TiO_2) with peaks for both anatase and rutile phases being clearly identified, which indicated that the film consisted of both anatase and rutile. The ratio between these forms is variable.

The intensities of the rutile Bragg reflections increased with the treatment time. The transformation temperature of anatase to rutile is 915 °C, and rutile is a thermally stable phase with the molten point 1870 °C [17]. The existence of rutile in the film confirms that the instant local temperature of the plasma was very high, while the bulk titanium plate was cooled down by the electrolyte, being lower than 50 °C.

The quality of titania coating and the ratio anatase/rutile depend by parameters, such as voltage, time, etc.

The surface morphology of the Ti after the PEO treatment is shown in figure 2.

The formation of an oxide layer was initiated when the DC power supply was applied. The sample treated at 430 V exhibits a porous and rough surface, with the pores that occupies perfectly the surface of the substratum. The pore diameter varies from 1 to 7 μm. The holes in the surface were channels of micro-arc discharge in electrolyte.

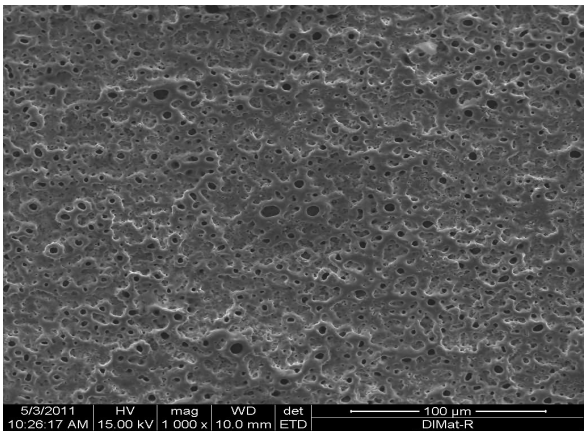


Figure 2. SEM morphology of the Ti oxidized at 430 V for 30 min

The pores on the surface are probably caused by the oxygen bubbles produced in the anodic reaction during the PEO process.

The contents of the elements on the film were tested by EDX (Figure 3).

All the oxidized layers contained Ti and O as well as Ca and P. No Na was detected in the oxidized films. As the oxidation time increased, the content of O hardly changed and the content of Ti decreased, but the content of Ca and P increased evidently.

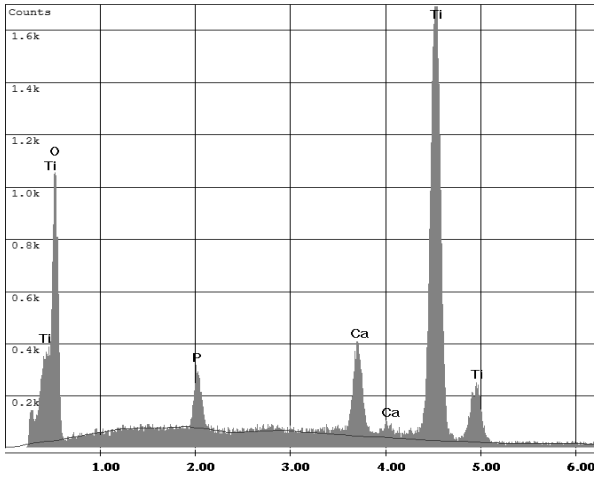


Figure 3. EDX spectrum of the PEO film prepared at 430 V for 30 min

4. Conclusions

Porous and rough titania film on titanium plate was formed by PEO at the preparation voltage of 430 V. The porous layer contains oxygen, titanium, calcium and phosphorus.

The XRD pattern obtained for the oxidized samples show that the oxide layer is principally composed of anatase TiO_2 and rutile TiO_2.

The PEO-formed bioactive porous titanium will not only be beneficial to bone ingrowths into the porous structure, but also will be beneficial to achieve a tough chemical bonding at the bone/implant interface.

Acknowledgements

The authors thank to Andrei Vasile for Scanning Electron Microscopy and Energy-dispersive X-ray analysis.

This research was supported by CNCSIS grant PD, NO 08/28.07.2010 funded by the Ministry of Education, Research, Youth and Sport, Romania, and by the European Union through the European Regional Development Fund, and by Romanian National Authority for Scientific Research, project POSCCE-O 2.1.2-2009-2/12689/717.

References

[1] Markov G.A., Tatarchuk V.V., Mironova M.K., Izv, SO AN PSSSR. Ser. Khim Nauk, 3 (1983) p.34.

[2] Yerokhin A.L., Nie X., Leyland A., Mattews A., Surf. Coat. Technol., 122 (1999) p.73.

[3] Oh H.J., Lee J.H., Jeong Y., Kim Y.J., Chi C.S., Surf. Coat. Technol., 198 (2005) p.247.

[4] Wu H., Lu X., Long B., Wang X., Wang J., Jin Z., Mater. Lett., 59 (2005) p.370.

[5] Ishizawa H., Ogino M., J. Biomed. Mater. Res., 29 (1995) p.1071.

[6] Ishizawa H., Ogino M., J. Biomed. Mater. Res., 29 (1995) p.65.

[7] Han Y., Hong S.H., Xu K.W., Surf. Coat. Technol., 168 (2003) p.249.

[8] Oh HJ, Lee JH, Jeong Y, Kim YJ, Chi CS. Surf. Coat. Technol., 198 (2005) p.247–52.

[9] Sun JF, Han Y, Cui K. Surf. Coat. Technol., 202 (2008) p. 4248–56.

[10] Wei DQ, Zhou Y, Yang CH. Colloid Surf B 74 (2009) p. 230–7.

[11] Han Y, Sun JF, Huang X. Electrochem Commun 10 (2008) p.510–3.

[12]. SUL Y.T., Biomaterials, 24 (2003) p.3893.

[13]. JINNO T., KIRK S.K., MORITA S. and GOLDBERG V.M., J. Arthroplasty, 19 (2004) p.102.

[14] Alberktsson T., Alberltsson B., Acta Orthop. Scand., 58 (1987) p.567.

[15] Kanagasbiemi I.M.O., Verheyen C.C.P.M., et al., J. Biomed. Mater. Res., 28 (1994) p.563.

[16] Takatsuka K., Yamamuro T., Makamura T., Kokubo T., J. Biomed. Mater. Res., 29 (1995) p.157.

[17] Hench L.L., Wilson J., An Introduction to Bioceramics, World Scientific Publishing, Singapore, 1993, p. 181.

CHARACTERIZATION OF DIATOMITE MODIFIED BY STRUCTURAL-CHEMICAL METHOD

Veacheslav ZELENTSOV, Tatiana DATSKO, Elena DVORNIKOVA
The Institute of Applied Physica of The Academy of Sciences of Moldova
2028 MD, Chisinau; str. Academiei 5, E-mail: vzelen@yandex.ru

Abstract. A novel fluorine sorbent, modified diatomite was characterized in the study. For modification of diatomite with the goal to make it more selective towards fluoride-ions we have used structural-chemical method which consists in introduction into the diatomite matrix of elements that have a high potential for adsorption of fluorine or form with him low solubility product. Such a modifier element is aluminum. The -modified diatomite was made through surface modification treatments including NaOH treatment and aluminosilicate deposition on raw diatomite. In the NaOH treatment under heating, amorphous SiO_2 of diatomite was partially dissolved in the NaOH solution. The dissolved Si contributed to form the aluminosilicate which deposited onto surface and into the macropores and mesopores of diatomite. For characterization of the original and modified diatomite chemical, thermogravimetric, X-rays, structure and adsorption (BET) and FTIR analyses were used. Blocking macropores and larger mesopores of diatomite with aluminosilicate resulted in increase of specific surface area to 81.77 m^2/g for the modified diatomite which is 2.5 times-larger than the raw diatomite (37.54m^2/g). Sorbent obtained was tested to remove fluoride from model solution with initial concentration of F^- 1mmol/l. In identical conditions (m=0,5g/l; pH = 4,9; T=293K; time 120min) adsorption capacity of modified diatomite was 40mgF / g sorbent in comparison with 4mgF / g for raw diatomite

Keywords: diatomite, modification, structural-chemical, aluminosilicate

1. Introduction

In recent years for natural water purification more widely used adsorption-based technologies and processes in which various natural minerals applied as a sorbent, particularly diatomaceous earth, and bentonite, which have a number of advantages over the traditional - synthetic sorbents and ion exchange resins: high stocks, availability, low price and the possibility of a single application.

Specific surface area of natural diatomite is generally low (15-35m^2/g), which does not allow the diatomite to be an effective sorbent for solutes. Therefore, to increase the surface area and improve the surface characteristics substantial modification of the raw diatomite need. A high porosity (80-85% voids) makes it a suitable carrier for the materials used for inoculation.

In this work to modify the surface of diatomite and give it selectivity towards fluoride ions we have used structural-chemical method. Structural-chemical modification method (SCM) includes three consecutive stages of diatomite treatment: alkaline-based heating at constant stirring, exposure in the aluminum salt solution (pH below 3.5) and the third stage – mixing with ammonia solution in basic medium. After separation of the precipitate, it was washed, shaped and dried in open air and further at the temperature 110-120^{0}C.

For characterization of the initial diatomite (D1) and the diatomite modified by structural-chemical method (DMA) X-ray, thermogravimetric, and structure of adsorption (BET), chemical and FTIR analyses were used. It was established that the initial diatomaceous earth contains SiO_2 - 60%, CaO - 11.7% Al_2O_3-4.8%, and also oxides of Mg, Fe, Na, K, diatomite main phases are quartz, amorphous silica, calcite, aragonite, kaolinite and montmorillonite present in small quantities.

Modification of diatomite leads to decomposition of calcite and aragonite phases and formation of a new one - aluminosilicate. During the diatomite treatment with NaOH at heating amorphous silica partially dissolved and in the second stage (interaction with a modifier) in volume and on the surface aluminosilicates formed, which probably deposited into the macropores and the larger mezopores.

2. Results and discussion

2.1. Adsorption-structural analysis (BET)

Fig. 1 shows isotherms of nitrogen adsorption-desorption by the samples D1 and DMA

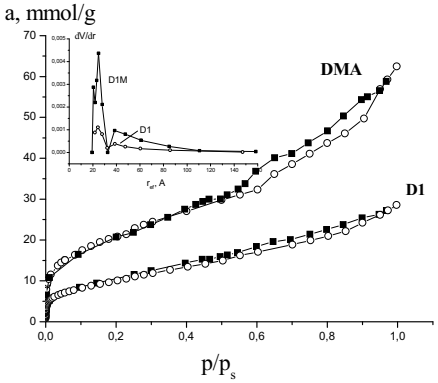


Fig. 1 Nitrogen adsorption isotherms by the natural diatomite D1 and the structural-chemical modified DMA samples

According to Fig. 1 the initial parties of the isotherms are convex curves for both samples. The isotherms of the initial sample and the modified diatomite are both of type IV by the classification of A.V. Kiseleov, i.e. samples are mixed structure mesoporous sorbents A special feature of the isotherms is the presence of reversible hystereses - adsorption branch coincides with the desorption one at low relative pressure p/p_s = 0.25 to 0.40, after the point of hysteresis beginning a larger amount of adsorbed nitrogen vapor (more than two times) is observed for the sample DMA.

This probably tells us about the formation of new active centers on the sorbent surface as a result of structural changes and the increasing of chemical interaction diatomite - nitrogen, which is characteristic for adsorption processes accompanied by capillary condensation. Both samples isotherms are satisfactorily described by the multimolecular adsorption model, specific surface values calculated following BET equation are equal to 37.54 and 81.77 m^2/g, corresponding for the initial sample and modified (the area of nitrogen molecule was taken as 16.2 Å).

Thus specific surface of diatomite modified sample has changed 2 times higher than natural diatomite sample. According to this fact the adsorption isotherm DMA is placed above the initial sample (Fig. 1). As it seen from the curves of pore volume distribution by radii values mesoporous structure is preserved for both samples and the effective pore radius is at 25A. Along with that on the pore volume distribution curves the second maximum is observed at r_{ef} = 39. The difference in pore volume distribution curves of samples studied is only the numerical values of dV/dr.

Table 1 presents the basics of the porous structure of samples D1 and DMA determined from nitrogen adsorption isotherms, and in some cases - and on the basis of benzene adsorption.

Table 1
Adsorption and structure characteristics of raw and modified diatomite

Sample	S_{sp}, BET, m^2/g	Mesopores		Micropores		Pore sorption volume, V_S, cm^3/g	Macropores		Pore total volume, V_Σ, cm^3/g^*
		V_{me}, cm^3/g	% of V_Σ	V_{mi}, cm^3/g	% of V_Σ		V_{ma}, cm^3/g	% of V_Σ	
D1	37,54	0,032	6,60	0,012	2,31	0,0442	0,448	91,12	0,498
DMA	81,77	0,091	9,40	0,027	3,20	0,1058	0,739	87,5	0,845

Sorption pore volume V_S of DMA samples is 0.105 cm^3/g and total pore volume V_Σ - 0.845 cm^3/g (found by the method of impregnation of the samples with benzene*). Thus the volume of macropores for the DMA is 0.739 cm^3/g. For the initial diatomite sample this value is 0.492 cm^3/g. Therefore, the initial and modified diatomite samples contain a significant amount of large pores.

Characteristics of adsorption and structure of those samples testify that the process of modification leads to increase in the sorption volume and total pore volumes of samples.

2.2. Physicochemical study of the raw and modified by structural-chemical method diatomite

Real density of the samples γ_r was determined based on impregnation with benzene*, γ_a -apparent density – with the method by Herbst. V_Σ - total pore volume was calculated using the formula:

$$V_\Sigma = \frac{1}{\gamma_a} - \frac{1}{\gamma_r} \qquad (1)$$

Simultaneously this parameter has been determined by wetting of dried at 110^0C samples with benzene. Sorption volume was calculated from nitrogen adsorption isotherms, taking the product of maximum adsorption a_m at p/ps = 1 and molar volume of liquid adsorbat. Adsorption volumes of the samples in the base of benzene vapor saturation were also determined by the amount of vapor adsorbed by desiccator method.

The samples pH_{PZC} were found from the curves of potentiometric titration data.

Total porosity P was calculated by the formula:

$$P = \frac{\gamma_r - \gamma_a}{\gamma_a} \cdot 100\% \qquad (2)$$

and technical porosity by the equation:

$$P_T = -\frac{\gamma_r - \Delta}{\gamma_r} \cdot 100\% \qquad (3)$$

where Δ - volumetric weight of the samples

Table 2 summarizes some characteristics of the samples studied. * Determined by this method the total volume of pores V_Σ differs little from the data referred to the real and apparent densities (Table 2). This method should be regarded as a relative and can be used to compare the results of the same class of sorbents. Obviously, the results are reproducible after V_Σ values satisfactorily coincide with those obtained from density data.

The table shows that structural – chemical modification of diatomite leads to increase of real density and decrease of apparent density and volumetric weight of the samples. Diatomite modification also leads to increasing of its total and technical porosity.

It should be noted that the V_Σ of both initial and modified diatomite is greater than the sorption volume of their pores. It tells us about the presence in the studied samples large pore (macropores) and for modified sample this difference is more pronounced.

2.3. Thermogravimetric analysis

To measure the adsorption and determine physicochemical characteristics all the samples were air-dried and heated at 110^0C to constant mass, after they

Table 2
Physicochemical characteristics of natural diatomite D1 and modified by structural-chemical method DMA

Parameter / Sample	D1	DMA	Annotation
Humidity (hygroscopic water),%), %	7	0	Drying temperature 120^0C, 4 hours
Real density γ_r, g/cm^3	2,11	2,35	
Apparent density γ_a, g/cm^3	1,03	0,78	
Volume weight, g/cm^3	0,54	0,38	
Total porosity P, %	51	67	According to the real and apparent density data
Technical porosity P_T, %	74	84	
Suspension pH	8,15	7,84	
pH_{PZC} (pH of point of zero charge)	8,8	8,5	
Total pore volume V_Σ, cm^3/g	0,497	0,856	After real and apparent density data

were kept in desiccator for further research. Samples drying temperature of 110^0C was determined from thermogravimetric analysis data.

Determined by this method the total volume of pores V_Σ differs little from the data referred to the real and apparent densities (Table 2). This method should be regarded as a relative and can be used to compare the results of the same class of sorbents. Obviously, the results are reproducible after V_Σ values satisfactorily coincide with those obtained from density data.

Table 3 shows the results of thermogravimetric analysis of the samples studied.

The table shows that structural – chemical modification of diatomite leads to increase of real density and decrease of apparent density and volumetric weight of the samples. Diatomite modification also leads to increasing of its total and technical porosity.

It should be noted that the V_Σ of both initial and modified diatomite is greater than the sorption volume of their pores. It tells us about the presence in the studied samples large pore (macropores) and for modified sample this difference is more pronounced.

2.3. Thermogravimetric analysis

To measure the adsorption and determine physicochemical characteristics all the samples were air-dried and heated at 110^0C to constant mass, after they were kept in desiccator for further research. Samples drying temperature of 110^0C was determined from thermogravimetric analysis data.

Table 3 shows the results of thermogravimetric analysis of the samples studied.

Table 3 Thermal effects on thermograms of raw D1 and modified DMA diatomite

Sample	Type of effect	Temperature interval, ^{0}C	DTA curve peak, ^{0}C	Effect characteristic
D1	Endoefect	40-140	90	Distinct
	Endoefect	750-820	780	Distinct
	Endoefect	190-330	260	Broad not deep
	Exoefect	280-380	Widely spread	Shallow
	Endoefect	40-190	120	Distinct, large, clear
	Endoefect	720-950	870	Wide, shallow
DMA	Endoefect Exoefect	190-470	Small	Insignificant
	Exoefect	900-960	950	Visible

On the raw diatomite sample DTA curve there are two endoefects: one in the 40-110^0C with a minimum temperature at 90^0C, the second - in the 750-820^0Ctemperature range with a minimum at 780^0C. First endoefect corresponds to physically adsorbed water removal, the second - decomposition of carbon minerals present in samples of natural diatomite. The total loss of mass corresponding to these effects, determined by TG curve is 26mg, which makes up 96.2% of the total loss of mass. The part of decomposed carbonate is 6 mg. It should be marked that on the DTA curves of natural diatomite can be observed a broad endoefect in the temperature region 190-330^0C, which is attributed probably to the structural water removal and organic impurities of samples decomposition. A shallow and wide exoefect on the DTA curve in the temperature range 280-380^0C is related to the start of combustion of organic substances. On the heating curves of the modified diatomite samples a clear and narrow endoefect also present in the temperature range 40-190^0C with a minimum at 120^0C, which corresponds to physically adsorbed water elimination and an exoefect in the temperature range 190-470^0C. The nature of these peaks is similar to those for unmodified samples. These effects

correspond to the weight loss in the amount of 26mg, which makes up 89.6% of all losses of mass of the sample. After temperature 470^0C on the DTA curve in

the temperature range 720-950^0C a lossless mass endoefect is observed at 870^0C minimum.

This is probably due to decomposition of carbonates, remaining in the samples after diatomite modification. Most carbonates of diatomaceous earth were broken as a result of chemical treatment at the second stage with the solution of aluminum salts (aluminum salt solutions are acidic as a result of hydrolysis). But because the rest mass of carbonates is low, it corresponds to an insignificant endoefect. Noticeable exothermic effect on the thermogram with a peak at 950^0C can be attributed to the crystallization of products of acid decomposition of carbonates in the modification of diatomite (mainly calcite and aragonite). Qualitative changes in the composition of modified diatomite are confirmed by X-ray analysis and FTIR spectra: appearance of new reflexes on the diffractogram characteristic for aluminosilicates and vibration of groups Si─ O ─ Al on the curves of infrared transmission spectra.

Sorbent obtained was tested to remove fluoride from model solutions at the concentration of F^- of 1mmol/l. Under identical conditions of adsorption (m = 0.5 g/l, pH = 4.9, T = 293 K; time 120min) adsorption capacity of modified diatomite was 40mgF/g sorbent in comparison with 4mgF / g for raw diatomaceous earth.

3. Conclusions

By the structural-chemical method a new selective fluoride sorbent has been synthesized. Obtained sorbent possesses both basic mineral and modifier compounds properties: it is relatively inexpensive and has high selectivity towards fluoride typical for aluminum compounds.

The structure changes in modified diatomite are accompanied by increasing of specific surface and sorption pore volume they are caused primarily by increasing of mesoporous surface area and volume of meso and micropores. The development of microporous structure of diatomite is the result of blocking macropores with aluminosilicate during structural - chemical modification.

ARTS AND EDUCATION

ARTE ŞI EDUCAȚIE

LEARNING AND THE DIGITAL REVOLUTION

Isabelle **SABĂU**, Carmen **SABĂU**
in Honor of Mircea Sabau
isabau@niu.edu

Abstract: The digital and communications revolution of the 21st century has greatly transformed the political, social and educational landscape of the modern world. Online learning has increased opportunities for inquiry, discovery and engagement, while at the same time challenging traditional views of pedagogy, intellectual and memory development, and the distinction between information and knowledge. This paper proposes to examine the processes and methods driving online learning and their connection to the development of intellectual and moral integrity. The main questions to be discussed will focus on the best practices that encourage the development of critical thinking skills, while promoting individual freedom and responsibility in the creation of online learning communities.

Keywords: education, technology, online learning.

1 – Introduction

Technological advances have greatly affected the method of interpersonal communication and learning. Today online learning has become a large industry, which includes for-profit institutions, as well as hybrid courses and even full programs delivered through technologically mediated equipment. Unfortunately, the for-profit online educational industry is dedicated to financial profits rather than teaching and learning, promising undeliverable outcomes to potential students and aggressively pursuing those in need of degrees [1]. To counteract this problem reputable institutions have increased their offerings of both hybrid and online courses, thus providing alternative opportunities to the growing population of adult returning students in pursuit of degree-completion or graduate studies. Online learning is broadly defined as education at a distance, promising anytime, anywhere delivery of instruction, which is mediated through computers, internet and mobile electronics.

2 – Online Learning

Traditional pedagogy often relied on lecture followed by discussions, tests or projects. However, in the online environment there is a need for new pedagogical practices due to the lack of face-to-face meetings. These new practices empower the student to take charge of their learning by providing various materials and opportunities for collaboration. The online environment is on the rise but requires engagement and active participation in the learning process [2]. Discussion boards, chat rooms, wiki's, blogs along with the newer social media such as facebook, myspace, twitter and others provide opportunities for diminishing isolation, enabling dialogue among the participants and instant communications and collaboration.

Today's education and the business world demand higher levels cooperation and the newer pedagogies, having increased the constructivist approach to learning stressing performance-based assessment through various projects and collaborative assignments. The educational environment also benefits greatly from the proliferation of websites on the Internet many of which include videos and multimedia presentations on a variety of topics. Websites such as YouTube, provide lectures and videos created by professional educators and various museums have included multimedia presentations about their collections and exhibits. Online courses are often conducted through course management systems such as Blackboard or Moodle, which provide a customizable gateway in which all the activities of the course can take place. In its newest version Blackboard has also incorporated the possibility for utilizing mobile devices such as Blackberry, iPhone and cell phones making it possible for a student to participate in online courses through these devices from anywhere on the globe, through the various apps that can be installed on these mobile devices [3].

The newer generation of students has grown up with many of these electronic devices and are very well versed and comfortable navigating them. Mark Prensky calls this newer generation the digital natives emphasizing their dexterity and skills of utilizing digital and electronic equipment [4]. The mobile industry has enabled individuals to create various apps for cell phones thereby involving users in the creation of new means of communication and research. The digital world has given rise to the continuous immersion in the media-laden world greatly affecting both learning and social

interactions. Since the digital environment depends on bytes of information, which are often streamed with incredible speed, information often becomes fragmented and repeated. At the same time, the democratization of the medium of communication that the Internet has introduced, enables anyone with Internet access to create websites and participate in the web. This in turn has led to the proliferation of misinformation and the difficulty of judging accuracy and truth on various websites. The fragmentation of knowledge is also inherent in the way online courses are created as they require segmentation of the information into smaller units or modules. Pedagogical practices online must emphasize the synthesis of these various units to help learners discover relevancy in the chunked material. Another very important change pertains to the way people process information, reading skills have been transformed by the hyperlinking technology, which encourages quick browsing and scrolling through websites, partly contributing to the low improvement scores in reading skills [5]. The distinction between information and knowledge remains paramount as the first pertains to facts and statistics, while the latter requires critical thinking and analytic skills. To create knowledge one must take the facts and the information and formulate arguments, based on logical principles that lead to plausible solutions to various problems. Critical thinking skills include extracting information, analyzing it and synthesizing the various facts forming the most important emphasis of the learning process, especially online.

The online delivery method also requires more responsibility and motivation on the part of the learner. While traditionally, the student had to physically go to a classroom and listen to a lecture, in the online environment the student must frequently login to the course and participate in the discussions. Small presentations and multimedia lectures can be provided to render the digital world more inviting and engaging. Online courses must be strictly organized and deadlines provided upfront, while frequent reminders must be used to ensure full participation. At the same time, discussion boards in the online environment enable more in depth dialogue, as individuals can asynchronously participate giving them more time to formulate insightful responses and posts [6]. In order to ensure the increased development of critical thinking skills, course materials and assignments must stress the inquiry and research aspect as well as the application of the material learned. Collaborative projects enable students to work in groups focusing both on teamwork skills and on research. Blogs and journals can be used to promote self-reflection and self-analysis further enhancing higher order thinking skills.

In addition, virtual environments have proliferated and numerous educational institutions have created virtual spaces for some of their courses. One of the most popular of these virtual environments is Second Life [7], where an individual creates an avatar and is able to enter a variety of spaces to visualize ideas and collaborate with peers. In Second Life there are a number of islands created by various educational institutions, for example, the re-creation of the Sistine Chapel by Vassar college, where one can fly up and study in great detail the various frescoes as well as find other sources about the architecture, the paintings and the individuals who created the chapel [8]. Although the learning curve may be steep, for the newer generation it is relatively easy to get proficient in manipulating the avatars, as many young people are familiar with video games and therefore have good eye to hand ordination and dexterity. Recent studies of Second Life educational environments show increase in participation, motivation and interest on the part of the learners [9]. While virtual environments are still in infancy, nevertheless the promise of these immersive environments remains an exciting possibility for new pedagogies of cooperation and creation of knowledge. Visualizations of data and information can lead to new interpretations and connections between various domains and subjects of learning. Since the virtual worlds provide virtual spaces for individuals to move through, fly in and create objects that can be manipulated, the environment has the potential to be more interactive. The digital world allows for the empowerment of the student placing much of the responsibility for learning on the student and emphasizing motivational practices to increase participation and engagement. It is important for students to understand the demands of the online environment, in particular their need to login, to participate and independently research for information, while also honing in on their time management. Through the mediation of technology individuals can become increasingly more self sufficient and resourceful.

The educational landscape has changed in other ways as well. A growing population of adult professional students is returning to school driven by economic conditions and the need to change careers or recertify in their professions [10]. This population of students requires more flexibility as they often have full-time jobs, families, and young children. The online environment is well suited for professionals who travel and for those who might be homebound for various reasons, while accelerated programs are offered throughout the year to facilitate degree completion on a shorter timescale than traditional study programs.

Another aspect of the electronic world has increased the idea of multitasking as individuals feel the need to not only stay connected via e-mail, text messaging or various chats, but at the same time conduct their research and other activities of daily life. Unfortunately, studies show that multitasking is not as

successful as it is believed to be, because the fragmentation of attention given to various tasks minimizes concentration and renders activities more superficial [11]. Guidelines for successful online course creation include precise organization of activities with all the deadlines provided on the syllabus and engaging types of projects to motivate the students and keep them focused on the tasks. Taking into account the proliferation of the electronic devices and the multitasking emphasis of the fast-paced modern world can help creators of the online learning to accommodate various learning styles and situations, and emphasize the development of critical thinking skills.

Quality online programs and courses require active participation on the part of the instructor, while the moral integrity of the participants and their academic conduct must be emphasized. The online world has opened the door for increased plagiarism and stress needs to be placed on the proper documentation of sources and references. The activities in an online class must be tailored to demand that individuals extract information and synthesize the material rather than copy from the web. While there are a number of electronic means to check for plagiarism, it is important to stress the analytic skills of determining accuracy of the information one finds on the Web. The students should be asked to connect the material of their course with their own current life and environment to increase the relevancy of their education. Individual freedom and responsibility are necessary components of the online world and all participants must be held accountable for their contributions.

Instant messaging devices, text messaging and Twitter have enabled people to condense language and use abbreviations that change the landscape of the language itself and often requiring more attention to writing skills. The mobile devices, which enable video and audio materials, are further undermining writing skills and requiring educators to emphasize essays and formal papers. Digital communication still relies on the ability to express oneself clearly and concisely and therefore discussion boards are often the key to increasing writing skills. Reading skills must also be emphasized and new devices such as Kindle and others promise to provide electronic access to various books that can be downloaded and viewed on these portable tablets, which can store hundreds of books at a time. A number of companies have also provided electronic access to books published prior to the 20th century, which are now firmly established in the public domain. The Gutenberg project [12] and the Google company have created a variety of agreements with publishers to digitize numerous books. While there are some issues with these initiatives, such as criteria for choosing the materials to be digitized and their respective languages [13], nevertheless such websites provide even greater access to information and materials.

As the technology changes and improves, new apps and software provide even greater opportunities for collaboration across the globe in the hope of more peaceful understanding, acceptance and toleration of the great diversity inherent in the human population. The electronic world erases physical boundaries as well as time constraints bringing people together instantaneously. Recent global political events especially those in the Middle East have demonstrated the power of digital technology and social media to mobilize people and influence changes in the political landscape. These same social media enable individuals to stay in touch over great distances, share information, collaborate on projects and complete their educational goals. As with all media one must be careful not only to check information on the Internet, but to realize that no information posted on the Internet may be stored forever. Privacy concerns are rampant in the digital world and each individual must be aware of the potential for misuse of information especially in identity theft and other types of immoral and illegal scams. Therefore, while education strives to provide new skills and empower people to create jobs, nevertheless the most important attribute modern education can provide is analysis, synthesis and evaluation which comprise critical thinking abilities. Quality education online must vigilantly emphasize critical thinking and participation in order to be successful and attain the status of being comparable to traditional formal education.

3 – Conclusion

The future of education lies in the ability of educational institutions, colleges and universities, to incorporate the digital media and the social environments into the educational practice and to help the newer generation of students by providing them with the opportunity to utilize the technologies they are already familiar with for academic and educational practices. The modern world of education is highly competitive and programs must be flexible, tailored not only to accomplish the task of educating learners, but also of updating pedagogical practices that are suitable for the electronic age. The greatest promise of the digital age is the ability to connect various areas of study and subjects, and discover novel ways of interpreting our environment and ourselves. The growth of mobile technologies and social networks provide the hope that a more peaceful cooperative and environmentally friendly future can be actualized. Economic globalization and the interconnectedness of financial markets has proved both, the positive and negative outcomes of the current global world, and educational programs must prepare the new generation for the electronic world and the necessary

creativity and imagination to discover and implement effective solutions for modern day problems. While traditional methods remain important, the addition of digital pedagogies and novel approaches to delivering education will further enhance opportunities for learning and development.

References

[1] Maggio J. , Smith, M.: *College Inc*., Frontline, 2010, retrieved March 15, 2011 from http://www.pbs.org/wgbh/ pages/frontline/collegeinc/etc/script.html

[2] Gustke Constance, *E-Education Inc. seeks the mainstream*, retrieved March 15, 2011 from http:// www.edweek.org/ew/articles/2010/07/14/36ebiz.h29.html

[3]Blackboard Mobile, retrieved March 15, 2011 from http://blackboard.com/Platforms/Mobile/Overview.aspx

[4] Prensky M.Ş *What makes a Digital Native* – interview for Frontline, February 2, 2010, retrieved from http://www.pbs.org/wgbh/pages/frontline/digitalnation/living-faster/digital-natives/what-makes-a-digital-native.html?play

[5] x x x U.S. Department of Education, National Center for Education Statistics. (2010). *Digest of Education Statistics 2009* (NCES 2010-013), retrieved March 15, 2011 from http://nces.ed.gov/fastfacts/ display.asp?id

[6] Quillen Ian, *E-Learning delivery debated*, E-Learning 2010, retrieved from http://www.edweek. org/ew/ collections/e-learning-2010/e-learning/index. html

[7]x x x Linden Research Inc., http://secondlife.com/whatis/?lang=en-US

[8]Vassar IslandŞ *Sistine Chapel re-creation*, http://world. secondlife.com/place/46f2144a-2a3e-35e6-3df9-8919afcab081

[9] x x x *Virtual Worlds – Best practices in Education* 4th Annual Conference, March 17-19, 2011, http://www.vwbpe.org/

[10] Croix Wendy*: It's back to school for adult learners: new traditions in Higher education*, retrieved from http://www.worldwidelearn.com/education-advisor/indepth/adult-learners-online.php

[11] Gorlick A.: *Media multitaskers pay mental price*, Stanford study shows, August 24, 2009, retrieved from http://news.stanford.edu/news/2009/august24/multitask-research-study-082409.html

[12] Hart M.: *Project Guttenberg*, http://www.gutenberg.org/wiki/Main_Page

[13] Jeanneney Jean-Noel: Google and the Myth of Universal Knowledge, Chicago, University of Chicago Press, 2007.

STEFAN LUCHIAN – POETRY OF COLOR.

Carmen SABAU, Isabelle SABAU
in Honor of Mircea Sabau.
e-mail: CSabau@comcast.net, isabau@niu.edu

Abstract: Stefan Luchian, along with Nicolae Grigorescu and Ion Andreescu, are the pioneers and founders of the Modern Romanian School of Painting and are considered among the most influential Romanian painters of the turn of the 20th century. Luchian, a talented young artist born in the Suceava region in 1868, absorbed the artistic milieu of his time, traveled to Munich and Paris to get acquainted with the new trends in Art, yet instilled his works with a distinctive and unique Romanian spirit. The lyrical and poetic soul of Luchian reveals itself in his spontaneous capture via quick and sure strokes, flattened surfaces, textural renderings and refined coloring, which record his numerous conversations with nature. This paper proposes to discuss the works and the importance of Luchian in the context of Romanian Art of the end of 19th and early 20th centuries and the unique manner in which he revealed his sensibility and the compassion of the Romanian soul in his works.

Keywords: painter, Romanian, XVIIIth-XIXth century.

1 – Introduction -His life.

Stefan Luchian was born on February 1, 1868, in the Village of Stefanesti in the Suceava Region. His father, Dimitrie Luchian, a Moldavian Major and son of the nobleman Vasile Luchian of Galatzi, President of the Counsel of the City, married Elena Chiriacescu, daughter of a landlord from Perieti – Ialomita in Muntenia, at the advice of the Principe Alexandru Ioan Cuza – his friend – in 1863. In 1870, the family had a second son, Anibal, and in 1873 they moved to Bucharest, where Stefan followed Elementary School (1875-1879) and then the Lyceum Sf. Sava (1880-1883) [1]. His first known work, representing a house, was signed *"Luchian St. cl. III"* [2]. Meanwhile, his father died in 1877, at 51, when Stefan was only 9 years old.

Between 1885 and 1889, he followed the School of Belle-Artes in Bucharest, with Professors Theodor Aman and Gheorghe Tattarascu, both already established painters. At the conclusion of his studies, he received the Bronze medal for two paintings – *Expression Head* and *Study after Nature*, which are now lost. He also followed the Musical Conservatory, where he studied the flute.

The same year, in the fall, he traveled to Munich with a fellowship, where he studied at the Belles - Artes Academy and copied Rembrandt and Corregio in the Museums. After a year, in 1890, he returned to Bucharest, where he participated with four paintings at the first Exhibition of the "Artistic Circle" [3].

At the beginning of 1891 he left for Paris, where he lived in the Latin Quarter and frequently visited Museums and Exhibitions, taking an interest in the artistic life of the Capital City. In February, 1892, his mother died, leaving him an orphan at 24 years and he was obliged to return to Romania to sell the house and share the money with his brother. But in the fall of the same year, he again went to Paris and studied at the Julian Academy with Professors W. Bouguereau and Tony Robert-Fleury. During this trip he painted *On the beaches of the Sea* (1892, Paris) and the *Last horses-race of the fall.* But by March 1893 he returned to Bucharest and commenced a very active artistic life. That same year, the Luchian brothers sold the remaining land from their mother [4].

In a letter he wrote to Cecilia, a young lady whose portrait he painted in 1898, while he was painting along with Artachino a Church in Alexandria, he stated that: "*I grew up in the best and comfortable conditions until an older age and with the death of my mother, due to different events, suddenly I found myself without any means for my existence, but my painting"* [5]. This was a difficult time for the young painter as by 1897 all the money was gone and he was obliged to move frequently to poorer and cheaper rooms and was often without financial means [6]. Yet, he preserved his optimistic and cheerful nature stating: "*Always I joked, although in my heart I was crying".* He was endowed with a very sensitive nature, generous, gentle, affectionate and kindhearted [7].

He organized a workshop and presented four works at the Artistic Circle and at the Exhibition of Living Artists, among which was the "Last horse-race of the Fall", painted in Paris, (somehow influenced by Degas), for which he gained a medal. From this moment forward he exhibited every year at all the Exhibitions of the Artistic

Circle, the Living Artists, the Independents Artists, which he helped organize, and the Young Artists. He also had personal Exhibits (1893) and joint exhibits with the artists Titus Alexandrescu (1895), Artachino (1896), Nicolae Vermont (1899), Nicolae Darascu (1914). With the painter Artachino, he also painted three Churches: in Tulcea (1897), in Alexandria (1898) and the Church Brezoianu in Bucharest (1900) [8]. He was one of the organizers of the Artistic Society Ileana, where he presented 21 paintings in 1898. In 1900 he played the flute with the National Theatre Orchestra [9]. And yet he was only appreciated by a limited number of friends while broader success eluded him. At the exhibition in 1903 he didn't sell anything and in the next year he even paid his rent with a painting. Only the painter Nicolae Grigorescu bought one of his works, saying: *"Finally I have a follower!"* [10].

But by 1912 his financial situation began to improve, as appreciation for his work grew and both admirers and collectors like Virgil Cioflec, started to buy his paintings enabling him to buy a house, in which he will remain until his death. Meanwhile his disease, which began in 1901, when the famous doctor Gheorghe Marinescu at Pantelimon hospital treated him, steadily progressed. He recovered for a while, but slowly the paralysis spread and beginning in 1902, he was forced to live with relatives – the family Ernest Cocea, who lovingly cared for him. The numerous therapies he undertook at Govora 1902, Techirghiol 1903, Slanic-Moldova 1905, Brebu Monastery 1908 were short lived and in 1911 he could no longer participate in any exhibits [11].

During his life time, even in the worst years of paralysis, he presented approximately 315 paintings at 25 exhibitions. His last participation was in 1915, at the Exhibition of the Living Artists, where he showed eight older paintings and received the First Class Medal. As the disease progressed the paralysis set in his hands and on the night of 27-28 of June, 1916 he passed away, after long sufferings, at only 48 years of age…. He was buried in the Bellu Cemetery, in Bucharest on June 30 [12].

2 - His work.

His most important and intensive paintings, deepened by his 15 year long suffering, reflect his profound sensitivity and kind-hearted character. Time has given its verdict, placing him next to Nicolae Grigorescu and Ion Andreescu, the most famous of our XIX and XX Centuries painters. With remarkable craftsmanship he evoked the image of the Romanian peasant and the wonderful landscapes of our country, continuing the road opened by Nicolae Grigorescu, whom he admired very much, as they both shared the same love of man and nature and a special respect for the truth and beauty of life. But whereas Grigorescu saw everything with the eyes of a peasant, Luchian interpreted nature as a townsman. He brought man to the center of his art, creating the most profound portraits in Romanian art: although very many painters and sculptors have made his portrait, Luchian's self-portraits are the best representations, truthfully revealing the cruel ravages of his disease, but maintaining the vivid and blight expression of his eyes.

Among the most well known canvases with people is *The distribution of corn* (1905, painted at Chiajna, close to Bucharest). The work represents a new vision for the epoch, showing an imposing, starving crowd, animated by the same thoughts and will, going to their landlord on a sunny, winter day, determined to ask for their rations of corn, on the account of next year's working days. The mass of black caps suggests the large number of participants, old and young, men and women, even children [13]. This canvas later influenced a younger generation of painters, like: Camil Ressu, Iser, Sirato, Stefan Dimitrescu, Aurel Baiesu and Sabin Pop. This time period was an agitated era paving the way to the peasant uprisings of 1907. Due to his illness, Luchian could not participate actively, yet he kept abreast of the tumultuous events from newspaper accounts and discussion with friends. In the center of the painting, one can see Nicolae Cobzarul, a frequent model in Luchian's works, who steps thoughtful and anxious, with a staff in his hand. He will sit in other famous and well-known paintings, *Father Nicolas Cobzarul* and *The Carousal*. The first painting was bought by a well-known collector, Anastasie Simu, at the exhibition of the Artistic Youth May-April, 1906, the second by the same, in 1907 and now they are at the Museum of Arts of the Republic, in Bucharest). Luchian found in the old lute player both, sacred gift and the greatness of misfortune. *"He is the best of all of us"*, writes Luchian. *"When he gets warmed up and plays, one thinks that his lute gets fired in his hands"*. Father Nicolas portraits, with the majestic faces, are among Luchian's best masterpieces (especially the famous one from Simu Museum, with his head in his hands) [14]. The large forehead harmonizes with the lute displaying sinuous lines and contrasting with the fingers touching the thin strings.

The Carousal is described by Luchian in a letter to Virgil Cioflec on 30-X-1906, but it was much changed by the time of its exhibit, on X-1907. The figures include Nicolae Cobzarul, in the left corner of the canvas together with other friends of the artist: Ernest and Paulina Cocea, Mrs. Popp-Mazarini (in the centre), his nephew – C. Kiriacescu, and several others, all of them merry. The colors are more monotonous and cold, mostly yellow and brown shades, applied in a thin almost transparent layer [15]. *The last horse-race of the Fall 1892* was painted in Paris on the race course of Auteuil and was brought to Romania unfinished. Luchian received a very good critique concerning the originality of the colors and at the exhibition of the "Salon of Bucharest" in 1894 earned the artist a third prize. Mr N Petrescu said: *"in the structure of Luchian's eye there are wonderful visual proprieties"* [16]. This large painting shows the influence of both Manet and Degas, while the vivid and moving trees of the splendid

race course washed in verdure, display impressionistic qualities [17]. *Safta, the flowers vendor,* didn't appear in any of the exhibitions catalogues during Luchian's life, but for the first time in the Monography written by Virgil Cioflec in 1924. From family memories, the model was a young Bohemienne living on the family's land, at Perieti. It seems that a copy of the canvas, modified, was given to his friend Al. Bogdan Pitesti, around 1910. She doesn't look like the Gypsies of his predecessors, but is endowed with an enigmatic look and human dignity. All her features: the oval of the face, the tired eyes, the gentle and a little sad smile, the slender figure and graceful pose give her image a nobility of soul [18].

Luchian was a master in representing nature especially the Romanian specific landscapes. He was the interpreter of the Romanian soul, with its tenderness, melancholy and confidence in the beauty of life. In his landscapes, curved, calm lines dominate undisturbed by sharp angularities, emphasizing tall and slender trees, adorned by rich foliage, catching the sun sometimes with the bright sparkle of enamel and other times discreetly glimmering. He presents restricted views, showing the richness of a small number of trees, a steeple, a backyard, a well or a path in a graveyard, but his harmony of colors and the play of sun rays, brighten up the whole painting. There are no very dark, black or very bright parts in his landscapes, just shadows of different nuances. In *Old man's Gheorghe house,* in the foreground the grass is a light green, in the back, a dark green line of trees and in-between is the little house, white, with the high door and the tapering coffee-brown roof, creating a calm vision of the whole [19]. The landscapes are very varied in themselves: trees, villages, sea side, seasons; works in pastels, watercolors, oil. The colors are very vivid, although very seldom he uses red, but his yellows and greens are very luminous, as if everywhere the sun is shining. The white of winters or the white of the oven in the *Kitchen of Brebu* is dazzling, as is the brick-nuance of the roof of *Brebu Monastery,* next to the white walls and the two nuances of green of the grass and trees, or the violet of flowers and sky in the *Hingani Hills,* or the white of the tree bark in *After rain.* Interestingly, man is absent in these landscapes as serenity dominates the whole atmosphere. In *The Tower of Brebu*, the background of trees, the old steeple stands firm, built to last forever, continuing to the end of the canvas through a wall of the same color. Through the two windows on the top of the tower, looms the sky while the arched gateway appears full of secrets. In the *Brebu Well*, he skillfully uses pastel techniques to express the essence of the Romanian landscape, alternating vivid nuances with muted ones.

His flowers, deftly realized with just a few strokes applied with high precision, appearing as if they are still covered by the morning dew, poems of light and colors with a refined delicacy making Luchian one of the most important flowers painters [20]. In his late years, when he could no longer walk outside, he turned to flowers, which were a real comfort of his terrible sufferings. Painting a bouquet of carnations in a small pot, he said *"What else can you do? You do a flower! I am not going to paint hurricanes, earthquakes, cataclysms, fires, ruin look: there a little flower?!....* And when I'll tell you that there are some who don't like flowers, you won't believe me!" [21].

His body was devastated by cataclysms, but his soul knew how to find serenity in the joy of colors, in the brilliance of simple field flowers, arranged with love in a small, peasant, enameled pot. He paid careful and special attention to the arrangements of various flowers, mixing heights and tastefully organizing color combinations. No other Romanian painter succeeded to give such colorful brilliance to flowers as an expression of love and confidence in life and the optimism of Romanian people. He even used different techniques: sometimes he brushed the canvas with color for special density and applied the paint directly from the tube, other times, he applied the colors with a brush in opposite directions, or threw drops of vivid color to emphasize parts of the bouquet, or enveloped the flowers with black, thick lines. *"The most important model in his late years were the flowers. Whenever he received flowers in a foreign vase, from his admirers, he was looking at them with his kind (gentle) eye and joking, he arranged them slowly in an earth pot, because "they are better looking so, being from here (our country) ""* (Gheorghe Petrascu, from his reception discourse, at the Romanian Academy, on 22-V-1937) [22]. *The Anemones* painted in 1908 (in the National Gallery of Art) are for Luchian what Symphony nr IX was for Beethoven: a big joy over the suffering, the triumph of life over disease.

3 – Thoughts and opinions about Stefan Luchian.

Parallel with the School of Belles-Arts, Luchian finished also the Music Conservatory. His desire was to play the Violin, but: *"My hands were too long - he explained – and I began the Flute".* He described the instrument as *"A romantic, moving episode, which carries the youthful mark of the composer George Enescu"*. The passion for Music followed him, his entire life. He used to play records with sad songs of singers from Warsaw and Lemberg, for his friends and was always impressed to tears. In 1916 the writer Tudor Arghezi described a touching scene:

"One evening, when Luchian could no longer paint and was confined to bed, contemplating the shadow of a shortened day towards evening, a young gentleman dressed in black and carrying a violin under his coat, came to visit the solitude of his room in Primaverii street. Luchian's house was open at any time, like a cathedral. The Young man, opened the violin, placed it to his chin and began to play…for two hours…the painter speechlessly and solemnly listened…when the musician raised his bow,

Luchian's eyes, drowned in tears were brilliantly shining …the two men did not know each other …

- *Who are you? asked the sick man.*

The other man, with shyness -I am George Enescu…. " [23].

Despite his short life, Luchian, with his lyrical and poetic paintings, is one of the important pioneers of Romanian art at the turn of the 20th century, who, along with Nicolae Grigorescu and Ion Andreescu helped found a distinctive and unique Romanian school of Painting.

References

1. Marturii Luchian, Editura Meridiane, C.Z. 7, Bucuresti, 1966, p.273.
2. Lassaigne J.: Stefan Luchian, Editions Meridiane, Bucharest, 1972, p.103.
3. Marturii Luchian, Editura Meridiane, C.Z. 7, Bucuresti, 1966, p.273.
4. Lassaigne Jacques, Stefan Luchian, Editions Meridiane, Bucharest, 1972, p.103.
5. Marturii Luchian, Editura Meridiane, C.Z. 7, Bucuresti, 1966, pp. 17-18.
6. Marturii Luchian, Editura Meridiane, C.Z. 7, Bucuresti, 1966, p. 6.
7. Marturii Luchian, Editura Meridiane, C.Z. 7, Bucuresti, 1966, p.6.
8. Lassaigne Jacques, Stefan Luchian, Editions Meridiane, Bucharest, 1972, pp.104-109.
9. Marturii Luchian, Editura Meridiane, C.Z. 7, Bucuresti, 1966, pp. 274-275.
10. Marturii Luchian, Editura Meridiane, C.Z. 7, Bucuresti, 1966, p.6.
11. Marturii Luchian, Editura Meridiane, C.Z. 7, Bucuresti, 1966, pp. 274-275.
12. Marturii Luchian, Editura Meridiane, C.Z. 7, Bucuresti, 1966, pp. 276.
13. Jianu, I.: Comarnescu, P.: Stefan Luchian, Editura de Stat pentru Literatura si Arta, Bucuresti, 1956, pp. 112-114.
14. Lassaigne Jacques, Stefan Luchian, Editions Meridiane, Bucharest, 1972, pp. 72-73, 110-113.
15. Jianu, I.: Comarnescu, P.: Stefan Luchian, Editura de Stat pentru Literatura si Arta, Bucuresti, 1956, pp. 38, 72, 112-114.
16. Jianu, I.: Comarnescu, P.: Stefan Luchian, Editura de Stat pentru Literatura si Arta, Bucuresti, 1956, pp. 112-114.
17. Lassaigne Jacques, Stefan Luchian, Editions Meridiane, Bucharest, 1972, pp. 46-47.
18. Lassaigne Jacques, Stefan Luchian, Editions Meridiane, Bucharest, 1972, pp. 72-73, 110-113.
19. Jianu, I.: Comarnescu, P.: Stefan Luchian, Editura de Stat pentru Literatura si Arta, Bucuresti, 1956, pp. 133-147.
20. Lassaigne Jacques, Stefan Luchian, Editions Meridiane, Bucharest, 1972, pp. 46-47.
21. Jianu, I.: Comarnescu, P.: Stefan Luchian, Editura de Stat pentru Literatura si Arta, Bucuresti, 1956, pp. 147-153.
22. Marturii Luchian, Editura Meridiane, C.Z. 7, Bucuresti, 1966, pp. 102-104.
23. Jianu, I.: Comarnescu, P.: *Stefan Luchian*, Editura de Stat pentru Literatura si Arta, Bucuresti, 1956, p. 89.

THE ROLE OF MOTIVATIONAL FACTOR IN STIMULATING THE PRODUCTIVE POTENTIAL OF HUMAN RESOURCE

Cornelia NEAGU
Centre for Industrial Economics and Services, Romanian Academy
Bucharest, Romania, 050 911, Calea 13 Septembrie no. 13, e.mail:neagu_cornelia@yahoo.com

Abstract: This paper aims to identify, from the perspective of theoretical analysis of motivation for work, of the main components of the motivational factor of human resources, hierarchy, by assigning a degree of importance, of the motivational factor components of financial and non-financial (wage levels, job security, working conditions, promotion prospects in the company, employee loyalty, the degree of appreciation at work, the attractiveness of work performed, aid for difficult, etc.) and correlation with effects that their application has on firm level performance indicators.

Keywords: motivational theories, motivational factors, human resources, performance

1. Introduction

Human resource is not, a long time regarded as a simple input in the production of goods and services. Research on the behavior of labor in production process have been undertaken since 1924 by Elton Mayo, leading to the conclusion that employees are not motivated only by financial reward component and their behavior is closely correlated with their attitude. In most cases people are not endowed with special talents. The purpose of an organization, noted Peter Drucker, is "that ordinary people are led to the development of unusual things" Management's role is to organize, motivate, and equip ordinary people to obtain the highest possible level of performance that is capable each.

The impact of policies and human resource management practices on firm performance level is an important topic in management, industrial relations and psychology. The literature concludes that human resource management practices can help to create sources of competitive advantage, especially if they fall into a firm's competitive strategy.

2. Retrospective of motivational theories

Corresponding Larousse Dictionary, motivation "is a psychological and physiological change that occurs in human beings whenever a need arises, to meet that need, the individual adopts a behavior aimed at restoring the psychological and physiological equilibrium" In terms of effort motivational process is energetic force that drives a person to behave in a certain way, as the direction of the motivational process to achieve a goal oriented behavior, the persistence of the the motivational process is a systemic approach because the internal forces are interconnected environment forces, thus explaining the maintenance of a certain behavior. Understanding the operation staff motivation is mainly based on motivational theories grouped into: content theories and process theories.

A THEORY OF CONTENT (based on needs) to explain individual behavior based on the needs and aspirations of individuals

1. Manifest needs theory (Henry Murray (1938) according to which individual behavior is determined by combinations between pressure and needs. Individuals are motivated by a desire of the meet their needs and is motivated by several needs at the same time. In most cases the need is determined by the body responds to pressure and pressure refers to those aspects of the environment that facilitates or impedes a person's efforts to achieve a certain objective: basic needs - is the internal structure of individuals, food, water, shelter, reproduction, etc.; secondary needs - arising from of the learning process in which man is involved in its existence: the acquisition, construction, power, ambition, prestige, affection, social communication etc..

2. ***Hierarchy of needs theory*** (Maslow (1943) according to which needs grading in order of importance, fulfilling the needs for esteem, social security, at the level of what physiological needs Having been satisfied to an extent acceptable can become operational next level. A need once satisfied it ceases to be motivating. needs a higher level, especially personal ones (esteem, achievement), are more powerful motivational aspect than the lower level and their effect is longer. One need not must be 100% satisfied that another need to be motivating. Most people are only partially satisfied in their need. Key: Maslow's theory argues that dissatisfaction motivates human behavior, not satisfaction. Limitations: cultural differences can lead to significant changes in the hierarchy of human needs.

3. ***Dual factors theory*** (Herzberg 1959) which brings together the factors that influence employee job

satisfaction in two categories: motivating factors, job related content: recognition of the responsibilities, achievements, promotion, work itself, the possibility of personal fulfillment and a real potential motivator, their absence do not causes dissatisfaction at work, but their presence leads to increased satisfaction and efficiency standards, and hygienic factors linked to the work environment: company policy, system of financial rewards, job security, working conditions, social interaction, status in society, which have a greater potential to cause dissatisfaction than satisfaction, lack or inadequacy of their dissatisfaction at work increases, but their presence serves only to prevent dissatisfaction, not to increase satisfaction, they can only provide fleeting satisfaction, as their change for the better, their highest level quickly becomes time, losing its positive effect. Herzberg claims that an employee is satisfied and motivated, so productive. Satisfaction and motivation can only come from internal sources of labor, i.e. the job. According to theory, an employee who believes his work without interest and significance react listless, even if all external conditions are provided. Limits - the study was conducted on a sample of engineers, and its results are extrapolated to people who do not have the same training.

4. ERG Theory (Alderfer Clayton 1972) argues that individuals have three types of needs that influence their behavior: the existence of related material needs, the needs of networking with other individuals and personal development needs. In essence, the model of Maslow's was enriches by model Alderfer with two ideas: these needs are not in a strict hierarchy, the individual may seek a meeting point of two or more concomitant needs and there is a progressive satisfaction of needs - from more practical needs to needs more uncertain., individuals invest more effort into meeting the lower levels where you fail to meet the needs of the higher levels because they are easier to satisfy the much more clear, more concrete than the networking and development than the default.

5. The theory of learned needs (Mc Clelland 1961) believes that human needs can be acquired through experience and learning (in contrast to the unconscious nature of needs at other authors). Under the influence of external factors, some reasons / needs can be moved to a higher level in the hierarchy of each individual, thus exerting a much stronger influence on behavior. Show which opens new perspectives in motivating employees, emphasizing the importance of training staff. He analyzed three categories of needs: the *need for achievement* (accomplishment) - the intensity with which employees are motivated to perform tasks relating to employment, *need for affiliation* - human desire to establish, maintain and develop friendly relations with others, *need power* - the need to influence the behavior of others. Explicit distinction between explicit reasons (relative conscious, which explains the behavior of short-term) and implicit (behavior explains long periods of time).

6. Theory X and Y (Mc Gregor1960) considers that there are two sets of assumptions about the behavior of individuals and human nature, a set of negative assumptions (Theory X) and another set of positive assumptions (Theory Y), which are included in decisions and managers' actions. According to *Theory X*-oriented individuals are meeting the inferior levels of the pyramid of needs, and the money will be an extremely important source by which individuals will satisfy their needs, but in a limited way. Thus: the average human being has an aversion to work and avoided wherever possible; man at work is passive, lacks ambition and initiative, avoid responsibilities, employees are focused on their needs, being indifferent to the objectives of the organization, people will above all, safety and job retention *Theory Y*: rather emphasizes the desire of individuals to satisfy higher order needs. Thus: physical and intellectual effort in work is as natural as recreation and leisure activity, man at work is not passive by nature, he has the potential to develop creative and has the capacity to assume the responsibilities, objectives of the organization he is not indifferent, people are concerned about safety and job retention, job satisfaction, but want, esteem and personal achievement. There are *Theory Z,* W. Ouch, trying eliminate disadvantages and advantages of the first reunion.

B. PROCESS THEORIES that explain individual behavior based on relationship with the environment, concerns targeting behavior factors, reasoning that addresses continuous process, individuals have learned to behave in a certain way for the consequences it had in previous behaviors. Examines various aspects of correlation: purposes-exercise-performance- consequences.

1. Theory to establish goals (Locke E., G. Latham 1968) implies that setting a goal is an important source of motivation at work and suggests that specific goals increase performance and the existence of the feedback brings high performances compared to a situation where there is not feedback . The feedback helps to identify the gap between what an individual has achieved and what he wants to accomplish and also guides you how to progress in achieving goals.

2. Strengthening theory. Skinner believes that while setting goals theory is a cognitive approach, assuming that there is an intention that directs individual action, strengthening the theory is a behavioral approach, which maintains the conditions for strengthening behavior. Strengthening theory ignores the inner state of the individual and focuses exclusively on what happens when a person takes some action

3. *Equity theory* (Stacy Adams, Weick 1963) assumes that people are continuously involved in the comparison between individuals in terms of input and output site that brings each. Motivation depends on individual perceptions about the fairness of rewards received in exchange for effort, compared with its effects and efforts of other persons taken as references

4. Expectations theory (Vroom (1964) links human behavior to the expectations of people aware of their behavior on the achievement of goals set. To explain the degree of motivation, namely the level of effort by a person

at work, Vroom suggests a three determinants: valence, instrumentality, pending. Motivation: M = AxIxV

- wait (A) the individual effort to transform the performance. Individuals will lead efforts he believes that efforts will be reflected in high performance.

- Tool (I) - the link between employee performance and makes the desired rewards.

- valence (V) - preference for certain rewards employees who hope to obtain if the record performance. Managers should focus on: strengthening the link effort-performance (expectation) strengthening the link performance - desired result (instrument) to systematically assess the value that employees attach to various rewards, ensuring that employees are able to adopt the behavior set, providing extrinsic rewards and job design so as to generate the intrinsic, ongoing assessment of the distribution of equity awards; accurate assessment of the level of performance achieved by the employee.

5. Theory on the relationship between effort, performance, satisfaction Porter Lawler, deals the relationship performance - satisfaction and explains the origin of valency, intrumentality and expectations. According to this model effort by an employee at work is determined by two factors: the value represented by the employee of possible rewards, employee trust in the relationship, namely that the effort-reward effort will result in wanted rewards. Effort will become performance if:

- the employee has the skill, knowledge and skills needed to perform their work;
- a clearly understood role in the organization of work tasks that it has achieved the objectives which have to meet;
- intrinsic rewards are more closely related to superior performance, the link is direct, because these rewards are nearly automatically in the very high performance;
- external rewards depend on external sources of work tasks, already getting them involved in how the organization rewards good performance. Achieving these awards will influence employee perceptions of effort-reward relationship.

Perceived level of performance influences perceived fairness of rewards. If the rewards obtained are considered fair in comparison to the effort will result in a state of satisfaction that Porter and Lawler have defined it as the degree to which rewards received correspond to the level of perceived fair rewards. The state of satisfaction / dissatisfaction resulting from obtaining or fairness of the awards and their influence future value of the awards.

6. Cognitive evaluation theory (Deci1975) - argues that when extrinsic rewards are offered for a previous effort which was rewarded intrinsically, the overall level of motivation is likely to drop because of declining interest itself, which takes place in the mind of each individual, the workplace. Identify two processes by which rewards affect intrinsic motivation: the change in the perception of causality and change in feelings of competence and self-determination. Argues that each award has two components: a control component and a component information.

C. THEORIES OF STRENGTHENING emphasize a relationship between earnings and performance

1. Conditioning theory operated according to this theory, behavior is manifested related to its consequences, for example. the person will get performance if will be paid accordingly. Assumes that the behavior that leads to the satisfaction of needs tends to be repeated, and behavior that does not result in satisfaction tends to be stoped. Manager ensures appropriate reward for good performance, **reinforcing** behavior that led to this performance, ensuring increased probability of their recurrence.

D. INTERACTIONIST THEORIES believes that motivation arises from the individual to his environment meeting

1. Lewin Field Theory - motivation of individuals is generated from the attractions and barriers current in the environment in which it operates

2. Nuttin's theory - the basic unit to be studied is not individual or environment, but the individual-environment interaction. Individual-environment interaction generates true motivations.

3. Correspondence of motivational factors with the type of need that to be addressed

Corresponding to each category of needs addressed by motivational theories correspondents tried to identify motivational factors that will act as leverage in raising the performance of the company.

○ ***Needs a life:***

- *physiological* → financial rewards (pay system and regular incentives, bonuses)
- *security* → job security, health insurance schemes, supplementary pension plans
- *working conditions, occupational safety* → technical standards, degree of improvement of technology and resources used during working hours (number of hours worked), the balance of work-leisure time, flexible working hours, wage increases for heavy duty work.

○ **Social needs**

- *Interpersonal trust* → employee safety manager, stability, feedback from superiors for a job well done
- *interpersonal relations* → employee relations manager, working with others at work, extensive formal and informal communication within the company, whether or not conflicts at work;
- *supervision* → competent and efficient, a clear job descriptions and duties which the employee is responsible for the consistency of the work, obtaining a performance rating, so the employee can selfevaluate;
- *respect other* → status, power, autonomy, prestige, success, feeling that part of the organization, participation in decision making, machine, phone, laptop provided by company.

○ **Needs to growth,** to high performance, to contribute to achieving its objective and professional or social

- *esteem* → feeling of power, taking of evidence, degree of social welfare, obtaining benefits
- *professional development* → opportunity to develop their career, feeling that their work is very important opportunity for self-improvement, financial support for lifelong learning programs
-*nature of work*→work itself
- *belief that the employee is responsible* → responsible for their own decisions, compliance with the objectives of the organization
- *advancement and growth* →opportunities for promotion, training and retraining schemes, opportunities for women and men, the existence of a competitive work environment, opportunities for creativity, growth potential with the company, and further opportunities for improvement.

4. Types and forms of human motivation

- Depending on the effects of using rewards: *positive* by direct and correct correlation of the results and the behavior promoted with personal satisfactions by recognition and reward and *negative* by using emotional factors through the use of aversive;

- Depending on the immediate needs of the individual: *Cognitive* linked to the need to know, to know and finds satisfaction to explain and resolve as ends in themselves; *emotional* needs generated by the individual needs to obtain recognition of others and to feel well in their company.

- Depending on the source that generates sources: *Intrinsic* generated by internal sources of individuals, *Extrinsec* generated by external sources of individuals may be suggested or imposed by others or circumstances.
- Depending on the nature of awards granted: *Economic*, *Moral - spiritual*.

5. Relationship motivation - involving

Elements of connectivity between motivation and involvement:
- they have often been approached in the same way. The reasoning based on the theory needs to try to clarify the factors that determines the state of motivation. The implication, which is regarded as a positive state, generating performance, researchers were also concerned about finding the determinants of state involvement.
- both are concerned to a large extent on the individual.

Elements of differentiation between motivation and involvement:
- most motivational theories relate to the individual's evaluative action that will try to track interest in every situation. This theory insists on the structure of rewards offered by the organization, the goals and structure the content of work. Involvement tends to focus on the notion of value, personal identity.
- motivational theories focus on how tasks are performed. Theories of involvement have a greater tendency to focus on the organization: more important than work is the organization as a whole.
- perceptions of both theory insists that the individual has a particular work situation. In addition, the involvement goes further in linking the individual to the organization, achieving a more interactive approach and demonstrated that the organization can influence the psychological development of individual

6. Relationship motivation – performance

For that not always those motivated obtained relevant results appear necessity of the distinction between motivation and performance. Performance may be defined as the extent to which a member of an organization contributes to achieving organizational objectives. Although motivation, clearly contribute to achieving performance, the relationship is not one-to-one because many factors involved. It is possible that a person's performance to be low although this is highly motivated (low skills, underdeveloped skills, a poor understanding of pregnancy or chance, can degrade the performance of even the most motivated people). It is also possible to obtain performance even if the motivation is not too high (eg individual well understood very well the task and directs his efforts).

This paper is supported by the Sectorial Operational Programme Human Resources Development (SOP HRD), financed from the European Social Fund and by the Romanian Government under the contract number SOP HRD/89/1.5/S/62988

References

1. Abrudan, D.B. Serratore, M, *Motivația şi motivarea resurselor umane pentru performanță, Editura Solness, Timişoara, 2002;*
2. Allan, J., *How to be better at motivating people,* British Library, London, 1996;
3. Druță F, *Motivația economică,* Editura Economică, Bucureşti, 1999;
4. Hăhăianu, L, *Cum să-ți motivezi angajați pentru a obține performanțe deosebite,* Rentrop/Straton – Grup de editură şi consultanță în afaceri, Bucureşti, 2002;
5. Malthis, R.L, Nica P.C, Rusu C., *Managementul resurselor umane –*, Editura Economică, 1997;
6. Motivation Theory – dr. Janet Fredericks, www.neiu.edu;
7. Teorii motivaționale – www.gmx.xmn.edu.cn;
8. Motivația – www.psihologie.tripod.com;
9. Motivația şi motivarea personalului – www.slideshare.net;
10. Motivarea resurselor umane – de la teorie la practică – Carmen Chaşovschi, Otilia Albu- www.scribd.com;
11. Evaluarea motivației în muncă – un model de operaționalizare – www.carmen.buzea.ro;
12. How Motivation Indicators Drive Business to Success – http://ezinearticles.com;
13. The Key Factors or Indicators in Motivation of Employees – www.eppapers.com;
14. Totul despre motivarea resurselor umane – RENTROP&STRATON, www.rs.ro;

ICT SECTOR ASSESSMENT AND COMPETENCE IN THE FIELD, REFLECTING ON THE OCCUPATIONAL STRUCTURE IN VARIOUS COUNTRIES

Cornelia NEAGU, Marina BĂDILEANU, Andrei DOSPINESCU
Centre for Industrial Economics and Services, Romanian Academy, Bucharest, Romania, 050 911, Calea 13 Septembrie no. 13, e-mail: neagu_cornelia@yahoo.com, badmarina@yahoo.com, andreidospinescu@yahoo.com

Abstract: This paper aims to examine the experience of some countries regarding the relationship between the introduction of new technologies, particularly by developing information and communications technology (ICT) and occupational structure. ICT skills are increasingly becoming a requirement in the workplace, whose definition is constantly evolution, and no longer limited to basic skills and traditional knowledge, but requiring some combination of expertise in ICT with other skills such as business or marketing. This involves professional development, continuous employee to overcome feelings of insecurity, and to survive in an information society, under pressure from technology development, employees are also subject to both positive and negative ones.

Keywords: information and communications technology, the need for skills, the occupational structure

1. Introduction

The issue of impact of technological development, characteristic of the new economy, on the level and occupational structure is particularly extensive. In particular for the development of computer technology and information technology, according to Brooks, "technology can not solve all our problems but our problems can not be solved without new information technologies". You can not deny that technology plays a vital role in today's society, being an inevitable consequence of social development.

In addition, changing employment status shows that, with the development of technologies and requirements in what concerns the employees not only basic skills and traditional knowledge, which requires all employees need to acquire more skills in to overcome feelings of insecurity, and survival in an information society. In fact, under pressure from technology development, employees were subjected to both positive and negative effects.

ICT is a growing increasingly important in all economies and have a growing impact on business organizations. In addition, analysis of the importance and impacts of ICT is not always an easy approach.

Measurement problems are complicated and largely due to unclear terminology, combined with existence of a multitude of definitions (the new economy, e-economy, ICT sector). But analytical results varies depending on the definition adopted. For example the term "employment in ICT" can mean the total workforce employed in the ICT sector (including persons whose job is not related to ICT) or total employment related to the ICT (in all sectors, even those unrelated to ICT). Results of analyzes on the employment characteristics (such as age, salary, gender) will also depend on the definition adopted.

2. Employment of people with ICT skills

Methodology and classification.

ICT using sectors can be identified by the employment of staff with relevant expertise, i.e. their current level of ICT use, rather than by the level of investment in ICT capital. Industries are classified according to their workforce with specialized skills or ICT employment share of ICT skills in the industry (Welsum and Vickery, 2004).

The term "workforce engaged in ICT" can be interpreted in two ways:

1. employment in industries identified traditionally as falling within the ICT sector (all occupations, even those not using ICT);
2. employment in professions that use ICT in different degrees in all industries.

Standard list of ICT occupations, used for analysis in OECD publications, refers in particular to the first category (ICT experts). The approach is realized in the broad definition but a first attempt to identify the sum of the three levels of ICT skills, ICT experts say, advanced users and users at the basic level.

Measuring employment with skills in ICT.

Employment in ICT skills represents a significant share in total employment and labor seems to be growing in many segments. It aims to measuring the ratio of ICT specialists and ICT users in total employed workforce. ICT specialists are around 3-4% of total employment in most countries. Among the EU15 countries, Sweden had

the highest share of ICT professionals in total employment, both in 1995 and in 2004, Belgium had the lowest share in 1995 and Portugal in 2004. The trend is increasing in most countries, although levels of non-European countries can not be directly comparable to those of European countries because the classifications were not harmonized.

In 2004, ICT producers and users (broad approach) represented 20-30% of total employment in most countries. Countries like Denmark, Finland, Sweden and the UK with a relatively high share of ICT specialists, also had a relatively high share of employment in ICT skills in a broad sense.

Most countries have an increasing share of employment in ICT skills in the broad sense (except for Portugal in the EU, Australia, Canada and USA). Within the EU, the UK had the largest share of employment in ICT skills broadly in 1995 and in 2004 Luxembourg and Greece the lowest. Given the increasing importance of ICT skills and employment in the economy, unemployment in the workforce with skills in ICT is expected to be relatively low. By analyzing the ratio of the unemployed and ICT experts from 12 European countries shows that its position was damaged only five countries

3. Approaches to employment of people with ICT skills

At the aggregate level analysis was performed for the EU15, the United States, Canada and Australia. There was an attempted harmonization of classifications for all countries, but applied the same logic and reasoning to keep the choice of occupations as comparable as possible, despite national differences and differences in level of detail in different classification systems. Results indicate that, above all, less than 5% of total employment is owned workforce skilled in ICT, the approach of the narrow and about 20% wider approach.

Comparing the average results for the EU15, U.S., Canada and Australia, tend to measure narrowly follows a similar trajectory shows a broad measure of employment share by increasing ICT skills for the EU15, but decreasing for the U.S., Canada and Australia (due the recent increase in off shoring of IT's associated activities which means the loss of positions of these countries in favor of emerging locations such as India). Another explanation may be a relatively rapid rate of adoption and integration of new technologies. As a consequence, relatively more jobs could be lost through automation and / or digitization.

Upward trend in Europe could increase employment in the corresponding services and investigation findings that European firms tend to offshore within Europe. In addition Ireland is a major recipient of U.S. offshoring (mainly IT related activities). There are some differences and across the EU15. Since 2003, Sweden had the highest share of employment in ICT skills in a narrow sense (4.7%) and Belgium the lowest (2.1%). United Kingdom held the largest share of employment in ICT skills in the broad sense (27.7%) as the entire period, and Greece the lowest (13.6%).

By sector Employment in ICT skills has generally increased in EU15 countries in both types of approaches. Calculate the weighted average of the sectorial distribution of employment in ICT skills, by country, total employment, where the weights are calculated as the ratio of employment in industry j and country i in total employment in industry and for all countries.

Two sectors have a very high proportion of skilled employment in total employment in ICT-30 Production of computers and office equipment, while the difference between the EU15 and the rest of Europe is the largest and 72-Computers and activities associated with computers.

The next step is the breakdown by industries with high intensity, medium and low employment with skills in ICT. Sectors with an intensity of 30% or more are regarded as being highly intensive, those situated between 10-30% with moderate and low intensity below 10%. A large number of services sectors included in the group of highly intensive, primarily in or on top of the hierarchy, along with some manufacturing and wholesale sectors. Group of medium intensity is dominated by manufacturing industries, but also includes retail, printing and publication. The low-intensity group is dominated by primary industries and personal services (as opposed to business services industries that tend to fall into the high-intensity group).

Peneder (2003) shows that those industries that have started with a relatively high share of IT employment grew faster than the share of other industries. For the U.S., many service sectors appear at the top of the list (auditing, accounting services, computer services and data processing services and legal services), as well as certain sectors like manufacturing (computers and related equipment, TV and communications equipment).

Thus, 70 industries (of 236) are classified as high-intensity, in accordance with the broad approach, i.e. a share of employment in total employment in the ICT skills of over 30% and the top 70 industries in accordance Narrow approach (35 of the first 70 industries in the first classification are the first 70 of the second classification).

In Canada (2001), IT occupations accounted for 2.6% of total labor force employed, is quite concentrated, system analysts and consultants (26.6%) and computer programmers and interactive media developers (24.9%). Distribution is more unequal than industries in other countries, many industries have a share less than 10% of skilled employment in this field.

In Japan, most service areas have a high intensity of employment in ICT skills. Some manufacturing industries appear to have somewhat lower intensity than in Europe and the U.S., but this is caused by differences in aggregation of industries.

4. Employment in ICT skills and labor productivity

There were important debates on productivity gains in ICT sectors and ICT-induced productivity gains in other sectors. Skeptics argue that the new economy productivity gains over the last decade were due to gains in manufacturing industries with high concentration of computers but not in sectors that have invested in ICT.

Researches on micro-level data tend to emphasize a positive link between IT and productivity. In addition, the

mechanism by which positively affects the productivity of IT is difficult to establish.

It is also important to examine productivity issues in the context of ICT skills. In his notes DiNardo and Pischke (1997), computers are only effective when used in combination with certain types of skills (programming) and have value only for certain categories of employees (for economists but not for ballet).

In addition, Mann (2003) argues for the U.S., the more integrated use of ICT is likely to lead to a second wave of productivity growth not only due to increased adoption of ICT and thus reduce costs, but also due to changes in production and existing business processes. Thus, ICT integration will require the presence of an appropriate skills base.

It was shown that there is a positive and significant correlation between a sector's share in terms of employment with skills in ICT and GVA per employee. The results obtained in OECD (2004) seem to be quite robust, the highest level of GVA per employee tends to be associated with the largest share of employment in ICT skills at sectorial level. These results suggest that measuring employment in ICT skills is an important variable in understanding productivity.

5. The evolution of skills needs

As the rapidly changing skill needs and the deficit may be short and quickly resolved, they may not appear in official data, which usually have a relatively large time delay. Studies on monthly and quarterly changes aimed professions, in particular by tracking vacancies.

In accordance with the SSL / Computer Weekly Quarterly Survey of Appointment Data and Trends (January 2006) is a decrease in the labor market in the UK ICT. Number of jobs posted in the fourth quarter of 2005 decreased from the previous year (-6%), registering the first decline in two years. Salaries ICT job market rose 4%, they recorded a significant increase in those for which demand was strong.

Regarding the demand sectors, the largest increase was observed in media and publishing sector (19%), followed by Finance and Banking (6%), real estate software (5%) electronic and telecommunications companies (four %).

The public sector, distribution and retail and manufacturing sectors all saw declines in demand. Public and private sector were growing demand for combinations of skills. Thus, often no longer enough just holding the ICT expertise. Instead, it requires a combination of technical expertise and other types, such as management, project manager, business sales and marketing.

A consequence of this development is the increasing complexity of skills required for many jobs offered in ICT professionals from both public and private sectors, thereby achieving routine tasks involved. At the same time, these jobs may become more difficult to delocalized. Given the growing importance of ICT in the conduct of work (public and private sector) and the daily life of people, means to deliver ICT skills demanded increased attention.

.IT specialist skills and basic ICT skills are provided in different ways. Basic skills are generalized in a natural way with the spread of ICT: people need basic ICT use, have computers at home, kids use computers at school and home. For ICT specialist skills, there are four basic ways of providing them with the necessary skills and meeting: through formal education, various forms of training, immigration of people with appropriate skills, and relocation activities for which the necessary skills are not met

Opportunities to increase remote work could lead to greater participation in the labor market for certain groups such as women and people in remote areas, provided they possess the necessary skills. Attracting more women into ICT careers education and could reduce some pressure on supply.

Overall, fewer women than men tend to gain technological and scientific skills and ICT skills in particular. However there is the belief that ICT skills will become increasingly associated with multidisciplinary skills that needs assessed. This may be a way to attract more women in ICT related specialized professions. At the same time, it is likely that non-ICT skills to be more and more components associated with ICT, given the widespread use of ICT in many fields of study and in many professions. Women can also become more competent ICT in this way.

6. Conclusions

ICT skills are increasingly becoming a requirement in the workplace. In addition, for IT professionals, job definition is evolving, requiring some combination of ICT expertise with other types of skills.

Today, there are various ways of providing ICT skills for different population groups. Knowledge of basic needs is increasingly likely to be covered by the widespread dissemination and use of ICT in schools.

Improved access to ICT skills of older workers through training programs. Because the needs of the rapidly changing ICT expertise, formal education system can not provide the flexibility to adapt curricula to the requirements of the private sector.

Recruiting via the internet and teleworking are two trends are closely linked to wider diffusion of ICT in society. Recruitment through the Internet grows in importance, but currently has a limited impact.

Telework increases in importance and more people are working mule at least partly outside the company you are employed. In addition, rapid technological developments in ICT, combined with trade and investment liberalization in services, production services were more attractive so that many of these can be provided from remote locations.

Analyses suggest that over 20% of employment is potentially affected by offshoring of ICT does not mean that these jobs will necessarily be relocated but that about 20% of self employed people and functions that are

potentially to be undertaken outside the geographic location, due to technological advances in ICT and increasing trade in services.

The question arises whether a potential shortage of ICT skills and other countries providing relocation can be a barrier to ICT services. ICT policies include the promotion of basic ICT skills at using ICT in schools, as also for the entire population, and training initiatives in order to acquire more specialized skills, taken in connection with industrial associations and professional bodies and improving labor market information .

References

1. Turlea G., Nepelski D., de Prato G., Lindmark S., de Panizza A., Picci L.,Desruelle P.,Broster D., (2010), The 2010 report on R&D in ICT in the European Union, European Comission
2. *** (2010), ICT Country Profile, European Comission
3. OECD Information Technology Outlook 2006 – ISBN 92-64-02643-6
4. OECD Information Technology Outlook 2004
5. OECD- Committee for information, computer and communications policy – New perspectives of ITC skills and employment, apr. 2005
6. International Journal of Training and Development – Learning and skills formation in the new economy, ISSN 1360-3736
7. jary.kaivo-oja@tukkk.fi The information society and changes in the labour market: A comparison of work profile changes in the EU, the USA and Japan, Jari KAIVO-OJA, Ira AHOKAS, Pentti MALASK and Jyrki LUUKKANEN
8. http://www.bls.gov/oco/oco1002.htm#comp
9. European Commission Enterprise and Industry, Monitoring e-Skills Demand and Supply in Europe – Current Situation, Scenarios and Future Development Forecasts until 2015
10. Empirica 2009: e-skills – demand developments and challenges, a sectoral e-business watch study; INSEAD (2009): Who cares? Who dares? Providing the skills for an innovative and sustainable Europe; IDC (martie 2009):Enterprise investment reality check 2009; IDC (noiembrie2009): Post Crisis:e-skills are needed to drive Europe's innovation society; Deloitte (2009): Mind the talent gap; CompTIA (2008): Skills gaps in the world's IT workforce
11. Decision no. 2241/2004/EC of the Parliament and European Council of 15 December 2004 on the unique community for transparency of qualifications and competences (Europass)
12. New Skills for New Jobs – COM (2008) 868 – e-Skills for the 21st Century – COM (2007) 496 şi strategia Europa 2020
13. DiNardo, John, and Jörn-Steffen Pischke. 1997. "The Return to Computer Use Revisited: Have Pencils Changed the Wage Structure Too?" *Quarterly Journal of Economics* 112(1) (February), pp. 291-303.

CONSCIENCE SOCIETY. STAGE DEVELOPMENT

Dumitru TODOROI
Prof. , Dr. Hab., Ph D

Abstract. Conscience is ability or a faculty that distinguishes whether one's actions are right or wrong. It can lead to feelings of remorse when a human does things that go against his/her moral values, and to feelings of rectitude or integrity when actions conform to such norms. Conscience in Information Age represents individual spirit feelings, a set of conscientious actions of each individual member of Society. The Sum of Society's individual's conscientious actions forms Conscience Society of Information Age. Discussions in this subject help to materialize notions of Conscience, Conscience Society, Intelligent Systems, its Characteristics, Functions, its Adaptability in Information Era

Commonly used metaphors for conscience include the "voice within" and the "inner light". Conscience, as is detailed in sections below, is usually see as linked to a morality inherent in all humans, to a beneficent universe and/or to divinity, is increasingly conceived of as applying to the world as a whole and as a main feature of conscience society, has motivated its numerous models, characteristics and functions for creation the societal intelligent adaptable information systems in Conscience Society.

Creativity [Mih-11] is a result of brain activity which differentiates individuals and could ensure an important competitive advantage for persons, for companies, and for Society in general. Very innovative branches – like software industry, computer industry, car industry – consider creativity as the key of business success. Natural Intelligence' Creativity can develop basic creative activities, but Artificial Intelligence' Creativity, and, especially, Conscience Intelligence' Creativity should be developed and they could be enhanced over the level of Natural Intelligence. Providing only neurological research still does not offer a scientific basis for understanding creativity but thousand years of creative natural intelligence behavior observations offer some algorithms, models, methods, guidelines and procedures which could be used successfully in Conscience Society' Creativity.

This essay is based on the communication „Sisteme informatice in Societatea Conştiinţei." [1] presented at the International Conference of AESM, September 24-25, 2009, Chişinău, on the communication "Discovering and Managing Creativity in Product Development" [2] presented at the International Conference of AESM, September 24-25, 2010, Chişinău, and on the communication "Creativity and Conscience Society" [3] presented at the Internatiional Conference in Economic Informatics, May 5-10, 2011, Bucharest.

Keywords: Information, Knowledge, Conscience, Artificial Intelligence, Intuition, Creativity, Spirituality, Conscience Society.

Introduction.

Throughout generations, as people grow older, they remark that **morals** in society have degraded compared to when they were younger. Perhaps this is because as people grow older they view all the corrupt, thoughtless, and inhumane acts people commit. Or, perhaps this is true, that morals in society have indeed become worse. In this generation, it is often been heard that technology is to blame - first TV, and more recently, the internet. However, becoming a responsible human being often begins in the home, where parents can impart key values to their children. This key value should be so central that any conflicting messages from external sources are blocked and filtered. Thus, technology may have a role in corrupting society; however, it is not totally to blame.

Many of the ancient philosophers (Confucius, Socrates, Lao Tzu, Epictetus, and others) also wrote about morals. In summary, leading a moral life is a vital part for the world to maintain a conscience (civilized) society [1], so always keep in mind to: (1) accept differences in others; (2) respond promptly to others; (3) leave some "free" time; (4) care about others as if they were you; (5) treat everyone similarly; (6) never engage in violent acts; (7) have a sense of commitment; (8) have an inner sense of thankfulness(**http://lifeskills.endlex.com/article/morals_in_society.html**)

Conscience is ability or a faculty that distinguishes whether one's actions are right or wrong. It can lead to feelings of remorse when a human does things that go against his/her moral values, and to feelings of rectitude or integrity when actions conform to such norms.

Conscience in Information Age represents individual spirit feelings, a set of conscientious actions of each individual member of Society. The Sum of Society's individual's conscientious actions forms Conscience Society of Information Era. Discussions in this subject help to materialize notions of Conscience, Conscience Society, Intelligent Systems, its Characteristics and Functions, its Adaptability in Information Era.

Creativity [2] is a result of brain activity which differentiates individuals and could ensure an

important competitive advantage for persons, for companies, and for Society in general. Very innovative branches – like software industry, computer industry, car industry – consider creativity as the key of business success. Natural Intelligence' Creativity can develop basic creative activities, but Artificial Intelligence' Creativity, and, especially, Conscience Intelligence' Creativity should be developed and they could be enhanced over the level of Natural Intelligence. Providing only neurological research still does not offer a scientific basis for understanding creativity but thousand years of creative natural intelligence behavior observations offer some Computer Based Information Systems (CBIS) Brainwere (algorithms, models, methods, guidelines and procedures) which could be used successfully in Conscience Society' Creativity.

In the next paragraphs will be discussed the evolution of notion of Creativity (what It Is, why It Is Important, where It Is Used), will be analyzed Creativity from basic point of view (Creativity as a Brain Activity; Mastering Daily Life; Creativity and Profession; Piirto's six Steps; When and where Creativity Occurs; How Creative People are looked upon). Creativity manages Individual Creativity and Company Goals (Individual Creativity; Teams, Creativity and Product Development; Company's Product Development Goals; Entrepreneur's and Small Companies' Product Development).

1. Information Society, Knowledge-based Society, Conscience Society

Luciano Floridi **(http://en.wikipedia.org /wiki/ Information),** in his book [4] "Information - A Very Short Introduction (Oxford University Press)" underlined that information (1) explores a concept central to modern science and society, from thermodynamics and DNA to our use of the mobile phone and the Internet; (2) considers concepts such as 'Infoglut' (too much information to process) and the emergence of an information society; (3) addresses the meaning and value of information in science, sociology, and philosophy; (4) raises the broader social and ethical issues relating to privacy, accessibility, and ownership of information.

For the point of view of creation Conscience Society' Information Systems [1] the information is discussed as (5) signification in natural language; (6) Shannonian information; (7) genetic information; (8) information as an ontology factor; (9) information as an economic resource and the service of first necessity.

1.1. Information Society is a Society with human, economic and significant impact. In the Information Era the dimension sphere of Information and Knowledge Based Societies' interactions are without ambiguities. From structural and organization points of view Information Society is supported by CBIS, which is represented by SoftWare, HardWare, People, KnowledgeWare, BrainWare, and GroupWare component parts; these parts of CBIS manipulate information in such evolution fazes of computerized information process as information capture, storage, processing, and its distribution. Information Society implementation supposes correlation of such main factors as: (a) information technology, (b) MULTIMEDIA production and (c) communication technology.

1.2. Knowledge-based Society (http:// www.oas. org/en /topics/knowledge_society.asp) refers to the type of society that is needed to compete and succeed in the changing economic and political dynamics of the modern world. It refers to societies that are well educated, and who therefore rely on the knowledge of their citizens to drive the innovation, entrepreneurship and dynamism of that society's economy. Knowledge-based Society provides the basis of future society of conscience, truth, morals, creativity, and of spirits. Knowledge-based Society' CBIS are represented by its technological (internet, WWW, electronic books, artificial intelligence, nanoelectronics) and functional (knowledge management for enterprises, global moral usage of knowledge, biological knowledge, care knowledge, durable and sustainable environment knowledge, thoroughgoing study, knowledge and innovation culture development, e-learning) vectors [1].

1.3. Conscience Society is based on the notion of Conscience, Individual Conscience, World Conscience and the methods, models, algorithms, procedures, and technologies to create Conscience CBIS [1, 2] which will support Human-Human and Human-Machine intelligent communications.

1.3.1. Conscience (http://en.wikipedia. org/wiki/ Conscience) is an aptitude, faculty, intuition, or judgment of the intellect that distinguishes right from wrong. Moral evaluations of this type may reference values or norms (principles and rules). In psychological terms conscience is often described as leading to feelings of remorse when a human does things that go against his/her moral values, and to feelings of rectitude or integrity when actions conform to such norms. The extent to which conscience informs moral judgment before an action and whether such moral judgments are, or should be, based wholly in reason has occasioned debate through much of the history of Western philosophy.

1.3.2 World conscience (http://en.wikipedia .org/wiki/Conscience) is the universalist idea that with ready global communication, all people on earth will no longer be morally estranged from one another, whether it be culturally, ethnically, or geographically; instead they will conceive ethics from the utopian point of view of the universe, eternity or infinity, rather than have their duties and obligations defined by forces arising solely within the restrictive boundaries of "blood and territory".

1.3.3. Conscience CBIS is represented by [1] Conscience' SoftWare and HardWare, People in Conscience Society, KnowledgeWare (data,

information, knowledge, consciences), BrainWare (methods, algorithms, procedures and conscience models) and GroupWare (communications). These components parts of Conscience CBIS will activate with data, information, knowledge and conscience in such evaluation phases of Intelligent Information Interactions of Conscience Society as: conscience emphasize, conscience storage, conscience processing, and conscience distribution. Conscience CBIS will be based on conscience definition parts (knowledge, activity, sentiment, spirit, thought, lucidity) and conscience functions (informational-cognitive, finalist, anticipative-predictive, adjustment, creative-projective) which supply conscience reproduction characteristics (etymology of conscience word, mental goal presence, goals are established before, mental activity organization, people don't reproduce reality into itself).

Conscience CBIS constitute the Kernel of Artificial Intelligence Systems and of Artificial Conscience Systems of Conscience Society of Information Era.

2. Creativity in Conscience Society.

It is necessary to discuss the evolution of notion of Creativity (what It Is, why It Is Important, where It Is Used) in Conscience Society, to analyze different approaches to achieve Creativity in Conscience Society (Creativity as a Brain Activity; Mastering Daily Life; Creativity and Profession; Piirto's six Steps; When and where Creativity Occurs; How Creative People are looked upon), and also to manage Individual and Group Creativity in combination with Company Goals (Individual Creativity; Teams, Creativity and Product Development; Company's Product Development Goals; Entrepreneur's and Small Companies' Product Development).

2. 1. What Creativity Is, why It Is Important, where It Is Used

There are two notions with similar meaning: Creativity and Ideation. Creativity has a more general meaning.

(1) Creativity is man's (in our opinion not only man's (Natural Intelligence) but and exclusive important computer's, that is, Artificial Intelligence's) capacity to produce insights, new ideas, inventions or artistic objects, which are accepted of being of social, spiritual, esthetic, or technological value. Creativity is a mental process. There are two parts in this definition [2]:

- The first one considers a very large activity spectrum – starting from having insights and / or having new ideas – up to developing inventions and artistic objects. This opens the creativity door to every one: almost everyone has several new ideas daily. Therefore Creativity - in a larger sense - is a common activity of mankind (Natural Intelligence) and computer-kind (Artificial Intelligence): it belongs to the self Adapting Process to every day's life of natural and artificial intelligences. A given level of minimum creativity is crucial to survive in the initial period of Conscience Society. Jane Piirto said: "Creativity is the process of a life."
- The second part introduces a bottom limit in the very large creativity spectrum from insights to artistic objects: only these ideas, etc. which have intrinsic value – for others - are considered results of a Creative Process. All other, more personal results of a thinking process – necessary for individuals to cope with daily life - do not belong to creativity as this is defined through the quoted definition. Creative results are normally related to profession results: when we speak about creativity we mean professional creativity.

(2) Ideation is the mind process of forming and relating ideas, typically connected with new product development. The term ideation is often used interchangeably with "brainstorm", though brainstorm typically implies following a more specific group process while ideation is a more general term. Ideation is a concept utilized in the study of new product development.

Because Ideation is also a Creative Process, it could be regarded as a part of Creativity. A boundary between creativity and ideation cannot be defined, but we can consider that the creative processes are going much further and the results are more dramatic. Both could be considered also as a Psychological State of Mind in which an individual generates alternate scenarios or imagines things in a way that may contradict actual known and accepted reality

2.2. Analyzing Creativity

Creativity manifests itself in all situations of daily life. It is interesting also to analyze Daily Creativity Aspects, which serve only a person and therefore are not considered as belonging to creativity (see above definition): their mechanism could be the same as for more important Discoveries.

2.2.1. Creativity as a Brain Activity

Creativity is the result of brain activity. Brain develops many kinds of Activities; two of them are:

(a) activities which are ordered from the human will. It allows to the human being to move, to learn and to communicate with other human beings. It is a **Conscious** Activity. The conscious activities could be improved, trained, developed, and modified. .

(b) activities which are not consciously coordinated: body's growth and evolution, breathing and supplying cells with oxygen, eating and transforming food in energy, birth of a new life and probably…creating new ideas. It is a **Subconscious** and/or Unconscious Activity. These activities – normally - cannot be influenced from the human will. They follow automatically, as if they were coordinated from a good programmed computer-analogy with Artificial Intelligence Systems are often used to explain brain functions [5].

2.2.2. Mastering the Daily Life

Daily personal activities happen following established routines; hence only changes in the environment could require a new solution. Small

changes generate a spontaneous reaction: many of "new" situations occurred in the past, so the brain could review quickly one in its own "archive" and choose an already used solution. For instance: a person living alone would not think very long to prepare for breakfast the same what he prepared yesterday: a toast with spread and a coffee with milk and sugar. This solution is available in "archive" and was recently checked.

2.2.3. Creativity and Profession

The thinking process of professionals is formed during their study time and completed during their professional practice. The profession specific thinking process influences decisively the creativity. Let analyze some people with Identically Creativity.

Mechanical engineers are using daily notions like: performance, consumption, efficiency, specific weight, cost, optimization, and the like. When they are thinking about Creativity, they would consider all possibilities to improve these parameters.

Designers are using daily notions like: shape, color, nuances, comfort, customer feeling, and costs. When they are speaking about Creativity, they would modify some of these parameters in order to enhance the customer's experience.

Marketers are working with notions like: customer value, competitors' position, strategic positioning, price, and many others alike. For them, Creativity means to find a unique combination of product parameters, product price, and advertising actions which would ensure the highest possible revenue for his company in a specific market.

The Creativity worlds of these three professions couldn't be more different. It couldn't be a more difficult task than to balance them. But the company's success depends of a harmonious collaboration of these specialists and on synchronizing their Creative Efforts.

New idea appeared during working time	%
Brainstorming and similar activities	1
During breaks	3
At work	4
During tiring meetings	6
During boring meetings	10
Total	24

That suggests a more complicated structure of the creative process, which could be characterized through the following:

(a) Most ideas do not appear during the intensive, concentrated, conscious effort to solve the problem. A new idea is "born" later, at a time when the person relaxes.

(b) A new idea appears after a period of time: an "incubation" time – see Piirto - is required.

(c) It seems that in the time period from formulating a problem to the time when the solution is found, the brain is further working at the problem, even during the time when the person is not thinking or is not aware of it. It happens in the same way as other brain functions – breathing, digesting the food, growing tissue, etc.: unconsciously and automatically.

2.2.4. The Piirto's Six Steps

Jane Piirto describes Six Steps to the Creativity top [2] as follows:

1) (acquire) Knowledge; 2) (develop) Curiosity; 3) (become) Interested; 4) Passion; 5) Dedication; 6) Professionalism.

2.2.5. The Piirto's 7i

We already discussed the problem of Creativity differences between people. Jane Piirto identified the following features which characterize highly creative people: (1) Inspiration; (2) Imagery; (3) Imagination; (4) Intuition; (5) Insights; (6) Improvisation; (7) Incubation.

In the process of creation of Conscience Society we will be very interesting to analyze many of possibilities to achieve the performance of Natural Intelligence and Artificial Intelligence, and, especially, of Artificial Conscience using the intersection of "Piirto's Six Steps to the Creativity" with "Piirto's 7i features which characterize highly creative people".

2.2.6. When and where Creativity Occurs

Statistical studies made in Europe [2] about creativity in technical and scientific field show that creative idea appear only seldom in the work place, but much more during free time.

New idea appeared during free time	%
During meals	3
During sport activities	4
While watching TV	6
During business trips	11
During holidays	13
Walking alone	28
During other activities	11
Total	76

2.2.7. How Creative People are Looked upon

What seems to be sure is the perception that creativity cannot be planed. To be creative takes time, the result cannot be foreseen and it comes unexpectedly. Creativity needs conditions which do not match well with planned activities- used extensively in management. Therefore it is difficult to integrate creative people in a team: they are considered – very often – as arrogant, stubborn, uncompromising, tenacious, and persistent. All these are qualities which allow them to follow their own pathway and to create a new idea, very often against an important resistance and against generally accepted opinions. But these qualities are very different from the qualities which are asked for in a harmonious team. One needs a total team dedication

to the final goal in order to integrate and support Creative People.

When the Creativity is working, the individuals, the team and the company hit success!

Conclusion.

Commonly used metaphors for **conscience** include the "voice within" and the "inner light". Conscience, as is detailed in sections below, is usually see as linked to a morality inherent in all humans, to a beneficent universe and/or to divinity, is increasingly conceived of as applying to the world as a whole and as a main feature of conscience society, has motivated its numerous models, characteristics and functions for creation the Societal Intelligent Adaptable Information Systems in Conscience Society.

Academician Mihai Draganescu in community with such researchers as Moravec, Kurzweil, Buttuzzo, Broderick, and other analyzed the possibility to create the Conscience Society in the period from 2019 to 2035 years. In his essay [6] have been underlined: "… it is not possible for any kind of **Artificial Intelligence** (AI: electronic or in the future nano-electronic) to possess Intuition, Creativity and Spirituality without to resort to other structural natural elements, which reality become more and more plausible. The equality of Artificial Intelligence with Structured Natural Intelligence (AI = NIStructured) will happened, after a set of opinions of Moravec, Kurzweil, Buttuzzo, Broderick and a., in the period of 2019-2035 years. Some of researchers believe that in the moment, when will be obtained the equality AI = NIStructured, automatically such electronic brain will possesses the phenomenological properties of **Intuition, Creativity** and **Spirituality**…".

In this communication was discussed some steps of Information Era Societies' evolution and some features of Creativity as one of the basic notion of Natural Intelligence development and Artificial Intelligence creation in Conscience Society.

References.

[1] Radu Mihalcea, Ion Gh Rosca, Dumitru Todoroi. Sisteme informatice in Societatea Conştiinţei. // Analele ASEM, Editia a VIII-a, Editura ASEM, 2010, p. 341 – 360.

[2] Radu Mihalcea, Ion Gh Rosca, Dumitru Todoroi. Discovering and Managing Creativity in Product Development. // Analele ASEM, Editia a IX-a, Editura ASEM, 2011 (To be published)

[3] Dumitru TODOROI. CREATIVITY and CONSCIENCE SOCIETY. // Proc. of Int. Conference in Economic Informatics, May 5-10, 2011, Bucharest (To by published)

[4] Luciano Floridi, Information - A Very Short Introduction (Oxford University Press) // http://ukcatalogue.oup.com/product/9780199551378.do?keyword=floridi&sortby=bestMatches

[5] Dumitru Todoroi, Diana Micusa. Conscience Society in Information Era. // Proc. of the 34th Annual Congress of ARA, Bucharest, Presses Internat. Politechnique, Montreal, Mai 18-23, 2010, p. 39-48

[6] Mihai Draganescu, Conştiinţa, frontierã a ştiinţei, frontierã a omenirii. // Revista de filosofie, XLVII, nr.1-2, 2000, p. 15-22. http://www.racai.ro/~dragam/Constiinta.html

SPIRIT EDUCATION IN CONSCIENCE SOCIETY

Zinaida TODOROI[1], **Dumitru MICUSA**[2],
[1]"Chiprian Porumbescu" Music High School, Chisinau, ztodoroi@yahoo.com, [2]Arts Academy, Sankt Petersburg, **dima_micusa@mail.ru**

Motto: The Future is the Past multiplied by the Present (Paul BRAN)

Abstract. Conscience can lead to feelings of remorse when a human does things that go against his/her moral values, and to feelings of rectitude or integrity when actions conform to such norms. Conscience is ability or a faculty that distinguishes whether one's actions are right or wrong and represents individual **spirit** feelings, a set of conscientious actions of each individual member of Society. The Sum of Society's individual's conscientious actions forms Conscience Society.

Education in its broadest sense is any act or experience that has a formative effect on the mind, character or physical ability of an individual. In its technical sense education is the process by which society deliberately transmits its accumulated knowledge, skills and values from one generation to another based on Social Progress and premises for creating Conscience Society. Discussions in the subject of present and of perspective education models and technologies help to materialize notions of Conscience, Subconscious, Unconscious, and its characteristics in Conscience Society.

This essay is based on the communication „Education in Conscience Society" [1] presented by Zinaida Todoroi, Dumitru Todoroi and Helen Lobanoff at The HUMBOLDT-KOLLEG "Knowledge, Culture, Science – the Fundament of Quality of Life in Society", Timişoara, November 23-28, 2010.

Keywords: Information, Conscience, Subconscious, Unconscious, Conscience models, Education, Conscience Society

Introduction.

Social Progress evaluates from the Agricultural and Industrial Eras through the Information and Knowledge based societies to the Conscience society of Information Era which will be created in the next decades of XXI-st Century.

The Future Conscience Society of Information Era as "figure of speech" represents Past Information Society multiplied by the Present Knowledge Based Society. Information Era comprises other intermediate societies such as Internetworking and Creative societies.

Sustainable and Healthy societies of our days are the societies which successor is Conscience Society. Based on Social Progress Stage development scientists predicted that the Conscience Society will be created in period from 2019 to 2035 years.

1. Conscience component parts hierarchy.

1.1. The concept of **information** is closely related to notions of constraint, communication, control, data, form, instruction, knowledge, meaning, mental stimulus, pattern, perception, and representation [2, 3].

The English word was apparently derived from the Latin accusative form (informationem) of the nominative (informatio): this noun is in its turn derived from the verb "informare" (to inform) in the sense of "to give form to the mind", "to discipline", "instruct", "teach": "Men so wise should go and inform their kings."

Inform itself comes (via French) from the Latin verb informare [4], to give form to, to form an idea of. Furthermore, Latin itself already contained the word informatio meaning concept or idea, but the extent to which this may have influenced the development of the word information in English is unclear.

1.2. Science (from the Latin scientia, meaning "knowledge") is, in its broadest sense, any systematic knowledge-base or prescriptive practice that is capable of resulting in a prediction or predictable type of outcome [5]. In this sense, science may refer to a highly skilled technique or practice. In its more restricted contemporary sense, science is a system of acquiring knowledge based on scientific method, and to the organized body of knowledge gained through such research.

Science is a continuing effort to discover and increase human knowledge and understanding through disciplined research. Using controlled methods, scientists collect observable evidence of natural or social phenomena, record measurable data relating to the observations, and analyze this information to construct theoretical explanations of how things work. The methods of scientific research include the generation of hypotheses about how phenomena work, and experimentation that tests these hypotheses under controlled conditions. Scientists are also expected to publish their information so other scientists can do similar experiments to double-check their conclusions. The results of this process enable better understanding of past events, and better ability to predict future events of the same kind as those that have been tested.

1.3. Conscience from the **spiritual point of view** is ability or faculty that distinguishes whether one's

actions are right or wrong. It can lead to feelings of remorse when a human does things that go against his/her moral values, and to feelings of rectitude or integrity when actions conform to such norms. The extent to which conscience informs moral judgment before an action and whether such moral judgments are, or should be, based wholly in reason has occasioned debate through much of the history of Western philosophy. Commonly used metaphors for conscience include the "voice within" and the "inner light".

The word "conscience" derives etymologically from the Latin *conscientia*, meaning "privacy of knowledge" or "with-knowledge". The English word implies internal awareness of a moral standard in the mind concerning the quality of one's motives, as well as a consciousness of our own actions. Thus *conscience* considered philosophically may be first, and perhaps most commonly, a largely unexamined "gut feeling" or "vague sense of guilt" about what ought to be, or should have been, done. Conscience in this sense is not necessarily the end product of any sustained process of personal rational consideration of the moral features of a problematic situation (or the applicable normative principles, rules or laws) and can arise from prior parental, peer group, religious, state or corporate indoctrination, which may or may not be presently consciously acceptable to the person ("traditional conscience").

The word **"conscious"** [6] is derived from Latin conscius meaning "1. having joint or common knowledge with another, privy to, cognizant of; 2. conscious to oneself; esp., conscious of guilt". A related word was *conscientia* which primarily means moral conscience. The word first appears in Latin juridical texts by writers such as Cicero.

Consciousness from the spiritual point of view is subjective experience, awareness or wakefulness, the executive control system of the mind. It is an umbrella term that may refer to a variety of mental phenomena. Although humans realize what everyday experiences are, consciousness refuses to be defined, philosophers note: *"Anything that we are aware of at a given moment forms part of our consciousness, making conscious experience at once the most familiar and most mysterious aspect of our lives."*

Consciousness in psychology and philosophy has four characteristics: subjectivity, change, continuity and selectivity. Intentionality or aboutness (that consciousness is about something) has also been suggested by philosopher Franz Brentano. However, within the philosophy of mind there is no consensus on whether intentionality is a requirement for consciousness. Issues of practical concern include how the presence of consciousness can be assessed in severely ill or comatose people; whether non-human consciousness exists and if so how it can be measured; at what point in fetal development consciousness begins; and whether computers can achieve a conscious state.

Some philosophers divide consciousness into phenomenal consciousness, which is experience itself, and access consciousness, which is the processing of the things in experience [7]. Phenomenal consciousness is the state of being conscious, such as when they say "I am conscious." Access consciousness is being conscious *of* something in relation to abstract concepts, such as when one says "I am conscious of these words." Various forms of access consciousness include awareness, self-awareness, conscience, stream of consciousness, Husserl's phenomenology, and intentionality. The concept of phenomenal consciousness, in modern history, according to some, is closely related to the concept of qualia. Social psychology links sociology with psychology in their shared study of the nature and causes of human social interaction, with an emphasis on how people think towards each other and how they relate to each other. The behavior and mental processes, both human and non-human, can be described through animal cognition, ethology, evolutionary psychology, and comparative psychology as well. Human ecology is an academic discipline that investigates how humans and human societies interact with both their natural environment and the human social environment.

1.4. Subconscious from the spiritual point of view [8] is one of the most powerful parts of the human psyche and it has a hand in controlling every aspect of your mind. It is one that is living within your logic processes, and while it is not there for you to see in plain sight, do not be mistaken.

"The whole art of teaching [9] is only the art of awakening the subconscious curiosity of young minds for the purpose of satisfying it afterwards" **(Anatole France).**

1.5. The **unconscious mind** from the spiritual point of view [10] is considered as the storage room of everything that is presently not in your self-conscious mind; it stores all your previous lifetime experiences, your belief system, your memories, your skills, all positions you've been through, and all images you've ever seen.

2. Education: assessment, evaluation, application.

Education in its broadest sense is any act or experience that has a formative effect on the mind, character or physical ability of an individual. In its technical sense education is the process by which society deliberately transmits its accumulated knowledge, skills and values from one generation to another.

" It is, in fact, nothing short of a miracle that the modern methods of instruction [9] have not yet entirely strangled the holy curiosity of inquiry" **(Albert Einstein)**

Education as a science cannot be separated from the educational traditions that existed before. Adults trained the young of their society in the knowledge and skills they would need to master and eventually pass on. The evolution of culture, and human beings as a species depended on this practice of transmitting knowledge. In pre-literate societies this was achieved orally and through imitation. Story-telling continued

from one generation to the next. Oral language developed into written symbols and letters. The depth and breadth of knowledge that could be preserved and passed soon increased exponentially. When cultures began to extend their knowledge beyond the basic skills of communicating, trading, gathering food, religious practices, etc, formal education, and schooling, eventually followed. Schooling in this sense was already in place in Egypt between 3000 and 500 BC.

It is currently fashionable to divide education into different **learning "modes": (1) Visual:** learning based on observation and seeing what is being learned; (2) **Auditory**: learning based on listening to instructions/information; (3) **Kinesthetic:** learning based on hands-on work and engaging in activities.

Education module is represented by its **learning modalities** (Fig. 1): **assessment, evaluation, application.**

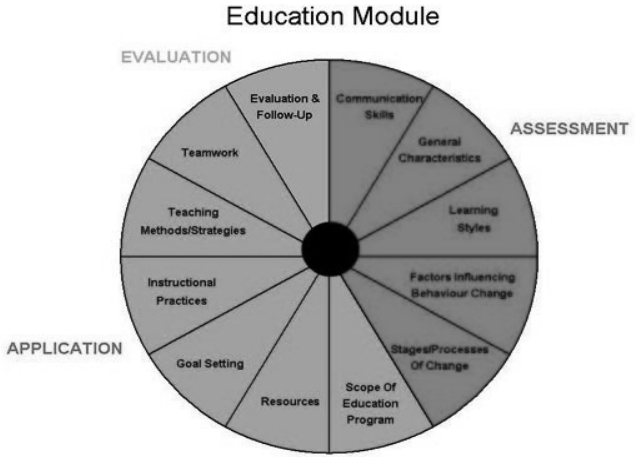


Fig. 1. The learning modalities: assessment, evaluation, application.

It is claimed that, depending on their preferred learning modality, different teaching techniques have different levels of effectiveness. A consequence of this theory is that effective teaching should present a variety of teaching methods which cover all three learning modalities so that different students have equal opportunities to learn in a way that is effective for them.

Nowadays some kind of education [11] is compulsory to all people in most countries. Due to population growth and the proliferation of compulsory education, UNESCO has calculated [12] that in the next 30 years more people will receive formal education than in all of human history thus far.

2.1. Educational components.

There has been work on learning styles over the **last two decades** [9]. Dunn and Dunn focused on identifying relevant stimuli that may influence learning and manipulating the school environment, at about the same time as Joseph Renzulli recommended varying teaching strategies. Howard Gardner identified individual talents or aptitudes in his Multiple Intelligences theories. Based on the works of Jung, the Myers-Briggs Type Indicator and Keirsey Temperament Sorter focused on understanding how people's personality affects the way they interact personally, and how this affects the way individuals respond to each other within the learning environment. The work of David Kolb and Anthony Gregorc's Type Delineator follows a similar but more simplified approach.

2.2. Educational development

In developing countries, the number and seriousness of the problems faced are naturally greater. People in more remote or agrarian areas are sometimes unaware of the importance of education [13]. However, many countries have an active Ministry of Education, and in many subjects, such as foreign language learning, the degree of education is actually much higher than in industrialized countries; for example, it is not at all uncommon for students in many developing countries to be reasonably fluent in multiple foreign languages, whereas this is much more of a rarity in the supposedly "more educated" countries where much of the population is in fact monolingual.

There is also economic pressure from those parents who prefer their children making money in the short term over any long-term benefits of education. Recent studies on child labor and poverty have suggested that when poor families reach a certain economic threshold where families are able to provide for their basic needs, parents return their children to school. This has been found to be true, once the threshold has been breached, even if the potential economic value of the children's work has increased since their return to school.

A lack of good universities, and a low acceptance rate for good universities, is evident in countries with a high population density. In some countries, there are uniform, over structured, inflexible centralized programs from a central agency that regulates all aspects of education.

3. Education and research in current decade.

3. 1. The first G8 University Summit was held in Sapporo, Japan, from 29 June to 1 July, 2008. This was accepted the first Declaration of the goals of Higher education in **Sustainable and Healthy**

societies research area which recognized the following points [14]:
- The importance of sustainability;
- Sustainability issues have become urgent political concerns;
- The responsibility of universities;
- The need to restructure scientific knowledge;
- The need for a network of networks;
- The need for knowledge innovation;
- The role of higher education for sustainability;
- The function of the university campus as an experimental model.

3.2. The second G8 University Summit was held in Torino, Italy, from May 17-19, 2009. The Final Declaration on "Education and Research for Sustainable and Responsible Development" focused on **Economics, Ethics, Energy policy and Ecosystems** [15].

Universities should foster sustainable and responsible development at a local as much as on a global level through new approaches within the educational and research systems, and implement the following:
- New models of social and economic development consistent with sustainability principles;
- Ethical approaches to sustainable development ;
- New approaches to energy policy;
- Focus on sustainable ecosystems.

The goal was to address the proposals for action to the G8 leaders and the international community.

3.3. The 2010 G8 University Summit brings the Presidents of leading research universities from the G8 countries and the wider G20 [16].

The theme of the Summit meeting: "Universities and Communities: transition to a sustainable future" with a focus on **sustainable health, sustainable energy** and **sustainable higher education**.

The 2010 G8 University Summit Themes**:**
- Sustainable Energy;
- Sustainable Health;
- Sustainable Higher Education.

Declaration of the 2010 G8 University Summit [17] underlines that understanding how these three themes interconnect is crucial to building a **fully sustainable, global human society.**

Establishing **Sustainable energy** systems – clean, green, appropriate, efficient and accessible to all – is a foundation of sustainable societies.

In the **Sustainable health** research area there is a critical need to respond to health disparities between regions and manage the consequences of social and economic change, including demographic change, so as to fully realize true sustainability.

Sustainable Higher Education will not be effectively met by universities working in isolation; they will work together to find solutions on the campus and beyond to problems such as: (1) scarcity of resources, (2) development and mobility of intellectual capacity, (3) aging or inadequate infrastructure, and (4) changing social demographics.

3.4. The decade of change in **European Higher Education.**

As was underlined by Lesley Wilson, Secretary General of European University Association at Panel on 'Sustainable Higher Education' G8/G20 University Summit **the decade of change in European Higher Education** will constitute [18]:

3.4.1. Sustainability through reform on a European scale will be probably the Theme of the next **2011 G8 University Summit:**
- More coherence and compatibility through Europe wide change;
- Bologna Process: a voluntary, bottom-up collaborative process;
- European frameworks, common tools, national & institutional implementation;
- European Research Area: Universities as research institutions;
- New funding instruments.

3.4.2. Increasing Responsiveness:
- Three cycle degree structure & common tools: Introduction of the Bachelor, a new Master level and reformed PhD programmes;
- Employability and labor market access – problem with the acceptance of the Bachelor degree;
- Improving access and participation – lifelong learning: a set of activities or a new way of looking at access to education for all citizens;
- Policies for attracting and maintaining a more diversified student body.

3.4.3. Sustainability through more cooperation:
- Internationalisation: a more strategic element of institutional mission;
- More Intra-European cooperation;
- Global engagement in Research: often building on cooperation at the master and doctoral level;
- Increasing mobility is a challenge: no major increase over the last decade;
- More likely to increase between the BA and the MA than as a study abroad period as part of the Bachelor.

3.4.4. Improving capacity to manage change:
- Quality and quality assurance;
- More autonomy;
- More diversified funding.

3.5. Future directions for **the next decade in the European education** and **research areas.**

Impact on universities as central to current European developments as the changes in education and research permit to underline that **future directions for the next decade in the European education and research areas** will constitute [18]**:**

(1) Strengthen the voluntary, cooperative governance model experimented with at European level;

(2) Move away from structures and tools to situate debate on the kind of European and global citizens we need in future;

(3) Avoid stifling quality, creativity and innovation by an over emphasis on accreditation, measurement

and standards;

(4) Maintain European solidarity and engagement while strengthening global engagement.

Conclusion.

World conscience [19] is the universalist idea that with ready global communication, all people on earth will no longer be morally estranged from one another, whether it be culturally, ethnically, or geographically; instead they will conceive ethics from the utopian point of view of the universe, eternity or infinity, rather than have their duties and obligations defined by forces arising solely within the restrictive boundaries of 'blood and territory.

Our conscience is more than a Great Teacher; it is a Great Treasure. For if we choose to follow the gentle urgings of this Great Gift from God, we will know happiness, have peace of mind, and experience a life rich with meaning. On the other hand, should we choose to ignore the prodding of this Great Friend, our constant companions will be stress, regret, worry, fear, anxiety, guilt, shame, grief, and despair. Those who wander on the path of life without the guidance of their conscience are a pitiful sight, for as St. Anthony of Padua writes, "Blind are they who see not their own conscience; lame are they who wander from the right way."

Consciousness is awareness of all things while conscience is specialized awareness; it is the awareness of morality or the difference between right and wrong, as well as the awareness of perfection. The soft whispering of our conscience directs us to avoid wrongdoing and to carry out acts of goodness. It also inspires excellence, for it is an urge to become more godlike. Since God is Perfection, we have a natural inclination, when it is unimpeded, toward endless growth.

(A) **To educate conscientious members of** society it is necessary to **develop research** in the next very important directions:

(B) - the hierarchy theory of conscience, its information and operation bases;

- human conscience, individual and collective consciences, their interactivity;
- belief, conviction, religion and conscience;
- science, conscience, subconscious, unconscious;
- humanity in Conscience Society

(B) „To study and at times practice what one has learned, ist hat not a pleasure?" (Confucius)

In concordance with developed research in direction of creation Conscience Society it is **necessary to educate** humanity how to improve their body [3], their education [20], intelligence and their ecological competence, to efaluate spiritually, to understand the role of individuals in the Hystory, to develop ecologic economy [21], and to adopt and support pure environment in general.

"In the healthy body lives the healthy spirit" (Romanian popular saying)

China's great treasure Qigong [22] is not the place of diagnosis, therapy, or treatment by the phisician, but rather help you make better, informed choices about health and treatment options.

References

[1]. Zinaida Todoroi, Dumitru Todoroi, Helen Lobanoff. Education in Conscience Society. // Int. HUMBOLDT-KOLLEG "Knowledge, Culture, Science – the Fundament of Quality of Life in Society", Timişoara, November 23-28, 2010 (To be published)

[2]. Dumitru Todoroi, Nicoleta Todoroi, Dumitru Micusa. Conştiința: definiții, caracteristici, funcții, modele, adaptabilitate. // Proc. of International conf. "Modelare matematică, optimizare şi tehnologii informaționale", Ediția a II-a, Chişinău, Evrica, 24-26 martie 2010, pp.268-287

[3]. Neumivachin I. P., Neumivachna L.S. Endoecologia zdorovya (Helth Endoecology). // DILYA edition, Moscow, St-Petersbourg, spb@ dilya.ru, 2006, 540 pages.

[4]. http://en.wikipedia.org/wiki/Information.

[5]. http://en.wikipedia.org/wiki/Science

[6]. Dumitru Todoroi. Muzica de la conştient la subconştient. / Proc. of the International Conference "Competitivitatea şi inovarea în economia cunoaş-terii", Vol.II, Ed. ASEM, 2009, Chisinau, p.27-31

[7].http://en.wikipedia.org/wiki/Human-cite.note-Bl.81

[8]. http://en.wikipedia.org/wiki/Subconscious

[9.http://www.wisdomquotes.com/cat_education.html

[10].http://en.wikipedia.org/wiki/Unconscious_mind

[11]. Radu Mihalcea, Ion Gh Rosca, Dumitru Todoroi. Sisteme informatice in Societatea Conştiinței. // Analele ASEM, Editia a VIII-a, Editura ASEM, **2010**, p. 341 – 360.

[12]. http://en.wikipedia.org/wiki/Education

[13].http://en.wikipedia.org/wiki/File:Education_index_UN_HDR_2007_2008.PNG]

[14]. http://g8u-summit.jp/english/index.html

[15].http://www.g8university.com/pagine/pagina.aspx?ID=Reports001&L=EN

[16].http://www.g8universitysummit2010.com/g8summit/themes.html

[17].http://www.g8universitysummit2010.com/g8summit/declaration.html

[18].http://www.eua.be/fileadmin/user_upload/images/newsletter/Lesley_Wilson_EUA-G8_university_summit_PPT.pdf

[19]. Todoroi Dumitru, Micisha Diana. Conscience Society in Information Era. // Proc. of The 34th Annual Congress of ARA, Bucharest, Romania, Presses Internationales Politechnique, Montreal, Quebec, Mai 18-23, 2010, p. 39-48

[20]. Todoroi Dumitru, Lobanov Elena, Obada Igor. Conscience Society creation premises. World Personalities and … First 7 years at home. // Proc. of International conf. "Competitivitatea şi inovarea în economia cunoaşterii", Sept. 24-25, 2010, Editura ASEM, Vol. 1, 2011, p. 322 – 326.

[21]. Todoroi Dumitru, Parlicova Tatiana, Stadnic Valentina. Some guiding marks of ecological business in Conscience Society. // Proc. of International conf. "Competitivitatea şi inovarea în economia cunoaşterii, Sept. 24-25, 2010, Editura ASEM, Vol. 1, 2011, p. 326 – 331.

[22]. Kenneth S. Cohen. The Way of Qigong. The Art and Science of Chinese Energy Healing. // Ballantine Books, New York, 1997, 428 pages.

APPLICATIONS OF DIFFERENTIAL SUBORDINATIONDS AND SUPERORDINATIONS AND SANDWICH THEOREMS

Anamaria G. MACOVEI
"Ştefan cel Mare" University, Faculty of Economics and Public Administration,
Suceava, România, anamariam@seap.usv.ro

Abstract: The notions of differential subordinations and superordination were introduced by S. S. Miller and P. T. Mocanu. In this paper we present some applications of differential subordination and superordination using function $\left(\frac{f(z)}{z^k}\right)^{\alpha}$. A sandwich type results is also given
Keywords: Differential Subordination, Differential Superordination, subdominant, dominant, starlike function, convex function

1. Introduction

Let H(U) denote the class of functions analytic in the unit disc

$$U=\{z\in\mathbb{C}:|z|<1\}.$$

For $n\in\mathbb{N}^*$ and $a\in\mathbb{C}$, let

$$\mathrm{H}[a,n]=\left\{f\in\mathrm{H}(U):f(z)=a+\sum_{j=n}^{\infty}a_j z^j, z\in U\right\}.$$

Let A (k,n) denote the class of functions of the form

$$f(z)=z^k+\sum_{j=n+k}^{\infty}a_j z^j,\ z\in U,\ k,n\in\mathbb{N}.$$

and normalized by $f(0)=f'(0)-1=0$.

If $k=1$ then A $(1,n)=\mathrm{A}_n$. If $k=1$ and $n=1$ then A $(1,1)=\mathrm{A}$.

Let

$$S^*=\left\{f\in A:\mathrm{Re}\frac{zf'(z)}{f(z)}>0, z\in U\right\},$$

denote the class of normalized starlike function in U and

$$K=\left\{f\in A:\mathrm{Re}\frac{zf''(z)}{f'(z)}+1>0, z\in U\right\},$$

denote the class of normalized convex function in U.

The general theory of differential subordinations was introduced by S.S. Miller and P. T. Mocanu [4]. S.S. Miller and P. T. Mocanu [7] introduced the following notion of differential superordination, as the dual concept of differential subordination.

Recall the concepts of superordination and subordination. Let $f(z)$ and $F(z)$ be members of H (U) and let $F(z)$ be univalent in U. The function $F(z)$ is said to be superordinate to $f(z)$, or $f(z)$ is subordinate to $F(z)$, if there exists a function $w(z)$ analytic in U, with $w(0)=0$ and $|w(z)|<1$, $z\in U$, and such that $f(z)=F(w(z))$. In such a case we write $f(z)\prec F(z)$. If $F(z)$ is univalent, then $f(z)\prec F(z)$ if and only if $f(0)=F(0)$ and $f(U)\subset F(U)$.

Let Ω, $\Delta\subset\mathbb{C}$, let the function $p\in\mathrm{H}(U)$, with $p(0)=a, a\in\mathbb{C}$ and let $\psi:\mathbb{C}^3\times U\to\mathbb{C}$. This theory deals with generalizations of the implication:

$$\left\{\psi\left(p(z),zp'(z),z^2p''(z);z\right):z\in U\right\}\subset\Omega\Rightarrow p(U)\subset\Delta \quad (1)$$

Let $\psi:\mathbb{C}^3\times U\to\mathbb{C}$ and let the function h is univalent in U. If the function $p\in\mathrm{H}[a,n]$ and satisfies the differential subordination

$$\psi\left(p(z),zp'(z),z^2p''(z);z\right)\prec h(z),\quad z\in U, \quad (2)$$

then p is called a solution of the differential subordination.

A univalent function q is called a dominant of the differential subordination (2) if $p(0)=q(0)$ and $p(z)\prec q(z)$ for all p satisfying (2). A dominant $\tilde{q}$ that satisfies $\tilde{q}\prec q$ for all dominants q of (2), is said to be the best dominant

of (2). The best dominant is unique up to a rotation of U.

Let Ω, $\Delta \subset \mathbb{C}$, let the function $p \in \mathrm{H}(U)$, with $p(0) = a, a \in \mathbb{C}$ and let $\varphi : \mathbb{C}^3 \times U \to \mathbb{C}$. This theory deals with generalizations of the implication:

$$\Omega \subset \left\{ \varphi\left(p(z), z\,p'(z), z^2\,p''(z); z\right) : z \in U \right\} \Rightarrow \Delta \subset p(U) \tag{3}$$

Let $\varphi : \mathbb{C}^3 \times U \to \mathbb{C}$ and let the function h is analytic in U. If the function p and $\varphi\left(p(z), z\,p'(z), z^2\,p''(z); z\right)$ are univalent in U and satisfies the differential superordination

$$h(z) \prec \varphi\left(p(z), z\,p'(z), z^2\,p''(z); z\right), \quad z \in U, \tag{4}$$

then p is called a solution of the differential superordination.

A univalent function q is called a subordinant of the differential superordination (4) if $q(z) \prec p(z)$ for all p satisfying (4). A univalent subordinant $\tilde{q}$ that satisfies $q \prec \tilde{q}$ for all subordinants q of (4), is said to be the best subordinant of (4). The best subordinant is unique up to a rotation of U.

2. Preliminaries

For our present investigation, we shall need the following definitions and results.

Let Θ denote the set of functions q that are analytic and injective on the set $\overline{U} \setminus E(q)$, where

$$E(q) = \left\{ \zeta \in \partial U : \lim_{z \to \zeta} q(z) = \infty \right\}, \tag{5}$$

and are such that $q'(\zeta) \neq 0$ for $\zeta \in \partial U \setminus E(q)$. Let $E(q)$ is called exception set. Denote by Θ (a) the subclass Θ for which $q(0) = a$.

Lemma 1 [5]: *Let $q \in \mathrm{H}_u(U)$ and let θ and ϕ be analytic in domain D containg $q(U)$, with $\phi(w) \neq 0$, when $w \in q(U)$. Set $Q(z) = z\,q'(z)\,\phi(q(z))$, $h(z) = \theta(q(z)) + Q(z)$, $z \in U$ and suppose that either:*

a) *h is convex or Q is starlike,* (6)

b) $\mathrm{Re}\dfrac{z\,h'(z)}{Q(z)} = \mathrm{Re}\left[\dfrac{\theta'(q(z))}{\phi(q(z))} + \dfrac{z\,Q'(z)}{Q(z)}\right] > 0$, (7)

If $p \in \mathrm{H}(U)$, with $p(0) = q(0)$, $p(U) \subset D$ and

$$\theta(p(z)) + z\,p'(z)\,\phi(p(z)) \prec \theta(q(z)) + z\,q'(z)\,\phi(q(z)) \tag{8}$$

then $p(z) \prec q(z)$, and q is the best dominant.

Lemma 2 [1]: *Let $q \in \mathrm{H}_u(U)$ and let ϑ and φ be analytic in domain D containg $q(U)$. Set $\xi(z) = z\,q'(z)\,\varphi(q(z))$ and suppose that either:*

a) *ξ is starlike,* (9)

b) $\mathrm{Re}\dfrac{\vartheta'(q(z))}{\varphi(q(z))} > 0$, $z \in U$. (10)

If $p \in \mathrm{H}[q(0),1] \cap Q$, with $p(0) = q(0)$, $p(U) \subset D$ and $\vartheta(p(z)) + z\,p'(z)\,\varphi(p(z))$ is univalent in U, and

$$\vartheta(q(z)) + z\,q'(z)\,\varphi(q(z)) \prec \vartheta(p(z)) + z\,p'(z)\,\varphi(p(z)) \tag{11}$$

then $q(z) \prec p(z)$, and q is the best dominant.

3. Main resultats

Theorem 1: Let $f \in \mathrm{A}(k,n)$, $k, n \in \mathbb{C}$ and $\alpha > 0$. Let q is convex in U, with $\mathrm{Re}\,q(z) > \beta$ and suppose that satisfies the condition

$$\mathrm{Re}\left[\frac{z\,q''(z)}{g'(z)} + q(z) - \beta + 1\right] > 0 \tag{12}$$

If

$$\frac{1}{2}\left(\frac{f(z)}{z^k}\right)^{2\alpha} - (\alpha k + \beta)\left(\frac{f(z)}{z^k}\right)^{\alpha} + \alpha\frac{f'(z)}{z^{k-1}}\left(\frac{f(z)}{z^k}\right)^{\alpha-1} \prec \frac{q^2(z)}{2} - \beta\,q(z) + z\,q'(z), \tag{13}$$

then

$$\left(\frac{f(z)}{z^k}\right)^{\alpha} \prec q(z), \tag{14}$$

and q is the best dominant.

Proof.

Let the function p defined by

$$p(z) = \left(\frac{f(z)}{z^k}\right)^{\alpha}. \tag{15}$$

Differentiating this function, with respect to z and performing calculations we get

$$p'(z) = \alpha\left(\frac{f(z)}{z^k}\right)^{\alpha-1}\frac{z^k f'(z) - p\,z^{k-1} f(z)}{z^{2k}} \Rightarrow$$

$$z\,p'(z) = \alpha\left(\frac{f(z)}{z^k}\right)^{\alpha-1}\frac{f'(z)}{z^{k-1}} - \alpha k\left(\frac{f(z)}{z^k}\right)^{\alpha} \Rightarrow$$

$$\frac{p^2(z)}{2} - \beta p(z) + z\,p'(z) = \frac{1}{2}\left(\frac{f(z)}{z^k}\right)^{2\alpha} - (\alpha k + \beta)\left(\frac{f(z)}{z^k}\right)^{\alpha} + \alpha\frac{f'(z)}{z^{k-1}}\left(\frac{f(z)}{z^k}\right)^{\alpha-1} \tag{16}$$

From relations (13) and (16) we have:

$$\frac{p^2(z)}{2} - \beta p(z) + z\,p'(z) \prec \frac{q^2(z)}{2} - \beta\,q(z) + z\,q'(z).$$

If we consider in Lemma 3 the functions $\theta(w) = \dfrac{w^2}{2} - \beta w$ and $\phi(w) = 1$, then we have:

$$\theta(q(z)) = \frac{q^2(z)}{2} - \beta q(z),$$

$$\phi(q(z)) = 1.$$

$$Q(z) = z\,q'(z)\,\phi(q(z)) = z\,q'(z),$$

$$h(z) = \theta(q(z)) + Q(z) = \frac{q^2(z)}{2} - \beta q(z) + z\,q'(z)$$

We must prove the conditions (7) and (8) of Lemma 3.

Since the function q is convex in U, then $Q(z) = z\,q'(z)$ is starlike.

Derive the function h, with respect to z, performing calculations we obtain

$$h'(z) = q(z)\,q'(z) - \beta q'(z) + q'(z) + z\,q''(z) \Rightarrow$$

$$z\,h'(z) = z\,q(z)\,q'(z) + (1-\beta)\,z\,q'(z) + z^2\,q''(z) \Rightarrow$$

$$\frac{z\,h'(z)}{Q(z)} = \frac{z\,q(z)\,q'(z) + (1-\beta)\,z\,q'(z) + z^2\,q''(z)}{z\,q'(z)} \Rightarrow$$

$$\frac{z\,h'(z)}{Q(z)} = \frac{z\,q''(z)}{g'(z)} + q(z) - \beta + 1$$

By using the relation (12) we have

$$\mathrm{Re}\frac{z\,h'(z)}{Q(z)} > 0$$

Therefore, the conditions (6) and (7) of Lemma 3 are met. So Theorem 1 is proven.

Theorem 2: Let $f \in \mathrm{A}(k,n)$, $k,n \in \mathbb{N}$, $\left(\frac{f(z)}{z^k}\right)^{\alpha} \in \mathrm{H}[q(0),1] \cap \Theta$ and $\alpha > 0$. Let

$$\frac{1}{2}\left(\frac{f(z)}{z^k}\right)^{2\alpha} - (\alpha k + \beta)\left(\frac{f(z)}{z^k}\right)^{\alpha} + \alpha\frac{f'(z)}{z^{k-1}}\left(\frac{f(z)}{z^k}\right)^{\alpha-1}$$

is univalent in U. Let the function q is convex in U and suppose that satisfies the relation

$$\mathrm{Re}\left[q(z)q'(z) - \beta q'(z)\right] > 0 \qquad (17)$$

If

$$\frac{q^2(z)}{2} - \beta q(z) + z\,q'(z) \prec \frac{1}{2}\left(\frac{f(z)}{z^k}\right)^{2\alpha} - (\alpha k + \beta)\left(\frac{f(z)}{z^k}\right)^{\alpha} + \alpha\frac{f'(z)}{z^{k-1}}\left(\frac{f(z)}{z^k}\right)^{\alpha-1} \qquad (18)$$

then

$$q(z) \prec \left(\frac{f(z)}{z^k}\right)^{\alpha}, \qquad (19)$$

and q is the best subordinant.

Proof:

If the function p defined by relation (15), and performing calculations, then we obtain equality in equation (16) from proof the Theorem 1. From relations (16) and (18) we have:

$$\frac{q^2(z)}{2} - \beta q(z) + z\,q'(z) \prec \frac{p^2(z)}{2} - \beta p(z) + z\,p'(z).$$

If we consider in Lemma 4 the functions $\vartheta(w) = \frac{w^2}{2} - \beta w$ and $\varphi(w) = 1$, then we have:

$$\vartheta(q(z)) = \frac{q^2(z)}{2} - \beta q(z),$$

$$\varphi(q(z)) = 1,$$

$$\xi(z) = z\,q'(z)\,\varphi(q(z)) = z\,q'(z).$$

We must prove the conditions (9) and (10) of Lemma 4.

Since the function q is convex in U, then $\xi(z) = z\,q'(z)$ is starlike.

If derive the function ϑ, with respect to z, after a simple calculation and relation (17), then we have

$$\mathrm{Re}\frac{\vartheta'(q(z))}{\varphi(q(z))} = \mathrm{Re}\left[q(z)q'(z) - \beta q'(z)\right] > 0$$

Therefore, the conditions (9) and (10) of Lemma 4 are met. So Theorem 2 is proven.

Combining Theorem 1 and Theorem 2 we get the following sandwich theorem.

Theorem 3: Let $f \in \mathrm{A}(k,n)$, $k,n \in \mathbb{N}$, $\left(\frac{f(z)}{z^k}\right)^{\alpha} \in \mathrm{H}[q(0),1] \cap \Theta$ and $\alpha > 0$. Let

$$\frac{1}{2}\left(\frac{f(z)}{z^k}\right)^{2\alpha} - (\alpha k + \beta)\left(\frac{f(z)}{z^k}\right)^{\alpha} + \alpha\frac{f'(z)}{z^{k-1}}\left(\frac{f(z)}{z^k}\right)^{\alpha-1}$$

is univalent in U. Let q_1 and q_2 is convex in U. Suposse the function q_1 satisfy relation (17) and the function q_2 satisfy relation (12). If

$$\frac{q_1^2(z)}{2} - \beta q_1(z) + z\,q_1'(z) \prec \frac{1}{2}\left(\frac{f(z)}{z^k}\right)^{2\alpha} - (\alpha k + \beta)\left(\frac{f(z)}{z^k}\right)^{\alpha} + \alpha\frac{f'(z)}{z^{k-1}}\left(\frac{f(z)}{z^k}\right)^{\alpha-1} \prec,$$

$$\prec \frac{q_2^2(z)}{2} - \beta q_2(z) + z\,q_2'(z)$$

then

$$q_1(z) \prec \left(\frac{f(z)}{z^k}\right)^{\alpha} \prec q_2(z),$$

and q_1 and q_2 are respectively the best subordinant and best dominant.

If $k = 1$ then we have the following theorem:

Theorem 4: Let $f \in \mathrm{A_n}$, $n \in \mathbb{N}$ and $\alpha > 0$. Let q is convex in U, with $\mathrm{Re}\,q(z) > \beta$ and suppose that satisfies the condition (12)

If

$$\frac{1}{2}\left(\frac{f(z)}{z}\right)^{2\alpha}-(\alpha+\beta)\left(\frac{f(z)}{z}\right)^{\alpha}+\alpha f'(z)\left(\frac{f(z)}{z}\right)^{\alpha-1}\prec$$

$$\prec\frac{q^2(z)}{2}-\beta q(z)+z\,q'(z)$$

then

$$\left(\frac{f(z)}{z}\right)^{\alpha}\prec q(z),$$

and q is the best dominant.

Theorem 5: Let $f\in A_n$, $n\in\square$, $\left(\frac{f(z)}{z}\right)^{\alpha}\in H[q(0),1]\cap\Theta$ and $\alpha>0$. Let

$$\frac{1}{2}\left(\frac{f(z)}{z}\right)^{2\alpha}-(\alpha+\beta)\left(\frac{f(z)}{z}\right)^{\alpha}+\alpha f'(z)\left(\frac{f(z)}{z}\right)^{\alpha-1}$$

is univalent in U. Let the function q is convex in U and suppose that satisfies the relation (17). If

$$\frac{q^2(z)}{2}-\beta q(z)+z\,q'(z)\prec$$

$$\prec\frac{1}{2}\left(\frac{f(z)}{z}\right)^{2\alpha}-(\alpha+\beta)\left(\frac{f(z)}{z}\right)^{\alpha}+\alpha f'(z)\left(\frac{f(z)}{z}\right)^{\alpha-1}$$

then

$$q(z)\prec\left(\frac{f(z)}{z}\right)^{\alpha},$$

and q is the best subordinant.

Combining Theorem 4 and Theorem 5 we get the following sandwich theorem.

Theorem 6: Let $f\in A_n$, $n\in\square$, $\left(\frac{f(z)}{z}\right)^{\alpha}\in H[q(0),1]\cap\Theta$ and $\alpha>0$. Let

$$\frac{1}{2}\left(\frac{f(z)}{z}\right)^{2\alpha}-(\alpha+\beta)\left(\frac{f(z)}{z}\right)^{\alpha}+\alpha f'(z)\left(\frac{f(z)}{z}\right)^{\alpha-1}$$

is univalent in U. Let q_1 and q_2 is convex in U. Suposse the function q_1 satisfy relation (17) and the function q_2 satisfy relation (12). If

$$\frac{{q_1}^2(z)}{2}-\beta q_1(z)+z\,q_1'(z)\prec$$

$$\frac{1}{2}\left(\frac{f(z)}{z}\right)^{2\alpha}-(\alpha+\beta)\left(\frac{f(z)}{z}\right)^{\alpha}+\alpha f'(z)\left(\frac{f(z)}{z}\right)^{\alpha-1}\prec$$

$$\prec\frac{{q_2}^2(z)}{2}-\beta q_2(z)+z\,q_2'(z),$$

then

$$q_1(z)\prec\left(\frac{f(z)}{z}\right)^{\alpha}\prec q_2(z),$$

and q_1 and q_2 are respectively the best subordinant and best dominant.

4 References

[1] T. Bulboacă, Classes of first-order differential superordinations, Demonstratio Mathematica, 352 (2002), 11-17;

[2] N. E., Cho, T. H., Kim, *Multiplier transformations and strongly close-to-convex functions*, Bull. Korean Math. Soc., 40 (3) (2003), 399-410;

[3] S. S. Miller, P. T. Mocanu, Differntial subordinations and univalent functions, Michig. Math. J., 28 (1981), 157-171;

[4] P. T. Mocanu, T. Bulboacă, G. S. Sălăgean, Teoria geometrică a funcțiilor univatente, Casa Cărții de Ştiință (Cluj), 1999;

[5] S. S. Miller, P. T., Mocanu, *Differential Subordinantions*. *Theory and Applications*, Marcel Dekker Inc., New York, Basel, 2000;

[6] S. S. Miller, P. T. Mocanu, Subordinants of Differential Superordinations, J. Complex Variables. Vol. 48, No. 10 (2003), 815-826;

[7] S. S., Miller, P. T., Mocanu, *Briot-Bouquet differential superordinationts and sandwich theorem* , J. Math. Anal. Appl., 329 (2007), 327-335;

[8] G., Murugusundaramoorthy, N., Magesh, *Differential subordinations and superordinations for analytic functions defined by the Dziok-Srivastava linear operator*, Journal of Inequalities in Pure and Applied Mathematics, 7 (4), art. 152 (2006), 1-9;

[9] G. I., Oroş, *Briot-Bouquet diferential subordinations and superordinations using the Dziok-Srivastava linear operator*, Math. Reports 11 (61), 2 (2009), 155-163;

[10] T. N. Shanmugam, S. Sivasubramnian, M. Darus, C. Ramachandran, Subordinations and Superordination Results for Certain Subclasses of Analytic Functions, International Mathematical Forum, no. 21, 2 (2007), 1039-1052.

SUBCLASSES OF UNIVALENT FUNCTIONS DEFINED BY CONVOLUTION

Anamaria G. MACOVEI
"Ştefan cel Mare" University, Faculty of Economics and Public Administration, Suceava, România, e-mail: anamariam@seap.usv.ro

Abstract. This paper presents subclasses of univalent functions defined by convolution, and the connection between them.
Keywords**:** Convolution, starlike function, convex function, close-to-convex function
2000 Mathematics Subject Classification: 30C45

1. Introduction

Let H(U) denote the class of functions analytic in the unit disc

$$U = \{ z \in \mathbb{C} : |z| < 1 \}.$$

For $n \in \mathbb{N}^*$ and $a \in \mathbb{C}$, let

$$H[a,n] = \{ f \in H(U) : f(z) = a + a_n z^n + a_{n+1} z^{n+1} + ..., z \in U \}.$$

Let A denote the class of functions of the form

$$f(z) = z + \sum_{j=2}^{\infty} a_j z^j, \ z \in U.$$

and normalized by $f(0) = f'(0) - 1 = 0$.

Let the functions $f, g \in$ A, defined as:

$$f(z) = z + \sum_{j=2}^{\infty} a_j z^j \quad \text{and} \quad g(z) = z + \sum_{j=2}^{\infty} b_j z^j,$$

$z \in U$. Then the convolution of f and g is denoted as

$$(f * g)(z) = z + \sum_{j=2}^{\infty} a_j b_j z^j, \ z \in U. \quad (1)$$

Let

$$S^* = \left\{ f \in A : \operatorname{Re} \frac{z f'(z)}{f(z)} > 0, z \in U \right\},$$

denote the class of normalized starlike function in U,

$$K = \left\{ f \in A : \operatorname{Re} \frac{z f''(z)}{f'(z)} + 1 > 0, z \in U \right\},$$

denote the class of normalized convex function in U and

$$C = \{ f \in A : (\exists)\, \varphi \in K, \ \operatorname{Re} \frac{f'(z)}{\varphi'(z)} > 0, z \in U \},$$

denote the class of normalized close-to-convex function in U.

2. Preliminaries

For our present investigation, we shall need the following definitions and results.

Let the functions $f, g \in$ A, defined as:

$$f(z) = z + \sum_{j=2}^{\infty} a_j z^j \quad \text{and} \quad g(z) = z + \sum_{j=2}^{\infty} b_j z^j,$$

$z \in U$, with $(g * f)(0) = 0$ and $(g * f)'(0) \neq 0$

Definition 1: Denote:

$$S_g^* = \left\{ f \in S : \operatorname{Re} \frac{z (g * f)'(z)}{(g * f)(z)} > 0, z \in U \right\}.$$

Definition 2: Let $0 \leq \alpha < 1$. Denote:

$$S_g^*(\alpha) = \left\{ f \in S : \operatorname{Re} \frac{z (g * f)'(z)}{(g * f)(z)} > \alpha, z \in U \right\}.$$

Definition 3: Denote :

$$K_g = \left\{ f \in S : \operatorname{Re} \frac{z (g * f)''(z)}{(g * f)'(z)} + 1 > 0, z \in U \right\}.$$

Definition 4: Let $0 \leq \alpha < 1$. Denote:

$$K_g(\alpha)=$$

$$\left\{ f\in S:\operatorname{Re}\frac{z(g*f)''(z)}{(g*f)'(z)}+1>\alpha,\ z\in U \right\}.$$

Definition 5: Let $\varphi\in S_g^*$. Denote :

$$C_g=\left\{ f\in S:\operatorname{Re}\frac{z(g*f)'(z)}{(g*\varphi)(z)}>0,\ z\in U \right\}.$$

Definition 6: Let $\varphi\in S_g^*$ and $0\le\alpha<1$. Denote:

$$C_g(\alpha)=\left\{ f\in S:\operatorname{Re}\frac{z(g*f)'(z)}{(g*\varphi)(z)}>\alpha,\ z\in U \right\}.$$

Lemma 1 [1]: Let $\phi\in$ A be convex univalent, $g\in S^*$ and $F\in$ H (U) such that $\operatorname{Re}F(z)>0$, for $z\in U$. Then $\frac{\phi*Fg}{\phi*g}$ lies in the convex hull of $F(U)$.

Lemma 2 [3]: Let the function $p(z)=a+p_n z^n+\ldots,\ p\in \mathrm{H}[a,n]$.

a) If $\psi\in\Psi_n\{\Omega,a\}$, then

$$\psi\left(p(z),zp'(z),z^2p''(z);z\right)\in\Omega,\ z\in U\Rightarrow \operatorname{Re}p(z)>0,\ z\in U.$$

b) If $\psi\in\Psi_n\{a\}$, then

$$\psi\left(p(z),zp'(z),z^2p''(z);z\right)>0,\ z\in U\Rightarrow \operatorname{Re}p(z)>0,\ z\in U.$$

3. Subclasses of univalent functions

Theorem 1: If $f\in S^*$ and the function g is convex, then $f\in S_g^*$.

Proof:

From $f\in S^*$, we have

$$\operatorname{Re}\frac{zf'(z)}{f(z)}>0.$$

Considering

$$\frac{z(g*f)'(z)}{(g*f)(z)}=\frac{(g*zf')(z)}{(g*f)(z)}=\frac{\left(g*\frac{zf'}{f}f\right)(z)}{(g*f)(z)} \qquad (2)$$

Since the function g is convex and if we consider $F(z)=\frac{zf'(z)}{f(z)}$, then applying of Lemma 1 we have

$\operatorname{Re}\frac{z(g*f)'(z)}{(g*f)(z)}>0$ which implies $f\in S_g^*$.

So theorem 1 is prove.

Theorem 2: Let the function g is convex. If $f\in S^*$ and the functions g and h is convex, then $h*f\in S_g^*$.

Proof:

From $f\in S^*$ and the function g is convex, then according to Theorem 1 we have $f\in S_g^*$. So we have

$$(g*f)'(0)\ne 0 \text{ and } \operatorname{Re}\frac{z(g*f)'(z)}{(g*f)(z)}>0. \qquad (3)$$

Considering

$$\frac{z(g*h*f)'(z)}{(g*h*f)(z)}=\frac{(h*z(g*f)')(z)}{(h*(g*f))(z)}=\frac{\left(h*\frac{z(g*f)'}{(g*f)}(g*f)\right)(z)}{(h*(g*f)(z)} \qquad (4)$$

Since the function h is convex and if we consider $F(z)=\frac{z(g*f)'(z)}{(g*f)(z)}$ and relation (3), then applying of Lemma 1 we have in relation (4) we obtain

$\operatorname{Re}\frac{z(g*h*f)'(z)}{(g*h*f)(z)}>0$ which implies $h*f\in S_g^*$.

So theorem 2 is prove.

Theorem 3: Let the function g is convex and let the function h is convex, with $h(0)=h'(0)-1=0$. Then $S_g^*\subseteq S_{h*g}^*$.

Proof:

Let $f\in S_g^*$ and according to theorem 4 we have $h*f\in S_g^*$, ie

$$\operatorname{Re}\frac{z(g*h*f)'(z)}{(g*h*f)(z)}>0.$$

We have

$$\operatorname{Re}\frac{z(g*h*f)'(z)}{(g*h*f)(z)}=\operatorname{Re}\frac{z(h*g*f)'(z)}{(h*g*f)(z)}>0$$

which implies $f\in S_{h*g}^{\ *}$

So theorem 3 is prove.

Theorem 4: Let the function g is convex. Then $K_g\subseteq S_g^{\ *}$

Proof:

If suppose $f\in K_g$, then we defined:

$$(g*f)'(0)\neq 0 \text{ and } \operatorname{Re}\frac{z(g*f)''(z)}{(g*f)'(z)}+1>0\,. \quad (5)$$

If we note by $p(z)=\dfrac{z(g*f)'(z)}{(g*f)(z)}$, deriving this relationship and making calculations we obtain

$$p'(z)=\frac{(g*f)'(z)+z(g*f)''(z)}{(g*f)(z)}-$$

$$-z\left[\frac{(g*f)'(z)}{(g*f)(z)}\right]^2 \Rightarrow$$

$$p'(z)=\frac{(g*f)'(z)}{(g*f)(z)}+\frac{z(g*f)''(z)}{(g*f)(z)}-$$

$$-z\left[\frac{(g*f)'(z)}{(g*f)(z)}\right]^2 \Rightarrow$$

$$z\,p'(z)=\frac{z(g*f)'(z)}{(g*f)(z)}+\frac{z^2(g*f)''(z)}{(g*f)(z)}-$$

$$-\left[z\frac{(g*f)'(z)}{(g*f)(z)}\right]^2 \Rightarrow$$

$$\frac{z\,p'(z)}{p(z)}=1+\frac{z(g*f)''(z)}{(g*f)'(z)}-\frac{z(g*f)'(z)}{(g*f)(z)} \Rightarrow$$

$$p(z)+\frac{z\,p'(z)}{p(z)}=1+\frac{z(g*f)''(z)}{(g*f)'(z)} \quad (6)$$

From (5) and (6) results

$$\operatorname{Re}\psi\left(p(z),z\ p'(z)\right)=\operatorname{Re}\left[p(z)+\frac{z\ p'(z)}{p(z)}\right]>0,$$

$z\in U$,

where $\psi(r,s)=r+\dfrac{s}{r}$. Applying Lemma 2 we obtain $\operatorname{Re}p(z)>0$, $z\in U$, ie

$\operatorname{Re}\dfrac{z(g*f)'(z)}{(g*f)(z)}>0$ which implies $f\in S^*$.

So theorem 4 is prove.

Theorem 5: Let the function g is convex. The function $f\in K_g$ if and only if $h\in S_g^{\ *}$, where $h(z)=z\,f'(z)$, $z\in U$ or $f\in K_g \Leftrightarrow z\,f'(z)\in S_g^{\ *}$.

Proof:

If suppose $f\in K_g$, then we defined:

$$(g*f)'(0)\neq 0 \text{ and } \operatorname{Re}\frac{z(g*f)''(z)}{(g*f)'(z)}+1>0\,.$$

If you derive function h, where $h(z)=z\,f'(z)$, $z\in U$, then we obtain:

$$h'(z)=f'(z)+z\,f''(z)\Rightarrow$$

$(g*h)'(z)=(g*f')(z)+z(g*f'')(z)$, $z\in U$, therefore

$$(g*h)'(0)=(g*f')(0)\neq 0 \quad (7)$$

If logarithamic the relation $(g*h)(z)=z(g*f')(z)$, $z\in U$, then we obtain $\log(g*h)(z)=\log z+\log(g*f')(z)$ and deriving this relation we have

$$\frac{(g*h)'(z)}{(g*h)(z)}=\frac{1}{z}+\frac{(g*f')'(z)}{(g*f')(z)} \Rightarrow$$

$$\frac{z(g*h)'(z)}{(g*h)(z)}=1+\frac{z(g*f'')(z)}{(g*f')(z)}$$

Therefore, we have

$$\operatorname{Re}\frac{z(g*f'')(z)}{(g*f')(z)}+1=\operatorname{Re}\frac{z(g*h)'(z)}{(g*h)(z)}>0\,. \quad (8)$$

From (7) and (8) we have $h\in S_g^{\ *}$.

If suppose $h\in S_g^{\ *}$, then we have:

$$\frac{(g*h)(0)}{z}\neq 0 \text{ and } \operatorname{Re}\frac{z(g*h)'(z)}{(g*h)(z)}>0,\ z\in U\,.$$

Performing the calculations we

$$\operatorname{Re}\frac{z(g*h)'(z)}{(g*h)(z)}=\operatorname{Re}\frac{z\,(g*zf')'(z)}{(g*zf')(z)}=$$

$$=\operatorname{Re}\frac{z\left[(g*f')(z)+z(g*f)''(z)\right]}{z(g*f')(z)}=$$

$$=\operatorname{Re}\frac{(g*f')(z)+z(g*f)''(z)}{(g*f')(z)}=$$

$$=\operatorname{Re}\frac{z(g*f)''(z)}{(g*f)'(z)}+1>0$$

Then $(g*f)'(0)\neq 0$ and $\operatorname{Re}\frac{z\,(g*f)''(z)}{(g*f)'(z)}+1>0$ which implies $f\in K_g$.

So theorem 5 is prove.

Theorem 6: Let the function g is convex. Then $S_g^{\,*}\subseteq C_g$

Proof:

If suppose $f\in S_g^{\,*}$, then we have:

$$(g*f)(0)=0 \quad \text{and} \quad \operatorname{Re}\frac{z(g*f)'(z)}{(g*f)(z)}>0.$$

Considering $f=\varphi \;\Rightarrow\; \varphi\in S_g^{\,*}$ and taking into account the definition we have

$$\operatorname{Re}\frac{z(g*f)'(z)}{(g*\varphi)(z)}>0 \text{ which implies } f\in C_g.$$

So theorem 6 is prove.

Theorem 7: Let the function g is convex. If $f\in C_g$ and the function h is convex, then $h*f\in C_g$.

Proof:

Since $f\in C_g$ we have

$$(g*f)(0)=0 \quad \text{and} \quad \operatorname{Re}\frac{z(g*f)'(z)}{(g*\varphi)(z)}>0. \quad (9)$$

Let

$$\frac{z(g*h*f)'(z)}{(g*h*\varphi)(z)}=\frac{(h*z(g*f)')(z)}{(h*(g*\varphi))(z)}=$$

$$=\frac{\left(h*\frac{z(g*f)'}{(g*f)}(g*f)\right)(z)}{(h*(g*\varphi))(z)} \qquad (10)$$

We know that the function h is convex and if we consider $F(z)=\frac{z(g*f)'(z)}{(g*f)(z)}$ and the relation (9), then applying Lemma 1 in relation (10) we obtain

$\operatorname{Re}\frac{z(g*h*f)'(z)}{(g*h*\varphi)(z)}>0$ which implies

$h*f\in C_g$.

So theorem 7 is prove.

Theorem 8: Let the function g is convex. Let $f\in C_g$ and the function h is convex, with $h(0)=h'(0)-1=0$. Then $C_g\subseteq C_{h*g}$.

Proof:

Let $f\in C_g$ and according to Theorem 7 we $h*f\in C_g$, ie

$$\operatorname{Re}\frac{z(g*h*f)'(z)}{(g*h*\varphi)(z)}>0.$$

Considering

$$\operatorname{Re}\frac{z(g*h*f)'(z)}{(g*h*\varphi)(z)}=\operatorname{Re}\frac{z(h*g*f)'(z)}{(h*g*\varphi)(z)}>0$$

which implies $f\in C_{h*g}$

So theorem 8 is prove.

References

[1] R. W., Barnard, C., Kellogg, *Applications of Convolution Operators to Problems in Univalent Function Theory,* Michigan, Math. J. 27 (1980), 81-94;

[2] W., Kaplan, *Close-to-convex schlicht functions*, Michigan Math. J.1, 2 (1952), 169-185;

[3] P.T., Mocanu, T., Bulboacă, G. S., Sălăgean, *Teoria geometrică a funcțiilor univatente,* Casa Cărții de Ştiință (Cluj), 1999;

[4] M. O., Reade, *On close-to-convex functions*, Michig. Math. J., 3 (1955), 59-62;

[5] T. N. Shanmugam, *Convolution and differential subordination,* Internat. J. Math. & Math. Sci., Vol. 12, nr.2 (1989), 333-340.

ADAPTABLE SOFTWARW – MODULAR EXETNSIBLE MONADIC EVALUATOR AND TYPECHECKER BASED ON PSEUDOCONSTRUCTORS

Dan POPA
[*] "Vasile Alecsandri" University of Bacau, Romania, e-mail popavdan@yahoo.com

Abstract. This paper is investigating the use of pseudoconstructors (a monadic data structure which acts as an itself evaluator) to be simultaneously used for evaluation of terms and also for typechecking. This can lead us to the conclusion that we have a new software technique for modular DSLs building.
Key words: pseudoconstructor(s), modular monadic typechecker in Haskell

1. Introduction

Modular building of domain small languages (DSLs) had attracted many scientists from decades. We may quote from papers like [6], [15] , including papers by Hutton and Meijer [3] [4],[5] to name only some authors. On the other side, the Haskell language (see Haskell Report[13]), a language widely used as a DSL for language building, also widely used for monadic computing (i.e. programming according to the monadic patterns) is providing the concept of modules [2] , [14] .

The first problem, when dealing with papers concerned modular DSL, we had noticed the amazing fact that the solutions was not modular (in sense of Haskell modules).
We had also noticed that some advanced parser combinators [3],[4],[5] , and some from [9] was not so modular as we think they are, because they are producing trees which are declared using a non-modular data declaration [14] pp 43-45 (algebraic data declarations). The problem is closely related to Wadler's Expression Problem. The problem was solved by us in this – paper - [10] using *pseudoconstructors over monadic values* as defined by [8].
Usually, the ASTs (abstract syntax trees) was not modular – because Haskell did not allow us to spread a tree *data* declaration in many Haskell modules. The *pseudo-constructors over monadic values* (i.e. monadic structures which are simultaneously data structures and self evaluated modular interpreters, see [8]) had offered the solution and now the trees can be modularly defined even by spreading the declarations of pseudoconstructors (sse [8]) over the whole set of modules included by a big project.

Modular monadic semantics [7], [13] (in ML) when was (re)implemented using Haskell also failed to be modular in the sense of Haskell modules (and [14]), due to the data declarations, too. This leads us to a whole language implementation , partially introduced by a Ph.D Thesis [10], [11] based on modular monadic itself evaluators , where itself-evaluators are carrying a modular monadic entry pointless semantic (i.e a semantic without a specific *interpreter* function). This solution was used by the Rodin Project [12].

Because the demo-language Rodin had not included a typical typechecker (the modular monadic semantics isolates types very well as monadic values indexed by types, and also because Rodin was a monotype language with some type additions - ex. Strings to be printed) we had concentrated now on the task of building typecheckers and evaluators based on pseudoconstructors from [8], but in the same time.

The problem is necessary to be solved: when sticking to the idea of entry-pointless interpreters and evaluators or typecheckers, apparently the pseudoconstructors from [8] have only one semantic. No two different functions: *interpreter* and *typechecker* seems to mean – at first sight – no two different interpretations possibles. The problem is to put the same modular monadic structure to do bothe (or more than one) things. Notice, in this context of discussion, the code of a pseudoconstructor implementing an itself-evaluator: it did not have any *interpret* or *typecheck* function defined.

Let's examine it. Basically, such a module looks like here:

```
<structure>  arg1 …  arg n  =
  do  {   v1 <- arg1 ;
          …
          vi <- argi ;
          …
          vn <- argn ;
          return     f (v1 … vn) }
```

Also notice: in an e-mail from Simon Peyton Jones, such modular piece of software was considered to be carefully studied, being suspected of not being so usefull in some cases (for example in code optimization) but this task is still an open problem for us.

2.The as-instance implementation

The Haskell standard language is implementing the concept of type class and instance of a class. Various instances of the same class can implement the same interface using very different semantic functions. We are introducing the idea of implementing both the modular monadic evaluator and the typechecker as instances of the same type class.

Speaking of type checker, our starting point is gathered from [1] but a large set of semantics and books concerning semantics or lambda calculus may also be used as starting point.

On the other side, the evaluator is inspired by those used by the Rodin Project [12] and the chap. 9 from [11] – Ph.D Thesis.

3.Types and values

For typechecking we had used the following type, representing various results which can be obtained by the process of typechecking a term built by (as seen in [8]) pseudoconstructors. To simplify, only on simple type, MyInt was used, but more can be similarly added:

```
data Type  =      MyInt
                 | TypeError
                 | Pair  Type Type
                 deriving (Show, Eq)
```

Note that this is not modular, being an usual data declaration so it should be defined from the beginning.

4.Values as support for the evaluation

Inspired by [15] we have used the folowing type, as implementation of the values provided by evaluation of the terms. The type below is different than those used by Prof. Wadler, but the idea behind it's use in computations is the same:

```
data  Value =      Wrong
                 |  Num Int
                 |  PairV Value Value
```

A custom instance of the Show class is used to print such results of the process of computing the values of the terms built by pseudoconstructors , from [8]. We discovered that Wadler's evaluation mechanism works fine on terms build by pseudoconstructors. Back to the instance of Show, we had defined:

```
instance Show Value where
  show Wrong      = " Wrong value"
  show (Num I)    = show i
  show (PairV x y)= show (x,y)
```

Remark: The paired values designed as (PairV x y) are printed in a common manner, as a t-uple where t=2, using round brackets, as in the Haskell language itself.

Also, in order to compare values, which is a normal operation whenusing for example, an *if,* the above values was also made an instance of the Eq class:

```
instance Eq Value where
  Wrong == Wrong               =  True
  Num a == Num b               =  a == b
  PairV a1 a2 == PairV b1 b2 =  a1==b1 && a2 == b2
  _ == _          = False
```

This will allow, for example, to check if the value of the first sub-term of an if expression is providing a value which is equal with 1 - as it is conventionaly used by C-like languages.

5.The "Computing with errors" Monad

In the above quoted paper, [15] a monad is used to capture the essence of computing in the presence of errors , and we will use it in our example, as model of computation for the *values* of the terms. As a remark, nowadays The Haskell Platform is including the Maybe monad which can also be used to model the computations with errors. Using the Maybe Monad here, is also a possibility. The name of the type is M, and it has a single type parameter.

```
data M a = Success a | Error String

instance Monad M where
  return a         = Success a
  (Success a) >>= k = k a
  (Error s)   >>=k  = Error s
error s = Error s
```

The meaning is usual: a finally computed value *a,* injected into the monad by *return* becomes a *Success a.* This is the result of a successful computation.

The *bind* (>>==) between *Success a* and a second computation k is defined as k applied to a. So, we can compute the result by simply extracting a from (Success a) and apply the (notice: monadic action) k. On the other side, an error produced by a computation should propagate and finally produce an error, as result of the whole computation.

The result of computations is also made showable, using also a custom instance of the Show class:

```
instance (Show a)  => Show (M a) where
  show (Success a) = "Success: " ++ show a
  show (Error s)      = "Error :" ++ s
```

6. The dual semantics

Modular monadic interpretation can be implemented as a type class, which can also be instantiated as a typechecker. The class we had defined, (called "interpretare") is including the following functions: *if0, operator, constant, prj, pair, variable*. Here it is, and it is based on the idea that semantics should not necesarry be a function from Values to Values than is usual, or a function from Values to M Values – as the functions are implemented in [15]. We considered that modular monadic semantics for the terms build by pseudoconstructors ([8]) should usually be a sort of function from *m values* to *m values* semantics – or usually a function from *m types* to *m types* (next column):

```
class Interpretare  typ where
-------------------Code of the type-checker--------------------
instance Interpretare Type where
  if0 e1 e2 e3   = do { tau1  <- e1 ;
                                tau2  <- e2 ;
                                tau3  <- e3 ;
                                return ( f tau1 tau2 tau3 )}
                                   where
                                        f  tau1  tau2  tau3  =
          if tau2==tau3 && tau1 == MyInt

          then tau2 else TypeError
                                        f  _  _  _  =  TypeErro
```

As a result of this definition we are able to evaluate the types of terms by simply typing the terms in the interactive mode of hugs or ghci, and specifying That we are interested in types. In the folowings line, the list monad is used as support for the do-notations but other monads can also be used (try the Maybe Monad – for example).

8.The evaluator

A standard evaluator, in this case using a dummy environment – but it can be replaced by a real one - is also writable as an instance of the previous class. Notice (by missing) the absence of interpreter or typechecker nominal functions.

```
instance Interpretare Value where
  constant i = return (Num i)
  variable v = return (g v)                    -- dummy lookup
function
                where
                  g "x" = (Num 1)
                  g "y" = (Num 2)
```

```
  if0:: (Monad m) =>  m typ-> m typ-> m typ-> m typ
  operator :: (Monad m)
   => (Int -> Int -> Int) -> m typ-> m typ-> m typ
  constant :: (Monad m) => Int -> m typ
  prj :: (Num t, Monad m) => t -> m typ-> m typ
  pair :: (Monad m) => m typ-> m typ-> m typ
  variable :: (Monad m) => String -> m typ
```

Of course, in some special cases, like the simplest terms packaging other kind of data, the signature will not include only *m type*-s. If needed, the interface of the class can be extended. Here, we have just put a minimal collection. The word "typ" can be read as "type" which is a keyword in Haskell.

7.The typechecker

Starting from the class above, the implementation of the typechecker is strightforward. As a general case, all the subterms of a term, are itself-evaluated and the results are used by a fucntion (called f,here) to produce the final result, in this instance the computed type of the complete term.

```
    constant i = return MyInt
    variable s = return MyInt
    operator p e1 e2 = do {    MyInt <- e1 ;
                                    MyInt <- e2 ;
                                    return MyInt }

    prj 1 e = do { (Pair tau1 tau2) <- e ; return tau1 }
    prj 2 e = do { (Pair tau1  tau2) <- e ;    return tau2 }
    pair e1 e2 = do {            tau1 <- e1;
                                    tau2 <- e2;
                                    return ( Pair tau1 tau2 )}

  End   ----------------------------------------------------------------
    if0 e1 e2 e3= do{v0  <- (constant 1);
                          v1  <- e1 ;
                          v2  <- e2 ;
                          v3  <- e3 ;
                          return ( f v0 v1 v2 v3 )}
                          where
                            f v0 v1 v2 v3 = if v1==v0
                                                then v2  else v3
    prj 1 e = do {(PairV i1 i2) <- e ; return i1 }
    prj 2 e = do {     (PairV i1 i2) <- e ; return i2 }
    pair e1 e2 = do {            i1 <- e1;
                                    i2 <- e2;
                                    return (PairV i1 i2)}
    operator p e1 e2 = do {a <- e1 ;
                                b <- e2 ;
                                return (lift p  a  b );
                               }
                             where lift op (Num x)  (Num y) =
                                        Num $ op x y
```

9. The results

As a result of this dual definitions, the terms based on pseudoconstructors (like in [8]) can be easily typechecked and evaluated, simply writing them in interactive mode or using them in programs. There is a supplementary need: due to the polymorphism involved. to specify the type of the terms is a must. Also the monad which is selected to be used with the do-notations is needed. The system is so flexible – being based on do-notation, that almost any monad can be used. In the following examples, the list monad is used, but it is just a simple possibility, which is available in the system without suplementary programming. The reader is encouraged to use the Maybe monad, too.

10. Examples

Let's evaluate and type check some terms, to see the dual modular monadic entry -pointless semantic at work for terms based on pseudoconstructors. For the following examples, we had asked a Hugs system (but also a ghc or ghci can be used) to compute the value (packed a s a list) and the type (also packed as a list) of some terms which are built based on pseudoconstructors. Also notice how the terms looks like, and how simple can they be written comparing with some other solutions.

dan@device:/media/disk/2011-HOAS-7feb$ hugs interpretare2.hs

```
Main> (constant 1) :: [Type]
[MyInt]
Main> (constant 1) :: [Value]
[1]

Main> (variable "x") :: [Type]
[MyInt]
Main> (variable "x") :: [Value]
[1]
Main> (operator (+) (constant 1000) (constant
1)) :: [Type]
[MyInt]
Main> (operator (+) (constant 1000) (constant
1)) :: [Value]
[1001]
Main> (operator (+) (constant 1000) (variable
"x")) :: [Value]
[1001]
Main> (operator (+) (constant 1000) (variable
"x")) :: [Type]
[MyInt]
Main> (pair (constant 1000) (variable "x")) ::
[Type]
[Pair MyInt MyInt]
Main> (pair (constant 1000) (variable "x")) ::
[Value]
[(1000,1)]
Main> prj 1 (pair (constant 1000) (variable
"x")) :: [Value]
[1000]
Main> prj 2 (pair (constant 1000) (variable
"x")) :: [Value]
[1]
Main> prj 1 (pair (constant 1000) (variable
"x")) :: [Type]
[MyInt]
Main> prj 2 (pair (constant 1000) (variable
"x")) :: [Type]
[MyInt]
Main> prj 2 (pair (constant 1000) (variable
"x")) :: [Type]
[MyInt]

Main> (if0 (constant 0) (variable "x")
(variable "y")) ::[Type]
[MyInt]
Main> (if0 (constant 0) (variable "x")
(variable "y")) ::[Value]
[2]
Main> (if0 (constant 1) (variable "x")
(variable "y")) ::[Value]
[1]
Main> (if0 (constant 1) (variable "x")
(variable "y")) ::[Type]
[MyInt]
```

The reader is invited to use ghc instead of hugs, to try other terms and even give a complete formal proof that this implementation can type and evaluate all of the terms built by this set of pseudoconstructors. Also he or she should notice: the monad of Successful and Errors computations is not necessary needed by this kind of solutions, but can be included as a part of it.

References

[1] Louis Julien Guillemette, Stefan Monier, *Type Safe Code Transformation in Haskell*, Univ. of Montreal, Electronic Notes in Theoretical Computer Science, Elsevier Science, 174 (2007) 23-39

[2] Hudak Paul, Peterson John, Fasel Joseph – A Gentle Introduction to Haskell 98, Yale University, Los Alamos Laboratory, 1999

[3] Hutton, Graham; Meijer, Errik; Monadic parsing in Haskell; Journal of Functional Programming 1 (1): 1-000, 1993, Cambridge University Press
[4] Hutton, Graham; Meijer, Errik; Monadic Parser Combinators - "Technical report NOTTCS-TR-96-4 Dept. Comp Sci Univ,. Nottingham – 1996 http://www.cs.nott.ac.uk/
Department/Staff/gmh/monparsing.ps
[5] Hutton, Graham; Meijer, Errik; Monadic parsing in Haskell; Journal of Functional Programming 8(4): 437-444,Jully 1998http://www.cs.nott.ac.uk/Department/Staff/ gmh/bib.html#pearl
[6] Ivanovik, Mirjana; Kuncak, Viktor; Modular Language Speciffications in Haskell; Institute of Mathematics, University of Novi Sad, Yugoslavia, 2000
[7] Liang S , Hudak P., Jones M. Monade transformers and modular interpreters, POPL'95. ACM Press,1995
[8] Pseudoconstructors over monadic values
http://www.haskell.org/haskellwiki/Pseudoconstructors_over_monadic_values
[9]Popa Dan; *Practica Interpretarii Monadice*, Matrix Rom Publishing House, 2008
[10] Dan Popa, *Modular evaluation and interpreters using monads and type classes in Haskell* , Studii si Cercetări Ştiinţifice, Seria Matematică, Univ. Bacău, (18) 2008, pp pag. 233 – 248
http://www.haskell.org/wikiupload/7/7d/POPA_D.pdf
[11] Popa, Dan ; *Metode si tehnici de realizare a interpretoarelor adaptabile*, Univ. "Al.I.Cuza" Iasi, 2010
[12] The Rodin Project
http://www.haskell.org/haskellwiki/Rodin
http://www.haskell.org/haskellwiki/RodinEn
[13] Zine-el-Abidine Benaisa, Emir Pasalic; DSL Implementation using staging and monads, Pacific Software Research Center, Proceedings of DSL'99: The 2nd Conference on Domain-Specific Languages , Austin, Texas, USA, October 3–6, 1999 http://www.usenix.org/events/dsl99/full_papers/sheard/sheard.pdf
[14] Peyton Jones, Simon (editor); Haskell 98 Language and Libraries The Revised Report, Cambridge University Press (May 5, 2003)
http://haskell.org/definition/haskell98-report.pdf
[15] Wadler, Philip; *The essence of functional programming*, The 19th Symposium on Principles of Programming Languages,ACM, Albuquerque, New Mexico, 1992

CONSCIENE PYRAMID

Diana MICUŞA[1], **Nicoleta TODOROI**[2],
ARA corr. member, AFCM, Chisinau, micusastil@micusastil.md
The "Gh. Dima" Music Academy, Cluj-Napoca, ntodoroi@yahoo.com

Abstract. Our conscious and subconscious minds have an evolutionary development. Conscience is ability or a faculty that distinguishes whether one's actions are right or wrong. It can lead to feelings of remorse when a human does things that go against his/her moral values, and to feelings of rectitude or integrity when actions conform to such norms.

The subconscious mind is one of the most powerful parts of the human psyche and it has a hand in controlling every aspect of your mind. It is one that is living within you logic processes, and while it is not there for you to see in plain sight, do not be mistaken.

Think of the subconscious mind as the storage room of everything that is currently not in your conscious mind; it stores all your previous life experiences, your belief system, your memories, your skills, all situations you've been through, and all images you've ever seen.

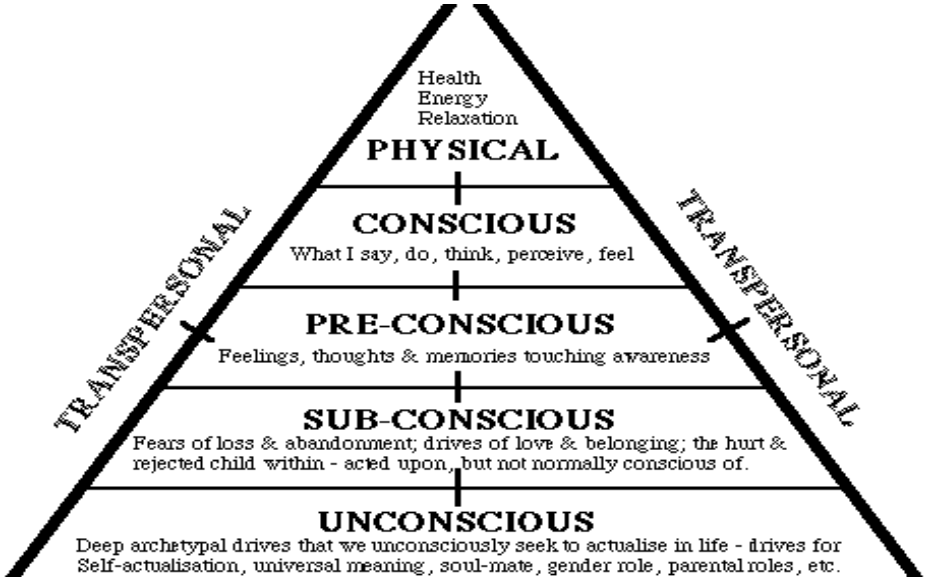
This essay is based on the communication „.Subconscious Mind evolution in Conscience Society" [16] presented by Nicoleta Todoroi, Dumitru Todoroi and Catalin Creanga at The HUMBOLDT-KOLLEG "Knowledge, Culture, Science – the Fundament of Quality of Life in Society", Timişoara, November 23-28, 2010

Keywords**:** Conscience, Subconscious, Subconscious Mind, Conscience models, Intent, Learning, Conscience Society.

1. Introduction.

The extraordinary power of human information processing can be seen as a product of the third great thrust of neural development that Paul MacLean has called the "neomammalian brain" – culminating in the structure of the human neocortex. The quest for coherence in the world, the search for a pattern to sequential events, is a reflection upon a long series of evolutionary changes in brain organization and complexity. These changes have brought us to the point where we can study in others, and admire in ourselves, a level of thinking far beyond anything that can be achieved in even the closest of our nonhuman relatives.

The term **subconscious** (see next "conscience pyramid") is used in many different contexts and has no single or precise definition [1, 7-10]. This greatly limits its significance as a meaning-bearing concept, and in consequence the word tends to be avoided in academic and scientific settings.



Sigmund Freud had explicitly condemned the word 'subconscious' as long ago as 1915: "We shall also be right in rejecting the term 'subconsciousness' as incorrect and misleading". In later publications his objections were made clear: "If someone talks of subconsciousness, I cannot tell whether he means the

term topographically -- to indicate something lying in the mind beneath consciousness -- or qualitatively -- to indicate another consciousness, a subterranean one, as it were. He is probably not clear about any of it. The only trustworthy antithesis is between conscious and unconscious."

In everyday speech and popular writing, however, the term 'subconscious' is very commonly encountered as a layman's replacement for the unconscious mind, which in Freud's opinion is a repository for socially unacceptable ideas, wishes or desires, traumatic memories, and painful emotions put out of mind by the mechanism of psychological repression. However, the contents do not necessarily have to be solely negative. In the psychoanalytic view, the unconscious is a force that can only be recognized by its effects — it expresses itself in the symptom. Unconscious thoughts are not directly accessible to ordinary introspection, but are supposed to be capable of being "tapped" and "interpreted" by special methods and techniques such as meditation, random association, dream analysis, and verbal slips (commonly known as a Freudian slip), examined and conducted during psychoanalysis.

The unconscious mind [11] is a term coined by the 18th century German philosophy romantic philosopher Sir Christopher Riegel and later introduced into English by the poet and essayist Samuel Taylor Coleridge. The unconscious mind might be defined as that part of the mind which gives rise to a collection of mental phenomena that manifest in a person's mind but which the person is not aware of at the time of their occurrence. These phenomena include unconscious feelings, unconscious or automatic skills, unnoticed perceptions, unconscious thoughts, unconscious habits and automatic reactions, complexes, hidden phobias and concealed desires.

The unconscious mind can be seen as the source of night dreams and automatic thoughts (those that appear without apparent cause); the repository of memories that have been forgotten but that may nevertheless be accessible to consciousness at some later time; and the locus of implicit knowledge, i.e. all the things that we have learned so well that we do them without thinking. One familiar example of the operation of the unconscious is the phenomenon where one fails to immediately solve a given problem and then suddenly has a flash of insight that provides a solution maybe days later at some odd moment during the day.

1. What is Subconscious Mind?

Observers throughout history have argued that there are influences on consciousness from other parts of the mind. These observers differ in the use of related terms, including: unconsciousness as a personal habit; being unaware and intuition. Terms related to semi-consciousness include: awakening, implicit memory, subliminal messages, trances, hypnagogia, and hypnosis. Although sleep, sleep walking, dreaming, delirium and coma may signal the presence of unconscious processes, these processes are not the unconscious mind. Science is in its infancy in exploring the limits of consciousness.

The idea of the 'subconscious' as a powerful or potent agency [1] has allowed the term to become prominent in the New Age and self-help literature, in which investigating or controlling its supposed knowledge or power is seen as advantageous. In the New Age community, techniques such as autosuggestion and affirmations are believed to harness the power of the subconscious [7] to influence a person's life and real-world outcomes, even curing sickness.

One example often used to explain the subconscious mind is the process of car driving. Initially when you are learning to drive, you have full concentration on the gear, the clutch, etc. You are all concentration on the process of driving; you look at every pothole, every bump, and every obstacle. As you get trained on driving, the act goes into your subconscious mind and you tend to drive without making a conscious effort to drive. You automatically avoid the obstacles, you automatically change gears when required while you could be doing umpteen other things at the same time like talking to your wife sitting beside you, listening to the music and observing the countryside. As you practice driving again and again, you make decisions automatically and you drive naturally. Driving decisions and actions go out of the conscious mind to the subconscious mind. After you have reached the destination, if you ask yourself which potholes or bumps you crossed on the way, you may not remember as you did not even notice when you actually slowed down and possibly changed gear to cross the bump. You did all that without being conscious of it.

Another example. You might know someone's phone number. This information is not stored in your conscious mind, but in your subconscious. If you think about it, you can produce the phone number, but it isn't simply floating around in your conscious mind. You need to direct your attention to memory in order to dredge up the phone number. Those memories you can recall easily are not conscious unless you pay attention and focus. When someone asks you to describe your perfect day, you reach into your subconscious mind for these memories.

Think of the subconscious mind [10] as the storage room of everything that is currently not in your conscious mind; it stores all your previous life experiences, your belief system, your memories, your skills, all situations you've been through, and all images you've ever seen.

2. The power of Subconscious Mind.

your logic processes, and while it is not there for you to see in plain sight, do not be mistaken. It is one of the most powerful parts of the human psyche and it has a hand in controlling every aspect of your mind.

One thing you need to know is that we always underestimate the power of the subconscious mind and this is something that we need to stop doing. It is far more powerful that we take it for and we need to

start learning how to use this to our advantage. What you need to first and foremost know about, is why it is there and how does it function as an entity living within the cortex of our brain.

The unconscious mind is considered as the storage room of everything that is presently not in your self-conscious mind; it stores all your previous lifetime experiences, your belief system, your memories, your skills, all positions you've been through, and all images you've ever seen.

3. What goes in our Subconscious Mind?

Based on whether our actions had positive or negative impact on us, we also made important judgements on do's and don'ts, things we should do and what we should not. We made our own judgements on where the life's potholes lie, what they look like, and what you do in life to avoid them. The problem is that we started making these judgements very early in our life when we were small kids and did not have the capability to truly judge the situations. But based on our kid-brains, we did pass some important judgements about do's and don'ts in life. We accumulated some learning and created a knowledge base. We passed judgements about ourselves, about people around us, about what type of people are good and what type of people are bad.

All of us made conclusions about people based on their looks. Just because that person with long nose and grey eyes we met was bad, our kid brain concluded that all men with long nose and grey eyes are bad. So through our kid-eyes, we have actually identified the potholes on the path of our life. These potholes are mainly situations or conditions which our kid brain has directed us to either avoid, or to retract. Or they are people with some particular physical traits, etc. which we as kids have concluded to be 'bad guys' to be avoided.

If some of our illogical beliefs in the early childhood, purely by chance, got support by a similar experience, the judgement and the learning got reinforced. A great deal of these judgements and learning of our kid brain have actually gone into our subconscious mind by repeated re-inforcements before we could mature and analyse them with our mature conscious brain. Some of these rules may be completely illogical, but they have got so firmly set in our subconscious that now when we see a person we will automatically react in a particular way and won't even know that we reacted that way. So just as we drive the car while avoiding the potholes and slowing down for bumps without really noticing them with our conscious mind, we tread the life's path avoiding imaginary potholes, slowing down on bumps that we defined in our childhood without even realising that we do so, without realising why we do what we do. Just as while we drive a car our brain makes several hundred decisions every moment without our conscious mind knowing it, we make numerous decisions every second in our life and we obviously don't make them with the conscious mind. These decisions are based on the knowledge base built in our subconscious mind. Our behaviour therefore is not a voluntary behaviour but largely governed by involuntary actions. And we call ourselves highly balanced people acting on conscious decisions.

4. Our behaviour is driven by our Subconscious Mind.

We do certain things out of conscious mind, whereas most of our actions are dependent on the subconscious mind. They are like reflex action in some ways, but different in many ways. In case of reflex action, there is some action or disturbance in or around you, and before you know or you realise it, your body reacts to the disturbance. But immediately after the reflex action, you know how your body has reacted. However in case of subconscious behaviour, most often, our conscious mind is not even aware that we have reacted to certain sub conscious stimuli.

It is said that the conscious mind is logical, analytical. Subconscious mind is illogical. And since most of our behaviour is governed by the subconscious mind, you can imagine that will be the outcome.

5. How to discover the Subconscious?

We believe that what is in our subconscious mind is hidden in some remote corner under some self imposed cover which we prefer to keep under cover (since most of these are recordings of unpleasant experiences). The difficult part is to discover it hidden in our subconscious mind. Once discovered, it may be easy to remove it. Following exercise can sometimes help to discover and eradicate some unpleasant things from our subconscious mind which unconsciously influence our behaviour.

6. Subconscious Learning.

Subconscious learning almost certainly is probable [7,14], and this has been backed up by many researches all over the world. What's more, subconscious education possibly will have an effect on our cognizant pronouncements - without any probability of us realizing it. Many researches from universities all over the Atlantic and North America have actually found that persons who had watched programmes and stimulation of a subliminal nature have found that they were able to learn better and pick up on the same, perceived patterns at a much faster rate than people who were not exposed to this before.

In fact, there has been some research into the whole subliminal learning when it comes to learning new languages. What has been seen is that when people listen to languages at a volume that is very soft, too soft for the person to actually hear properly but not too soft so that they can perceive it - have been found to not only learn the language much faster but also learn the syntax, pronunciations and the verbal skills.

These are some of the evidences that it is actually possible to learn subliminally, and this is just the tip of the ice berg when it comes to learning with the power of subliminal technology.

There are **three main aspects** that we want to look at when we are looking to unleash the **learning power** of the mind. For one thing, the mind is never turned off, even when we are in deep sleep, the preconscious aspect of the mind is much more aware and it is sensing the environment. This means that we are able to learn when we already asleep. Also, the brain's memory banks seem to be limitless, as there has been no scientific evidence or psychological evidence that we can actually forget things. The brain also does not overlap information, it actually neatly places and compartmentalises them into sections within the vast memory banks of the thalamus (arguably other parts of the lobe as well). When you combine these three things, you realize that there is a vast potential for learning far beyond what we are capable of. Unlocking it means we need to be able to speak to the controlling agent of these three aspects, the subconscious mind and once we can address it directly and reprogramme it to learn at much higher levels, then we would have succeeded in unlocking the power of subliminal learning in our brain.

7. Reprogramming your Subconscious Mind for success.

Many people go through their lives without understanding why they make the same mistakes, follow the same patterns, and live in the same ruts. They aren't happy with their present situation, but they seem to be unable to make any lasting changes.

Perhaps you've attend seminars, read books, and taken courses, but, in the end, fallen back into the same dysfunctional patterns you've always followed! Why does it always turn out this way? We struggle to make permanent changes in our lives because we input information only into our conscious mind. Here's the problem: your conscious mind is not what directs your behavior and belief system.

To change your behavior [1,7], you must first reprogram the hard-wired center of your mind: the subconscious mind. **Your subconscious learns behavior through repetition and practice**. Just as it learned to control your footsteps when you learned to walk, it also controls your footsteps in your life's journey based on what you've reinforced throughout your life. Just by reinforcing your new actions and thoughts, you will reprogram your subconscious mind!

There are several different techniques you can use to tap into the subconscious mind and reprogram how it works. Here are some strategies you can use to change your mind and change your life:

(1) **Affirmations.** Affirmations work to change your subconscious mind by using positive, personal, present tense statements to override the embedded negative thinking. By repeating these positive thoughts, you can create new pathways in your subconscious, giving it new attitudes.

Then your subconscious causes you to act in new ways that agree with these new attitudes. For example, repeating: "I choose healthy foods at each meal" can change your mindset about what you eat and why!

(2) **Visualization.** Visualization is the act of creating detailed mental pictures that depict a desired outcome so you can see success for yourself. These images stimulate the subconscious into accepting them as reality, which then directs behavior accordingly. Top athletes around the world use this technique during game-time.

(3) **Hypnosis.** Some types of therapy work with the subconscious mind, including hypnosis. Hypnosis works by easing you into a state of extreme relaxation. Once you're in this state, the conscious mind releases its grip, and the subconscious mind is easier to access. While under hypnosis, it's much easier to reprogram the subconscious into accepting new thoughts as reality.

(4) **Subliminal Audios**. You can use subliminal audios while you sleep. The conscious mind listens to music or someone speaking on one level, but the subconscious mind hears another layer of information recorded underneath the audible portion. When awake, the conscious mind is distracted with the audible portion of the audio, making it harder to tap into the subconscious mind.

Using techniques like these can help you reprogram your subconscious mind and remove the burden of the negative thoughts buried there. Imagine the freedom of living your life without the automatic dysfunctional behaviors you've had driving you for years!?

When you transform your negative outlook into a positive one, you can accomplish so much more. In doing so, your mind will be released from negative programming, allowing you to excel and succeed throughout your life.

8. The incredible power of intent.

Imagine two big spotlights. One is pointed upward, casting light far into the air. The other is pointed downward and buried into the earth - no light is cast at all. This is like intent. There are only two possible intentions in any given moment: the intent to learn about loving yourself and others, and the intent to protect against pain with some form of controlling behavior.

When you consciously choose the intent to learn, your light points upward, shining upon the truth that will guide you in your highest good [7]. Your mind opens and becomes a receiver of the information you need to support yourself in manifesting your dreams. Consciously choosing the intent to learn is the most powerful thing we can do. When we consciously choose the intent to learn, we open ourselves to our Higher Self - the part of us that connects us with the information and creativity in the universe.

When we unconsciously choose the intent to control, we shut off access to truth. Our mind closes and becomes like a closed circuit TV - recycling the old information that has been programmed into our mind. We become stuck in our limited mind, operating from the false beliefs that we learned as we were growing up. We become stuck in the past, recreating old hurts. The challenge here is that our unconscious automatic choice is to control.

When we were growing up, we all had to learn many ways to control to survive the challenges of childhood. We learned ways of trying to have control over how people feel about us and treat us, such as anger, blame, judgment, righteousness, or compliance. We learned ways to protect against losing ourselves to another's control, such as resisting or withdrawing. We learned many addictive ways of avoiding feeling our pain, such using food, drugs, alcohol, TV, Internet, sex, work, sports, gambling, shopping, self-judgment, and so on - all to have control over not feeling our painful feelings.

Most people immediately, and unconsciously, choose the intent to control the moment they feel any anxiety. The problem is that the intent to control is self-abandonment, always causing even more fear, anxiety or depression. Instead of shining the light of love upon your distress in order to learn and heal, you shove the light into the ground, causing more darkness.

Choosing your intent is the essence of free will, and it determines what you feel and what you manifest. While you might have momentary pleasure when something good happens, the deep joy and wellbeing that we all seek, and the ability to manifest your dreams, is the result of your intent to learn about loving yourself and others. The challenge in our lives is to remember that we are at choice - to remember to choose the intent to learn.

How can you remember to consciously choose the intent to learn? How can you remember the moment you feel any fear, anxiety, or any stress, to open to learning about what you are thinking or doing that is creating this stress? What can you do to stop your automatic reactive controlling behavior?

First of all, you need to accept that this is a lifetime practice - not something that will occur quickly [7, 14]. We have all been practicing the intent to control for most of our lives, so it will take much practice to even remember that there is another choice.

The place to start is to practice noticing your feelings throughout a day. Perhaps wearing a rubber band that you can snap on your wrist will remind you to check inside to see how you are feeling. You cannot begin to learn about your thoughts and actions that are causing your feelings until you are aware of your painful feelings. You cannot stop your addictive anesthetics until you are willing to feel your feelings and take responsibility for them.

If you decide that you are willing to feel your feelings, that willingness will lead you to becoming more and more conscious of your feelings. This is the beginning of being able to consciously choose your intent to learn.

9. Are Your beliefs holding You back?

Many people either tried to give up smoking or did all they could to lose weight, but in the long term were unsuccessful. Why is that? It is because their unconscious beliefs stood in their way?

Let's say you wanted to lose weight, you got excited, probably joined a gym or started going out for long walks or jogging. Perhaps you even made a decision to eat less fattening foods and more fruits and vegetables. Off you started with the 'new you'.

What happened a few days or a couple of weeks later? You went back to your old eating habits and your exercise regimen was added to the 'excuse jar'.

Again, we ask why is that? It's because your limiting beliefs stopped you from doing what you wanted. The limiting beliefs are by far more powerful than your wants and more powerful, in most cases, that your willpower. Limiting, self sabotaging beliefs reside in the unconscious mind. This 3 pound unconscious mind runs our lives - from our breathing, to our heart beat, to healing and much, much more. Approximately 90% to 95% of our lives are run by our unconscious mind.

Since our beliefs live within the unconscious mind, they, too, run our lives. The majority of your beliefs were formed when you were younger. You were initially programmed by your parents, teachers, friends, ministers, and more. As you grew older, your beliefs were formed from the media, people at work, your bosses, and so on.

You may be aware of some beliefs, but there are some you have no idea about, and do not even know they exist. They are buried deep within your unconscious mind.

Back to the example, if you are trying to lose weight and you have beliefs that skinny people look ugly, nothing but skin and bones, your unconscious mind will stick to those beliefs and will not 'allow' you to lose weight. It does not want you to look ugly and be nothing but skin and bones.

So, what do you do? You work on changing those sabotaging beliefs. You change them or eliminate them and then implant the beliefs that you do want.

How? Start off with one to three affirmations and say them to yourself as many times as you can throughout the day. Affirmations such as: "I give myself rewards for losing weight" or "I am determined to lose weight", or "I love and improve my body", or "I control my appetite", or "I eat right and exercise smart". Repeating your chosen statements often installs in your unconscious mind your intention and commitment to lose weight. In time, your limiting beliefs will have no power and you will have the new, enhancing beliefs. Be committed and be patient.

10. The Subconscious contains our unused potentials and our blockages

The subconscious contains within it our unused potentials, as well as the personal blockages that keep us stuck in the various problem areas of our life. The word shadow is a Jungian term and refers to those parts of us that are unconscious. Being unconscious, we do not see them (problems), but we often see their effects in our life, that is we don’t see what causes the shadow, but we see the effect.

Each of us has both a light and dark shadow, and each need to be examined so that energy captured there can be released.

10.1. Dark shadow: That which is holding us back. Repressed emotions, grief, hurts, inner wounds; all these are part of our dark shadow.

So are dysfunctional beliefs. For example, a belief such as, "If there is a flu around I'll catch it!" which, as you now understand, would attract the flu to you, could be called part of our dark shadow, especially if we are unaware of how this belief operates in our life.

Any part of us that makes us unbalanced and that we are unaware of can be called part of our dark shadow. The dark shadow is that part of us which is self-defeating, (autoînfrîngere) holding us back, often absorbing vast amounts of energy, leaving us feeling depleted, anxious, frustrated, and at the mercy of forces that we ourselves have set in motion.

The Mind Power student is keenly interested in both his light and dark shadows. He understands better than anyone what it means to ignore these shadow parts of his being. What is in our dark shadow is limiting us, so we do the inner work necessary to reveal these parts to us. Once revealed, we can design strategies to change those aspects of ourselves which are holding us back.

Now there is also the collective unconscious, which does not develop but is inherited. It consists of pre-existent forms, the archetypes.

The collective unconscious contains both dark and light shadows, and as such they are common to all of us. They reside as archetypal messages resonating in the human unconscious matrix and so find their way into all of us. One such dark shadow archetypal message is the belief, "I'm not good enough." This can be held as a general belief, "I'm not a good enough person" or something more specific, "I'm not a good parent / spouse/ artist/ mediator/ entrepreneur/ teacher, etc". When you find yourself thinking this, which you sometimes will, you can counteract the thought by first suspecting that it does not belong to you but rather to the collective. This works to make it non-personal, giving you the opportunity of nullifying it. It is our duty to overcome and heal the wound of "I'm not good enough" upon every occasion that it arises. By doing so we help not just ourselves but also the collective. We are helping our species when we refuse to accept shame.

Paradoxically, the act of eliminating shame is easier when we do it for the sake of others than when we do it just for ourselves. Doing this is not a selfish act; it is heroic. Shame is the original sin. What is not claimed and owned by the inner will manifest in the outer. The dark shadow must be faced and addressed or it will cause all kinds of problems in your life.

10.2. Light Shadow: Our potentials and those parts of us that have not been explored and brought to fruition in our lives. Special gifts and talents that lie underdeveloped, our art, our hidden desires, our unused and unexplored abilities, all these form part of our light shadow. Because we are a fragment, a holographic piece of the overall design of the universe [1, 7, 14], everything that is possible and good and excellent is potentially part of our light shadow.

While theoretically true, practically speaking, some things are more available to us than others. Not all the talents and gifts within the universe are ours to use, at least not in this particular lifetime. Some are more difficult to access, while others are waiting just below the surface, like a seed in a dried out river bed awaiting the rains to sprout and grow. Our light shadow can be discovered by following our bliss, our natural talents, our joys, our creativity. Trust what turns you on the most and follow it wherever it leads you.

The emergence of both light and dark shadow is always a positive event in our lives. It shows we are connected and in touch with the hidden parts of ourselves. When we awaken to these possibilities of transformation within ourselves, almost anything becomes possible.

2. **Conclusion.**

2.1. How to come into relationship with your subconscious?

You come into relationship with your subconscious by desiring contact. You educate the conscious mind to the existence of the subconscious's functions and potential through daily mediations [7]. Until you are aware of its existence, and not just in an intellectual way, you cannot work with the subconscious effectively.

(1) Contemplate daily the existence of this second mind.

(2) Think about the fact that the subconscious is part of the etheric web of all reality.

(3) Think about the potentials of imprinting into it, how it works, etc.

(4) Affirm to yourself daily, "My subconscious mind is my partner in success." This is a very powerful affirmation and has a threefold effect. First, by affirming "my subconscious mind," you are educating the conscious mind to the existence of this second mind. Secondly, by affirming "my partner," you are reminding the conscious mind of the possibilities and advantages of working with the subconscious. And thirdly, it is your partner "in success." By affirming this you are building up a success vibration [14]; you are weaving success into your etheric matrix. Make this a regular affirmation.

2.2. Dialogue with your subconscious.

Praise it and let it know how appreciative you are of its power and ability to create and interact with the etheric web:

(1) Tell it what you want to create and what imprints you are presently working with.

(2) Let it know that you are working diligently to have a functioning relationship established.

(3) Get to know this part of yourself as a separate and neglected component that is being welcomed back into the human matrix.

(2) By doing all of the above you will find that you will enter into "relationship" with your subconscious, and when you do, a whole new level of working with it reveals itself to you.

References:

[1]http://www.learnmindpower.com/articles/subconscious-contains-our-unused-potentials-and-ou/

[2] David G. Myers, Social Psychology,, McGraw Hill, 1993,p .101-110 http://books.google.com/books?id=hrydA45eCk0C&q=social+psychology&dq=social+psychology&pgis=1

[3] http://en.wikipedia.org/wiki/Human - cite_note-Bl-81

[4] Lycan, W.G., (ed.). (1999). *Mind and Cognition: An Anthology*, 2nd Edition. Malden, Mass: Blackwell Publishers, Inc.

[5]http://en.wikipedia.org/wiki/New_Age

[6]http://en.wikipedia.org/wiki/Pierre_Janet

[7] Kenneth S. Cohen. The Way of Qigong. The Art and Science of Chinese Energy Healing. // Ballantine Books, New York, 1997, 428 pages.

[8] Dumitru Todoroi. Muzica de la conştient la subconştient. / Proc. of the International Conference "Competitivitatea şi inovarea în economia cunoaşterii", Vol.II, Ed. ASEM, 2009, Chisinau, p.27-31

[9] http://en.wikipedia.org/wiki/Subconscious

[10] http://www.2knowmyself.com/Subconscious_mind

[11] http://en.wikipedia.org/wiki/Unconscious_mind

[12] Dumitru Todoroi, Nicoleta Todoroi, Dumitru Micusa. Conştiința: definiții, caracteristici, funcții, modele, adaptabilitate. // Proc. of International conf. "Modelare matematică, optimizare şi tehnologii informaţionale", Ediția a II-a, Chişinău, Evrica, 24-26 martie 2010, pp.268-287

[13] Dumitru Todoroi, Diana Micusa. Conscience Society in Information Era. // Proc. of The 34th Annual Congress of ARA, Bucharest, Romania, Presses Internationales Politechnique, Montreal, Quebec, Mai 18-23, 2010, p. 39-48

[14] Radu Mihalcea, Ion Gh Rosca, Dumitru Todoroi. Sisteme informatice in Societatea Conştiinței. // Analele ASEM, Editia a VIII-a, Editura ASEM, 2010, p. 341 – 360.

[15] Neumivachin I. P., Neumivachna L.S. Endoecologia zdorovya (Helth Endoecology). // DILYA edition, Moscow, St-Petersbourg, spb@dilya.ru, 2006, 540 pages.

[16] Nicoleta TODOROI, Dumitru TODOROI, Cătălin CREANGA. Subconscious Mind evolution in Conscience Society. // Int. HUMBOLDT-KOLLEG "Knowledge, Culture, Science – the Fundament of Quality of Life in Society", Timişoara, November 23-28, 2010 (To be published)

ASPECTS OF FAMILY INVOLVMENT IN EDUCATIONAL PROCESS

Valentin Cosmin BLÂNDUL
Universitatea din Oradea, e-mail bvali73@yahoo.com

Abstract. The issue of school-family collaboration is a widely known and a popular research theme both for Romanian and foreign researchers, who generally state, that the success of the educational process depends on the reciprocal collaboration of the two factors. Parents have the right to be informed about and the obligation to acknowledge the school behaviour of their children, whereas teachers need to consult and ask for their help and approval each time problems require to be solved. Therefore the present case study sets as its goal, to investigate the real aspects of the school-family collaboration in five rural schools. The study takes various economical and social factors into account, with which the communities are dealing. The group of interviewed subjects consisted of 60 teachers from the following schools in the Bihor County: Avram Iancu, Bogei, Cărăsău, Leş an Şuncuiuş. The questionnaire had 32 items and for the present research were taken only those items into account, which referred to the parental interest and implication in the planning of curricular and extracurricular activities. We measured also the type and amount of support teachers asked from the parents and also the parental implication in the after-school learning process of their children. The results of this investigation show, that in the most cases the collaboration function only in one direction, from the side of the school towards the parents. This collaboration happens only, if the school does not suffer any image damages, such those, which cannot be managed as internal matters. To optimise the "school-family" partnership, the following solutions will be recommended: to involve parents into the management structures of the school / class, to organise parental education courses and non-formal education courses for pupils, teachers and parents at the same time to offer financial help to the families in need, etc.
Key words**:** school, family, educational partnership, involvement, disadvantaged social categories, support.

1. The problem

In a very general approach, education can be regarded as "whole information, knowledge, skills and abilities that the child develops them in relation to family, school, social and cultural environment in which he lives" [4, pp. 13]. Analyzing the education definition, we can get a view about the complexity of the phenomenon, and that its achievement can not fall under the responsibility of only one person / institution. Share in which the educational factors get involved in the children formation is however variable, depending, among others, on his chronological age. Thus, in the first three years of life, the central role in child education lies to the family and, in particular, to the parents or to the legal guardian. Their main task is to child care and his early socialization. Alongside with family, to the early education achievement are involved a number of childcare institutions and child protection structures such as medical, day care centers for minors etc. [2]. In the second childhood, family and other educational agents mentioned are added to pre-school where the child forms the basic instrumental skills and perform its secondary socialization. School share to the human individual training becoming increasingly important starting with the 3rd childhood, an occasion in which the basic purchases acquired previously are consolidated, while putting the future foundation of the individual vocational guidance. Of those exposed, we realize that although each part of structure (family, school, community) has a very important role in achieving the child's education, to unitary fulfill the whole process is fundamental a close collaboration between each of them [3]. If the partnership is not properly managed, can lead to a genuine conflict between opposing systems of rules to the requirements of the child by family, school or group of friends to be antagonistic [1].

Involving parents in school life is governed through the rights and duties which they have [4, p. 26]:

a) knowledge of performance what is expected from their children at different

stages of development and intended for the end of each school cycle;

b) involvement in the choice of optional courses attended by their children;
c) inter-assistance to the class on the base of a written request addressed to the teacher;
d) involvement in the class or school Coordination Board and also in the Parents Committee;
e) information regarding the administration of the available money in the class or school fund.

As a conclusion, although absolutely all the experts insist on the need for close collaboration between school - community - family, to form a harmonious personalities of students, the reality proves that this activity is carried out often quite difficult, especially in the context of severe financial difficulties facing contemporary society. At the level of common sense, we can observe each institution tends to blame for any failures partners in raising children, sometimes throwing them responsibility for their own weaknesses. To what extent the empirical observations can be scientifically validated, which are the causes of problems, but mostly what it can do to optimize collaboration among all educational agencies - these are just some questions that this study aims to answer [5].

2. Research objectives

Starting from the above, the present research we aimed to establish the degree of achievement of the partnership established between school and family to educate the child. Concretely, we aimed the extent to which parents are involved in designing and teaching and carrying out the didactic and extra-didactic activities organized by schools, the extent to which parents are asked to get involved in their children disciplined behavior management, respectively the degree in which teachers support their students in achieving additional learning activities.

3. Subjects

For this research was selected a sample composed of 60 teachers working in 5 schools with grades I-VIII of Avram Iancu, Bogei, Cărăsău, Leş, respectively Şuncuiuş - Bihor county. Of these, 43.8% were male and 56.2% women, 37.8% had completed academic degree, 33.4% second degree, and the remaining 29.8% had grade I. The reason for selecting this sample was the desire to have a review endorsed on how the "School - Family" partnership is conducted within small communities, modest economically developed and numerous social problems related to unemployment, temporary work abroad, etc.

4. Research methodology

The method used in this research was represented by investigation based on the survey questionnaire and the instrument used for the 60 teachers was composed of 32 items grouped into the following categories: methods of collaboration between school and family, management of educational crisis, cooperation between teachers for didactic and extra-didactic activities etc. Quantitative interpretation of the results was done by calculating the frequency of the responses of subjects, the presentation of data obtained was carried out in graphical form.

5. Results

The results gained through quantitative interpretation of data are extremely interesting and can be viewed as follows.

Table 1. Involving parents in choosing teaching strategies and curriculum design activity

Frequency	S08 Avram Iancu	S08 Bogei	S08 Cărăsău	S08 Leş	S08 Şuncuiuş
Never	62,5%	25%	11,76%	62%	70%
Rarely	25%	66,66%	25,52%	28%	20%
Often	-	8,33%	17,66%	10%	-
Always	12,5%	-	47,05%	-	10%

Looking at Table1, we can observe that most teachers who teach in schools included in the survey, never used to consult parents in choosing the design of curricular activities or strategies used in teaching / learning / assessment (Avram Iancu S08, S08 Leş and S08 Şuncuiuş), and if however they do, this happens rarely (S08 Bogei). These results seem the more surprising as one of the fundamental right (and also an obligation) of parents is to inquire about their children during school and to be consulted when choosing and developing curricula, at least for the optional subjects. On the contrary, teachers who have sufficient teaching experience consider that they would not need the opinion of people outside the system. On the other hand,

parents or not know of their right to be involved in their children's school life, or simply, they does not have the time or interest required to do so. A special case is the S08 Cărăsău, where almost half of teachers declare that they involve their student's families' in the classroom activities. It seems that in small communities, relationship "school - the family" is forthcoming, and all those involved in the education of children are willing to collaborate.

Table 2. Involving parents in planning extracurricular activities

Frequency	S08 Avram Iancu	S08 Bogei	S08 Cărăsău	S08 Leş	S08 Şuncuiuş
Never	-	25%	-	31%	20%
Rarely	66,67%	75%	40%	48%	65%
Often	16,66%	-	40%	15%	25%
Always	16,66%	-	20%	7%	20%

Somehow similar things stand in terms of school availability to accept the family's involvement in the design of extracurricular activities; most responses suggest that this happens only rarely. Again S08 Cărăsău distinguishes itself by the majority of responses (60%) tip the balance between "often" and "always", which shows once again the openness of teachers working here with family and community. For the rest, we should observe a somewhat higher degree of permeability of the school on parents' involvement in the design of extracurricular activities, meaning that, whether for teaching activities, the refusal was almost categorically, now are more nuanced opinions (Table 2). This tells us that "ownership" of the educational process is still reserved exclusively for the school, while other activities are considered less important, teachers are willing to "delegate powers" and others, outside the system.

Table 3. Support parents to create a effective learning environment for their children

Frequency	S08 Avram Iancu	S08 Bogei	S08 Cărăsău	S08 Leş	S08 Şuncuiuş
Never	-	-	4,76%	-	10%
Rarely	12,5%	-	-	-	-
Often	50%	27,27%	23,8%	42,4%	60%
Always	37,5%	72,73%	71,43%	57,6%	30%

However, most teachers argue that provides support / advice to parents to help their children learn, doing so often (S08 Avram Iancu and S08 Şuncuiuş), that very often (S08 Bogei, S08 Cărăsău, respectively S08 Leş) (Table 3). The answers somewhat contradicts previous item, meaning that, in the problems of maintaining discipline in the classroom teachers doesn't collaborate with family, but they however do (and still quite frequently) in terms of dealing with problems of education. Seems to reinforce the idea that school is an institution willing to cooperate only if its reputation is not affected, but not wanting to accept that in some cases can't handle alone.

Table 4. Involving teachers in students' learning activities conducted after school program

Frequency	S08 Avram Iancu	S08 Bogei	S08 Cărăsău	S08 Leş	S08 Şuncuiuş
Never	25%	16,66%	-	10,2%	20%
Rarely	25%	16,66%	4,76%	14,8%	65%
Often	37,5%	66,67%	38,09%	57,9%	15%
Always	12,5%	-	57,11%	17,1%	-

Regarding the involvement of teachers in learning activities done by students after class hours, the proportion of responses range from a school / community to another. Thus, teachers of S08 Avram Iancu, S08 Bogei and S08 Leş argue that often they are involved in such activities; their colleagues from S08 Cărăsău say they always do that, while theachers of S08 Şuncuiuş rarely intervened in such activities (Table 4). Surprise the latter case, it appears that collaboration school - family are confined just about counseling regarding study support for children and less to homework or other supplementary didactic tasks. To the opposite

pole are S08 Cărăsău teachers, ready to fully involve in curricular and extracurricular activities of their students.

6. Discussion

A first aspect that should be discussed concerns the analysis of the economic environment, social and cultural context in which the 60 research subjects in the sample operate. Thus, research was conducted in rural areas, small and relatively compact communities where people know each other, and communication should not be a problem. But to have adequate partnership relations, both the school and the family must raise the cultural level and education to enable communication between them. Not always however it happens, and several reasons could be represented by the fact that some parents have a relatively modest degree of education, their employment on the labor market is relatively low, disadvantaged backgrounds, have relatively low life standard, or they are simply not interested in their children's school progress. It's hard to believe that these people will be able to express opinions pertinent to suggest that what teachers teaching strategies / learning / assessment to use or how to design curricular or extracurricular activities. It is no less true that, under these circumstances, teachers do not seem very interested to seek the cooperation of parents in this issue also. On the other hand, the same teachers say how interested they are about preparing students outside the classroom and indicated its willingness to provide support in this regard.

The main recommendations to achieve an effective educational partnership between school and family could be:

- Providing counseling families who request it;
- Identify parents “resource”, available to be involved in promotion of the phenomenon;
- Carrying out educational programs for parents;
- Identifying by the school of the cases and intervention in sense of improvement of school violence;
- The debate within various school structures of this themes;
- Acknowledgment by the school counselors a proactive role;
- Ensure an adequate school environment, promotion of values assumed by students, teachers and parents.

We consider that these ameliorative measures can give excellent results when are administered in a closely interdependence and involving all staff responsible for educating children.

7.Conclusion

As a conclusion, it appears that in most cases, school - family relation operates unidirectional, namely from school to parents. In other words, in the many times family collaboration initiative seems to come from teachers, most parents are too busy or uninterested to get involved in such action. May be however true the fact that some parents do not have the necessary skills to be involved in school life, they are not sufficiently trained for this purpose. On the other hand, the school is permeable to such collaboration only to the extent that its image is not affected. In the opinion of many teachers to accept the suggestions of "lay people" can be "recognition" of their tacit limits, likely to affect the professional prestige of the institution. To this can be added fact that outsourcings of discipline problems of students by seeking the family support may be represent the acceptance of institution's incapacity to effectively manage the educational crisis situations. All these problems increase in intensity in rural communities, where the fame is the village school. Fortunately, however, can’t be generalized phenomenon and the situation at S08 Cărăsău (where the partnership "school - the family" is authentic) could be taken as a model of good practice.

References:

[1] Blândul V. (2005) – *Introduction in Problems of Special Psychopedagogy,* University of Oradea Press;

[2] Chen R. (2008), *Financial Aid and Student Dropout in Higher Education: A Heterogeneous Research Approach*, in “Higher Education: Handbook of Theory and Research”, Volume 23, Springer Netherlands;

[3] Nicola I. (2000) – *Manual of General Pedagogy,* Aramis Publishing House, Bucharest;

[4] Popescu Marciana (2000) – *Involvment of Community in educational process*, Corint Publishing House, Bucharest;

[5] Sanders M., Epstein J. (2005) - *School-Family-Community Partnerships and Educational Change: International Perspectives*, in “Extending Educational Change”, Springer Netherlands;

NON-EXISTENCE OF FINITE APPROXIMATION RELATIVE TO MODEL-COMPLETENESS IN THE PROVABILITY-INTUITIONISTIC LOGIC

Olga IZBASH

Institute of Mathematics and Computer Science, Academy of Sciences of Moldova, str. Academiei 5, MD-2028 Chisinau, Moldova, e-mail oizbas@mail.md

Abstract: A. V. Kuznetsov [1] has introduced into consideration the provability-intuitionistic calculus and its interpretation in terms of $\Delta-$pseudo-boolean algebras. Author has previously established an infinite number of model-pre-complete classes in provability-intuitionistic logic. In the present paper, author has strengthened this result, and proved that this logic is not finitely approximated relative to model-completeness. It is constructed an example of system of formulas which is not model-complete in LC^{Δ} logic, but it is model-complete in any tabular extension of this logic.

Keywords: intuitionistic calculus, provability-intuitionistic logic, $\Delta-$pseudo-boolean algebra, model-complete system, approximated logic.

1. Introduction

Provability-intuitionistic logic formulas are defined usually on the alphabet that consists of propositional variables $p, q, r,$ eventually with indexes, symbols of operations

$$\&, \vee, \subset, \neg, \Delta \qquad (1)$$

and brackets) and (. The provability-intuitionistic propositional calculus I^{Δ} [1] is defined by the axioms of intuitionistic calculus I [2], three $\Delta-$ axioms

$$(p \supset \Delta p), \quad ((\Delta p \supset p) \supset p),$$
$$(((p \supset q) \supset p) \supset (\Delta q \supset p))$$

and two inference rules: modus ponens and substitution rule.

We agree to define the logic I^{Δ} as the set of deductible formulas in the calculus I^{Δ}. In general, any set of formulas in the signature (1), which contains the axioms of the calculus I^{Δ} and is closed relative to the rules for inference of this calculus, is called an extension of provability-intuitionistic logic. In this paper an important role will be played by the logic LC^{Δ} that is defined as

$$I^{\Delta} + ((p \supset q) \vee (q \supset p)).$$

As an algebraic interpretation of the calculus I^{Δ} and its extensions serve $\Delta-$pseudo-boolean algebras, i.e. systems of the type $< E; \&, \vee, \subset, \neg, \Delta >$, where $< E; \&, \vee, \subset, \neg >$ is a pseudo-boolean algebra [3], and conditions:

$$x \le \Delta x, \quad \Delta x \supset x = x, \quad \Delta x \le y \vee (y \supset x),$$

are satisfied, where $x \le y$ denote $x = x \,\&\, y$. A formula is valid in a $\Delta-$pseudo-boolean algebra A, if it is identically equal to the unity 1_A of this algebra. The set of all formulas valid in the algebra A is an extension of the provability-intuitionistic logic. We call this logic as the logic of the algebra A, and denote it by $L\mathrm{A}$. In particular; the logic LC^{Δ} coincides with the logic of $\Delta-$pseudo-boolean algebra

$$\mathrm{B} =< \{0 < \tau_1 < \tau_2 < \cdots < 1\}; \&, \vee, \subset, \neg, \Delta > .$$

So the equality $L\mathrm{B} = LC^{\Delta}$ is true.

We say that a formula F is expressible in the logic L through the system of formulas Σ, if F can be obtained from variables and formulas of the system Σ by applying a finite number of times the weak rule of substitution, which allows the passage from two formulas to the result of substitution of one of them into the other instead of all entries of some one of variables, and equivalent replacement rule in the logic L, which allows switching in L from one formula to a formula equivalent to her. However, if the formula F can be obtained from variables and formulas of the system Σ by applying a finite number of times only weak substitution rule, then F is direct expressible through Σ. The result of substitution the formulas $B_1, \ldots, B_n$ in the formula F instead of variables $\pi_1, \ldots, \pi_n$, respectively, we denote by the symbol $F[\pi_1 / B_1, \ldots, \pi_n / B_n]$ (or $F[B_1, \ldots, B_n]$).

Suppose the logic L satisfies conditions $I^{\Delta} \subseteq L \subseteq LC^{\Delta}$. A formula $F(p_1,..., p_n)$ of the logic L is named a model of a boolean function $f(p_1,..., p_n)$, if the equality

$$F(p_1,..., p_n) = f(p_1,..., p_n)$$

is identically true on the set $\{0,1\}$. The system Σ of formulas of logic L is called model-complete in L, if for any boolean function, at least one its model is expressible in the logic L through the system of formulas Σ. The system Σ of formulas is called model-pre-complete in L, if Σ is not model-complete in L, but for any formula F, which is not expressible in L through the system Σ, the system $\Sigma \cup \{F\}$ is model-complete in L.

The idea to research of a model-completeness belongs to A.V. Kuznetsov. A criterion for model-completeness in general 3-valent logic was obtained by Iu. N. Tolstova [4].

We say that a formula $F(p_1,..., p_n)$ preserves the predicate $R(x)$ on the algebra A, if for any $\alpha_1,...,\alpha_n$ of the algebra A the proposition $R(F[\alpha_1,...,\alpha_n])$ is true each time when propositions $R(\alpha_1),...,R(\alpha_n)$ are true. It is obvious, that a class of formulas that preserve on this algebra a given predicate is closed relative to the expressibility in the logic of this algebra. Therefore, if all formulas of a system Σ preserves on the $\Delta-$pseudo-Boolean algebra A some predicate, but the formula F does not preserve this predicate, we say that F is separated on this algebra A, by the system Σ through this predicate.

In connection with the following fact, previously established by the author [5], that there is an infinite set of model-pre-complete classes in the logic I^{Δ}, in this logic there is no criterion of model-completeness formulated in terms of a finite number of model-pre-complete classes. Theorem and the example below makes more complicated the problem of existence and construction a criterion for model-completeness in logic I^{Δ}.

It is known [6] that provability-intuitionistic logic I^{Δ} is finitely approximated in the following sense: logic L is called finitely approximated, if for any formula $B \notin L$, there is a tabular extension L^t of the logic L, such that $B \notin L^t$. Also, it is known, that the logic I^{Δ} is not finitely approximated relative to completeness in the sense of [7].

Logic L is called finitely approximated relative to model-completeness, if for any finite system of formulas Σ, which is not model-complete in L, there is a tabular extension of the logic L, which also is not model-complete.

Theorem. *Logic I^{Δ}, logic LC^{Δ}, and all logics intermediate between them are not finitely approximated relative to model completeness.*

Theorem statement follows from the following example.

Example. The system of formulas $\{\Delta p, \neg p \,\&\, q\}$ is not model-complete in LC^{Δ}, but it is model-complete in any tabular extension of the logic I^{Δ}.

Indeed, any formula F, that is a model of a boolean constant 1, is separated in algebra B by the system $\{\Delta p, \neg p \,\&\, q\}$ through the predicate $x \neq 1$. Therefore, the given system of formulas is not model-complete in logic LC^{Δ}.

2. Conclusion

We proved now that this system is model-complete in any tabular extension L of the logic I^{Δ}. The logic L coincides with the logic of some finite $\Delta-$pseudo-boolean algebra A. Since the system of boolean functions $\{1, \neg p \,\&\, q\}$ is complete in P_2, it is sufficient to show, that a formula, which is a model of a boolean function 1, is expressible in the logic L through the system of formulas $\{\Delta p, \neg p \,\&\, q\}$.

Obviously, each term of the following string:

$$(\neg p \,\&\, p), \quad \Delta(\neg p \,\&\, p), \quad \Delta^2(\neg p \,\&\, p),...,$$

$$\Delta^k(\neg p \,\&\, p),...$$

is direct expressible through the system of formulas $\{\Delta p, \neg p \,\&\, q\}$. Since the algebra A is finite, there is a finite number k $(k > 1)$, such that all terms of the above string, starting with $\Delta^k(\neg p \,\&\, p)$, are equal to the largest element of this algebra, i. e. to 1, and they are models of boolean function 1. So, the system $\{\Delta p, \neg p \,\&\, q\}$ is model-complete in L.

References

1. Kuznetsov A.V. *On the provability-intuitionistic propositional calculus*, DAN SSSR, V. 283, No.1,1985, p. 27-29 (in Russian).
2. Kleene S.C. *Introduction to metamathematics.* New York, Toronto, 1952.
3. Rasiowa H., Sikorski R. *The mathematics of metamathematics*. Warszawa, 1963.

4. Tolstova Iu. N. *The modeling of l-valued logic in k-valued (k>l).* Problemy Kibernetiki, Ser. 18, 1967, p. 67-82. (in Russian).
5. Izbas O.. A*n infinite number of model pre-complete classes in the provability-intuitionistic logic.* Proceedings of The 34-th Annual Congres of American Romanian Academy of Arts and Sciences, Bucharest, Romania, 2010, p. 567-570. (in Romanian).
6. Muravitsky A. Iu. *Finite approximability of* I^{Δ} *and non modelability of an its extension*. Mat. Zametki, V.29, No.6, 1981, p. 907-916 (in Russian).
7. Ratsa M.F. *Non tabularity of S4 logic with respect to functional completeness.* Algebra i Logica, V.21, No.3, 1982, p. 283-320 (in Russian).

ON FUNCTIONAL COMPLETENESS IN THE GR. MOISIL DUAL INTUITIONISTIC LOGIC

Mefodie T. RAȚIU

Institute of Mathematics and Computer Science, Academy of Sciences of Moldova,
Academiei str. 5, MD-2028 Chisinau, Moldova
ratsa@math.md

Abstract: Gr. Moisil [1] introduced into consideration the Dual Intuitionistic Logic. A.V. Kuznetsov [2] discovered the connection of this logic with the theory of distributive lattices. Dual Intuitionistic Logic [1] (DIL) is obtained from Propositional Intuitionistic Logic by enriching it with dual logic operations to implication and negation. Among the possible approaches of a problem in DIL is natural to study at the beginning the concerned problem for the case of intermediate logics between DIL and classical logic that are defined by finite distributive lattices. The simplest of these is the chain logic of three elements, which represents a specific fragment of trivalent general logic and coincides with the Lukasiewici trivalent logic. In the present paper we formulate four criterions of functional completeness in the chain extensions of Dual Intuitionistic Logic and also in the simplest not chain extensions of this logic.

Keywords: Intuitionistic Logic, Dual Intuitionistic Logic, expressible formula, functional complete system, predicate.

1. Introduction. Theoretical aspects

DIL is based on formulas built from symbols for variables p, q, r, possibly indexed by means of three pairs of dual operators: & and V, $\neg$ and $\rfloor$ (the weak negation), $\supset$ and $\setminus$ (subtraction), and parentheses. Formula $F \vee \neg F$ we note by $\perp F$.

An F formula is expressible in L logic by Σ system of formulas if F can be obtained from the variables and formulas from Σ with the help of weak rule of substitution and replacement rule of the equivalent in L. An Σ system of formulas is called (functional) complete in L logic if all its language formulas are expressible in L by Σ.

Consider the following algebra, explicitly stating its type

$$A = \langle M; \&, \mathrm{V}, \supset, \setminus, \neg, \rfloor \rangle \qquad (1)$$

which is lattice relative to the & and V, the operations $\supset$ and $\neg$ are also relatively pseudo-complement and respectively pseudo-complement, but the operations $\setminus$ and $\rfloor$ are dual to $\supset$ and $\neg$, accordingly.

Whether $\tau_0 = 1$, $E_m = \{ 0, \tau_0, \tau_1, \ldots, \tau_{m-2}\}$ if m is finite, and $E_m = \{0, \tau_0, \tau_1, \tau_2, \ldots\}$ if m is ∞. Let the multitude E_m is linearly ordered: $\tau_0 > \tau_1 > \tau_2 > \ldots$. Let's define the following operations on E_m:

$$p \,\&\, q = \min(p, q), \quad p \vee q = \max(p, q),$$

$$p \supset q = \begin{cases} 1, \text{ if } p \le q, \\ q, \text{ if } p > q, \end{cases}$$

$$p \setminus q = \begin{cases} 0, \text{ if } p \ge q, \\ q, \text{ if } p < q, \end{cases}$$

$$\neg p = p \supset 0, \quad \rfloor p = p \setminus 1.$$

Thus, we get the algebra

$$A_m = \langle E_m ; \&, \mathrm{V}, \supset, \setminus, \neg, \rfloor \rangle.$$

In interpreting the formulas on this algebra we get a logic that we note with LA_m.

Let's observe that take place the relations of inclusion

$$LA_2 \supseteq LA_3 \supseteq \ldots \supseteq LA_i \supseteq \ldots \supseteq \mathrm{DIL}$$

and also LA_2 is the logic of algebra

$$A_2 = \langle \{0, 1\}; \& , \mathrm{V}, \supset, \setminus, \neg, \rfloor \rangle$$

and coincides with the classical propositional logic. The logic LA_m will be m-valent dual chain logic.

We will note that a formula $F(p_1, \ldots, p_n)$ preserves on algebra A of (1) type a predicate $R(x_1, \ldots, x_m)$, if, for any elements $\alpha_{ij} \in A$ ($i = 1, \ldots,$

m; $j = 1, \ldots, n$), from the fact that the sentences are true

$R(\alpha_{11}, \alpha_{21}, \ldots, \alpha_{m1},), \ldots, R(\alpha_{1n}, \alpha_{2n}, \ldots, \alpha_{mn})$

result that the statement

$R(F[p_1/\alpha_{11}, \ldots, p_n/\alpha_{1n}], \ldots, F[p_1/\alpha_{m1}, \ldots, p_n/\alpha_{mn}])$.

is true.

Let's note by φ_0, φ_1, …, φ_4, classes of formulas that preserve on algebra A_2 the predicates

$$x = 0,\ x = 1,\ x \neq y,\ x \leq y,\ x \sim y = z \sim u.$$

Lemma 1 [3]. *In order that a system of formulas $\sum$ to be functionally complete in LA_2 it is necessary and sufficient that, for each classes φ_i $(i = 0, \ldots, 4)$, to exist in $\sum$ system a formula that do not belong to this class.*

Let's note by $R_5, \ldots, R_{14}$ the following predicates on algebra A_3, where $\tau = \tau_1$:

$$x = \tau,\ x = \neg\neg y,\ x = \lfloor\rfloor y,\ (x \,\&\, \bot y) \neq \tau,$$
$$(x \vee (y \,\&\, \lfloor y)) \neq \tau,\ (x = \neg\neg y) \vee (x = \lfloor\rfloor y),$$
$$\bot x = \bot y,\ (x \neq \tau) \vee (y \neq \tau),$$
$$(x = z \neq \tau) \vee ((x \neq \tau) \,\&\, (y = \tau) \,\&\, (z \neq \tau)),$$
$$(x = z \neq \tau) \vee ((x \neq \tau) \,\&\, (y \neq \tau) \,\&\, (z \neq \tau)).$$

Theorem 1 [4]. *In order that a system of formulas $\sum$ to be functionally complete in LA_3 logic it is necessary and sufficient that Σ to be functionally complete in logic LA_2 and, for each of the predicates R_5, ..., R_{14}, to exist in Σ a formula that does not preserve this predicate.*

Let's define additionally two predicates R_{15} and R_{16} on algebra A_4:

$$(\neg x = \neg y) \,\&\, (\lfloor x = \lfloor y),\qquad x = wy,$$

where the operation w is defined by table

p	0	τ_1	τ_2	1
wp	0	τ_2	τ_1	1

Let's note that the operation w is not expressed by any formula.

Theorem 2. *In order that a system of formulas $\sum$ to be functionally complete in LA_4 logic it is necessary and sufficient that Σ to be functionally complete in the logic LA_3 and for each of the predicates R_{15} and R_{16} to exist in Σ a formula that does not preserve this predicate.*

Theorem 3. *In order that a system of formulas $\sum$ to be functionally complete in logic LA_m where $m \geq 4$, it is necessary and sufficient that $\sum$ to be functionally complete in the logic LA_4.*

Let's consider the simplest non chain algebra

$$Z_5 = \langle \{0, \rho, \delta, \omega, 1\}; \&, \vee, \supset, \setminus, \neg, \lfloor \rangle$$

where the elements ρ and δ are incomparable and satisfy the relations

$$0 < \rho < \omega < 1; \qquad 0 < \delta < \omega.$$

Let's introduce into the analysis, 20 predicates on algebra Z_5 using $\Leftrightarrow$ symbol that we will read as "mean", but the operators & and V used at predicate union are understood classically:

$$P_1(x) \Leftrightarrow x = \rho,\quad P_2(x) \Leftrightarrow x \in \{\rho, \delta\},$$
$$P_3(x) \Leftrightarrow x \in \{0, \rho, 1\},\quad P_4(x) \Leftrightarrow x \neq \omega,$$
$$P_5(x) \Leftrightarrow x \neq \delta,$$
$$P_6(x, y) \Leftrightarrow (x = 0) \vee ((x = 1) \,\&\, (\bot\neg y = 1)),$$
$$P_7(x, y) \Leftrightarrow (x = 1) \vee ((x = 0) \,\&\, (\bot\neg y = 1)),$$
$$P_8(x, y) \Leftrightarrow (x = y) \vee ((\bot\neg x = \bot\neg y = \omega)),$$
$$P_9(x, y) \Leftrightarrow (x = y) \vee ((\bot\neg x = \bot\neg y = 1)),$$
$$P_{10}(x, y) \Leftrightarrow$$
$$\Leftrightarrow (x \in \{0, 1\}) \vee ((x = \omega) \,\&\, (y \in \{\rho, \delta\})),$$
$$P_{11}(x, y) \Leftrightarrow (x = y = \lfloor\rfloor y) \vee (x = \bot y = \omega),$$
$$P_{12}(x, y) \Leftrightarrow$$
$$\Leftrightarrow (x \in \{0, 1\}) \vee ((x = \omega) \,\&\, (y \in \{0, \omega, 1\})),$$
$$P_{13}(x, y) \Leftrightarrow$$
$$\Leftrightarrow (x = \omega) \vee ((x \in \{0, 1\}) \,\&\, (y \in \{0, \omega, 1\})),$$
$$P_{14}(x, y) \Leftrightarrow \bot\neg x = \bot\neg y,$$
$$P_{15}(x, y) \Leftrightarrow (\bot\neg x = 1) \vee (\bot\neg y = 1),$$
$$P_{16}(x, y, z) \Leftrightarrow$$
$$\Leftrightarrow ((\bot x \,\&\, \bot z) = 1) \,\&\, ((x = z) \vee (\bot\neg y = 1)),$$
$$P_{17}(x, y, z) \Leftrightarrow$$
$$\Leftrightarrow ((\bot x \,\&\, \bot z) = 1) \,\&\, ((x = z) \vee (y \in \{\rho, \delta\})),$$
$$P_{18}(x, y, z)) \Leftrightarrow$$
$$\Leftrightarrow ((\bot x \,\&\, \bot\neg z) = 1) \,\&\, ((x = \neg z) \vee (\bot\neg y \vee \bot z) = 1)),$$
$$P_{19}(x, y, z)) \Leftrightarrow$$
$$\Leftrightarrow ((\bot x \,\&\, \bot\neg z) = 1) \,\&\, ((x = \neg\neg z) \vee (\bot\neg y \vee \bot z) = 1)),$$
$$P_{20}(x, y, z, u)) \Leftrightarrow ((\bot x \,\&\, \bot\neg z \,\&\, \bot u) = 1) \,\&$$
$$\&\ ((x = u) \vee (\bot\neg y = 1) \vee (\bot z = 1)).$$

Theorem 4 [5]. *In order that a system of formulas $\sum$ to be functionally complete in the logic LZ_5 it is necessary and sufficient that Σ to be functionally complete in the logic LA_3 and, for each of the predicates P_i $(i = 1, \ldots, 20)$, to exist in Σ a formula F_i that does not preserve this predicate*

2. Conclusions

In conclusion, let remind that the problem of functional completeness in DIL and the problem of functional expressibility in DIL remain open.

References

1. Moisil Gr. C. *Logique modal*, Disquisitiones Math. Et Phys., Bucurest, 1942, Vol.11, Fasc.1, p. 3-98.
2. Kuznetsov A.V. *The connection of one extension of constructive logic with the theory of distributive lattices*, In the book: Vsesoiuznyi Koll. po obshchei algebre, Rezume, Novosibirsk, 1963, p. 32-33 (în Russian).
3. Post E.L. *Two-valued iterative systems of mathematical logic*, Princeton, 1941.
4. Ratsa M.F. *On the completeness of system of formulas in Chain Dual Logics*, Mat. Issledovania. Neclassiceskie Logiki, Chişinău: Ştiința, 1987, issue 98, p.71-92. (in Russian).
5. Ghalieh I.N., Ratsa M.F. *The solution of the problem of completeness with respect to expressibility in 5-valued non-chain extension of* DIL, Izvestia Acad. Nauk R. Moldova. Matematica, Chişinău: Ştiința, 1992, no. 4. (in Russian).

SONATA
IN DOMENICO SCARLATTI'S CREATION

Stela DRĂGULIN, Veronica DEMENESCU
Transilvania University of Braşov
No. 29, Eroilor Str., Braşov, steladragulin@yahoo.com
Universitatea de Vest from Timisoara
No.1, Piața Libertății, Timisoara, veronica_demenescu@yahoo.com

Abstract. Domenico Scarlatti (1685 – 1757), the composer with Italian and Spanish backgrounds, whose extensive contribution to keyboard music remains equally popular of our days, is a personality still sparkling hidden facets. The years between 1719 and 1757, period wherein Scarlatti composed the 560 piano, harpsichord and organ sonatas, display historical importance, especially within the Portuguese kingdom, due to which Scarlatti was introduced to Portugal and Spain. The terrible earthquake from 1755, which deprived the city of its great musical libraries, buried many important musical data from the first half of the 18th century. In any case, during the last 50 years, many aspects of Scarlatti's creation and life within the Iberian Peninsula came to light.

Keywords**:** bipartite sonata, internal rhythm, symmetrical equilibrium between phrases.

1.Introduction

Music history has recorded, over time, illustrious names, who have contributed to molding a genuine musical thesaurus. Numberless musical genres have well harmonized within the variegated array that illustrates the well-known epochs and periods of music history. One of culture's significant periods is Baroque.
In music, Baroque manifested by taking the ineffaceable shape of composers such as Johann Sebastian Bach, Georg Friedrich Händel, Domenico Scarlatti François Couperin, Jean-Philippe Rameau, Antonio Vivaldi and other outstanding representatives. A great treasure for music history dates back to this period and is embodied by Domenico Scarlatti's sonatas.

2.Search into Scarlatti's creation – an overview of the piano sonatas

A number of 562 sonatas have been discovered so far. They were written in Iberia; however their date and place are uncertain, these aspects depending on certain stylistic features, as well as musicological categories and considerations. They were composed for harpsichord, organ and piano. The manuscripts are being preserved in Venice, Parma, Vienna, Bologna and also in Spain and Portugal.

As regards the form of the sonatas, besides exotic trends, Scarlatti stands out through the innovations brought to bipartite sonata, having a single part. In accordance with Maurice Hinson, "Scarlatti conferred bipartite sonatas, an expressiveness never outclassed by another composer [1].
Kirkpatrick deems that Scarlatti's sonatas are binary-part pieces, divided in two halves by a double bar-line. The first half adverts the basic tonality, passing thereafter in the tonality of the dominant, of the major or minor relative, or even of the dominant's minor relative.
The second half starts from the tonic met at the double bar-line, cadences following and, eventually, the return to the basic tonality. He asserts that the crucial point is to be found at the end of each half, announcing the tonality wherein each part ends.

With respect to the musical instruments that Scarlatti would resort to, several information are available. He disposed of Spanish, Italian and French-origin harpsichords and pianos. They had several registers (more than 5) and variegated keyboard chromatic compass (from 49 to 61 keys). In Portugal, he disposed of 8 pianos and 6 harpsichords. Five instruments are still in their original condition and 3 harpsichords were later transformed into pianos. Most were designed and manufactured in the second half of the 18th century.
The categories of instruments must be studied in order to retrieve chronological information. For instance, from Kenneth Gilbert's studies, we can figure out that Scarlatti also came in contact with England, one of his harpsichords being of English origin [2]. The keyboard chromatic compass of the instrument that he composed and performed at was self-same with the ambitus encountered in sonata K 471. Scarlatti liaised with the Englishman Thomas Roseingrave (composer and harpsichord played) and with his uncle Francesco, established in London.

Definitely, every connoisseur of Scarlatti's sonatas is dazzled by their variegated qualities, be it harpsichord, organ or piano. « Of this latter category, who could shroud into oblivion Horowitz' spellbinding

colors and Pogorelich' special use of the pedals, expressivity, or Maris Tipo's vitality?"[3]. Some of the most difficult challenges in these sonatas are related to the rhythmical authenticity and architectural fidelity. Scarlatti may sometimes be very « Italian » and some others, very « Spanish ». He often forgets who and where he is, preferring to interlace and merge the two styles in a very special manner. Scarlatti was not only an outstanding harpsichord player, but also a vocal-work composer and a virtuosic performer.

He concept of internal rhythm, which defines the symmetry relations between musical phrases and cadences, places Scarlatti's rhythmic geniality on the same level with harmonic innovations.

The analysis of the sonatas in terms of microstructure does not supersede and offset the analysis of the macrostructure. Whilst the musical pieces of Scarlatti's Portuguese fellow (Carlos Seixas) are the very evidence for comprising more than a single part, not the same can be asserted about Scarlatti's creation.

So as to retrieve the correct style, perfect tempo, expressiveness and rhythmical vitality, so necessary for achieving Scarlatti's high quality music and technical requirements, we always undergo real challenge. The ability to control and express these aspects reveals remarkable performing musical spirit. Comprehending the symmetry between phrases and cadences, the variable metric and the crucial point ("Crux") we will be able to outline and shape an image upon the real significance of ideal performance. Interlacing and merging Iberian and Italian elements transform Scarlatti's creation into a special, even unique oeuvre.

3. Iberian elements in Scarlatti's sonatas

The influences of popular music upon his early Portuguese sonatas are not so marked as in Italian sonatas. We retrieve in the latter, several elements from "Fado". According to Clark, sonata K426 is representative for the essence and form of "Fado", having short phrases, interruptive pauses and the standard harmony model (I, IV, V).

Definitely, there are more than 140 sonatas composed in Portugal and Spain. Some of them might have been composed during the first five years spent by Scarlatti in Italy and sent thereafter to the king in Portugal. Evidence has been largely destroyed, during the 1755-earthquake.

The 61 sonatas of the collection "Libro di Toccate Per Cembalo" are also of importance, as a not yet published sonata (number 25) was discovered here. It is assumed they were sent to the king, from Madrid to Lisbon.

The piano sonatas well reflect the exotic atmosphere that Scarlati assumed and embraced in Iberia. It is deemed that most sonatas are based on Spanish influences, a source of inspiration being the composer's second wife, Anastasia. In his music, Scarlatti captured the sounds of castanets, guitars and the Spanish dance's intensity and passion.

Flamenco is a well-known popular music genre from Southern Spain, being sung by specialized artists, with guitar accompaniment. We notice the absence of a strict rhythm, the expressive ornamentation, the repetition of short phrases, the wistful state, the E minor tonality prevalence, with some variations. Musical genres whose characteristics are featured in Scarlatti's sonatas are Jota, Buleria, Petenera, Saeta etc.

A dance which influenced Scarlatti was "**Jota**", Fig.1. It is represented in several variants throughout Spain. "Jota aragonea" has ternary, swift tempo, being encountered in several sonatas, such as K 21, 33, 44, 62, 79, 96, 97, 101, 102, 105, 108.

There is worth mentioning the Jota dance in 6/8 measure, come across in the following sonatas, Fig.2: K 129,135, 137, 159, 172, 174, 218, 222, 245, 268, 278, 286, 305, 319, 323, 334, 340, 350, 372, 375, 398, 401, 403, 405, 413, 429,433, 444, 457, 477, 494, 525, 531, 541, 543, 555. In Scarlatti's creation, "**Buleria**" stands out, being originally a dance and a song proceeding from the "Flamenco" genre. A representative example is Sonata K.492, Figure 3.

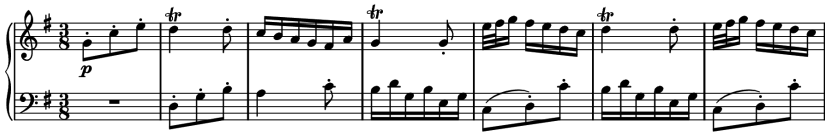


Figure 1

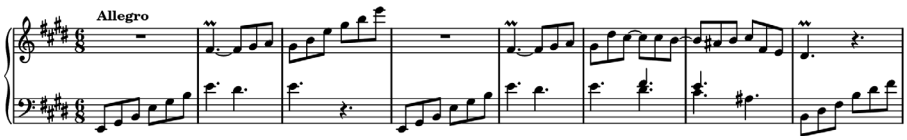


Figure 2

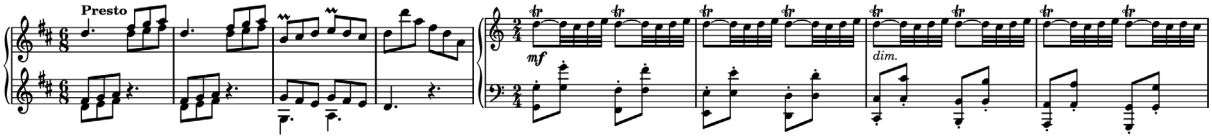


Figure 3

Figure 4

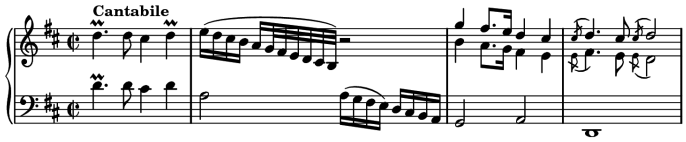


Figure 5

"Petenera" is a dance characterized by the alternation of the measures of 3/4 and 3/8. It may be retrieved artistically remodeled in sonata K.502, Fig.4.

"Saeta" is a popular song originating in Andalusia, which set its musical imprint on a few sonatas of Scarlatti's creation, such as Sonata K. 490, Fig.5.

4. Symmetry between phrases and cadences

Analyzing the "Exercises", for instance the ones dedicated to Scarlatti's Portuguese protector, King John V, we can form an image upon this concept. They were published between 1738–1739, however they had been written long before. The perfect symmetry (equally-dimensioned phrases) stands out, existing in every bipartite section.

When Scarlatti conveys outwardly his Italian side, the phrases and cadences usually succeed each other regularly. But when his Iberian roots get their groove, they carry along and burgeon early-Renaissance elements. An example of unequal phrases, which is not part of the "Exercises", may be retrieved in sonata Gavota in D minor, K. 64. At first audition, the listener perceives a symmetrical equilibrium between phrases and cadences, but at further in-depth analysis of the internal rhythm, the opposite may be discerned In Gavot's commencement, we find the scheme of 7+9 measures: the total of the measures is 16, but the uneven distribution of the measures' values is distributed according to the following formula:

7 (4 +3) + 9 [4 + 5 (3 + 2)] = 16 measures

Scarlatti is by no means a commonplace composer. He always makes sure that the previous phrase is dissimilar to the following.

5. Variable metric

Scarlatti is a genuinely modern composer. Metric methods proper to contemporary music are likewise frequently used in Scarlatti's sonatas, with the only difference that he does not highlight them. Therefore, performers must be very careful to these unexpected methods in order to form a correct image upon the rhythm and architecture of the musical piece. An element encountered in some sonatas is the Spanish Phrygian descending cadence. Hemiolas are also frequently encountered. There is worth reminding that Scarlatti never changes measure during a musical piece, but he nurtures expectations for the performer to adequately group the measures. Knowledge upon Baroque and its specific dances are of usefulness in understanding how to perform these musical works.

The grand specialist in the real significance of Scarlatti's creation, Ralph Kirkpatrick, attributes the term of "crucial point" to a structural phenomenon in the composer's creation. "Crux" is that mid-point of each bipartite sonata wherein the thematic material introduces the final tonality [4]. In other words, the location of this crucial point always depends on the stability of the final tonality and on establishing the thematic parallelism between the two halves. "Crux" is important to performers as the ability to enhance the architectonic form of a musical piece and likewise the expressiveness within longer phrases and sections are secrets underlying high-quality performance.

6. Conclusions

Most of the 555 sonatas were achieved in pairs [5]. Therefore, a tonal relationship was established between these musical jewels, pairs of sonatas existing in the same tonality, however one having been written in the major mode and its correspondent having been obviously composed in the homonymous tonality. These sonatas are not only in tonal relationship, a dynamic contrast or connections as regards the tempo or the composing complexity being manifest. The outcome is a marvelous collection of piano pieces, all of singular artistic quality. The piano-technique facet in Domenico Scarlatti's sonatas is a world of its own. Ever since the early beginnings of the music composed for keyboard instruments, th The approach and compliance with the technique difficulties in Scarlatti's sonatas are one of the most enticing characteristics of his music. In this sphere, he is superior, ludicrous and extremely practical. These sonatas highlight both the creative and performing potential. Scarlatti's oeuvre stands for an analytical synthesis of piano-texture, phrasing and performing elements.

What we may conclude is that Scarlatti's music does not reach much too ample dimensions. He conveyed through

music, optimistic life aspects, as youth, exuberance, joy of living, nature etc.

The appearance, within the first section, of two themes with different tonalities is typical to Scarlatti's sonatas (despite their self-same content), which will later turn into the main and secondary theme. In this sense, section A will grow into the exposition of the classical-form sonata. Section B contains the germ of development and reprise, however only for the secondary theme.

From the innovations brought through by Domenico Scarlatti, we may notice that for him, the development of the musical forms is a long process of accumulation and nowise of forging new forms since the very beginning. Tradition and innovation interlace within his creation.

Music history has recorded Scarlatti's decisive role in crystallizing sonata. Analyzing his creation, we may follow this process, understanding how such a great turning point was reached in finding new forms of expression.

When we use the term of sonata, we refer on one hand to a music genre and, on the other hand, to a musical form. Between these two clashing meanings, there is an essential difference: they are two distinct categories of musical structure.

In the road covered by the form of sonata, from the mono-thematic to the bi-thematic type (sonata itself), Domenico Scarlatti's contribution, who made the first step on this path, is worth being emphasized and analyzed. The content of his music, which is still enticing the audience, cannot be separated from his searches in the field of the form. The freshness and brilliance of his music, rich in creative fantasy doubled by indisputable artistic personality make his musical works enjoy appraisal even in our days. Who attentively listens to his sonatas will feel the joy to discover intonations similar to the popular ones, in character, melody and rhythm. These qualities suffice to account for his creation having abided over the centuries.

References

1. Peter Williams. *Bach, Handel, and Scarlatti 1685-1995*, Cambridge University Press, ISBN -13: 9780521082136, Cambridge,1985.
2. Kirkpatrick, Ralph. *Domenico Scarlatti, Sixty Sonatas*, Princeton University Press, ISBN 0-691-09101-3, Princeton, 1953.
3. Vidal, Carole. *Alessandro and Domenico Scarlatti: A Guide to Research* Schirmer, ISBN 978-0824059422, New York, 1993.
4. Sutcliffe Dean. *The Keyboard Sonatas of Domenico Scarlatti and the Eighteenth-Century Musical Style*, CambridgeUniversity Press,ISBN : 9780521481403, Cambridge, 2003.
5. Boyd, Malcolm. *Domenico Scarlatti-Master of Music,* Shirmer, ISBN 0028702913, New York, 1986.

SCHENKERIAN ASPECTS IN PIANO PERFORMANCE

Stela DRĂGULIN
Transilvania University of Braşov
No. 29, Eroilor Avenue, Braşov, steladragulin@yahoo.com

Abstract. The purpose of the article herein is to submit an introductory overview of the Schenkerian conception upon musical structure, to explain the reasons for the musicians' abiding by it and, beyond this, to demonstrate how it might contribute to solving certain issues faced, of our days, by musical performance. I cannot think of a more satisfying way to introduce Schenker's ideas, together with the terminology and visual means that it expresses, than to comment, to a certain extent, on one of the analytical sketches conceived according to his theory. The boldness and the very comprehension of Schenker's work are the guarantee for his being a controversial figure for the years to come. Nevertheless, we hope this analysis upon his oeuvre, through providing accurate information to those who are unfamiliar with it, will serve to placing future discussions on a more rational basis than formerly.

Keywords**:** concept of structural levels, instrumental musical performance, analytical sketch.

1.Introduction

Schenker's great achievement – which might be called deepening musical significance through discovering the principle of the structural levels – has covered an almost 40-year period and has paved the way to a deeper knowledge of musical structure through his finding that, within a composition, the various surface events are specifically associated, with fundamental organizing. After a period of time, Schenker's discovery gradually assumed a more distinct form, through the *concept of the structural levels* [1]. So as to substantiate this idea, Schenker coined a special vocabulary and forged unique performing means. In many respects, Schenker's oeuvre provides us with a model of what a performing musician's endeavor should be – one may search in vain for a similar effort. And, nevertheless, Schenker did not deem himself to be a theorist or musicologist, but rather an artist. He does have an artist's traits of boldness and perseverance combined with intelligence and prowess (which we likewise associate with those featured by a genuine scientist), traits that distinguished him from the pedantic fanatic who, too often in Schenker's times, bore the name of theorist. Let us nurture the hope that, as his ideas are better comprehended and applied, Schenker's image as visionary will be superseded by the image of unique, original and overly talented person. For the conceptual setting that he exposed, as well as for the great quantity of specific musical structures that he offered, he deserves all musicians' appraisal.

It may be noticed that the basis of Schenker's concept upon structural levels, which underlie his theory, will neither be found in abstruse speculations, nor in acoustic or metaphysical formulations, but in the very organization of music. Schenker has consistently derived his theoretical formulations from auditory experiences of real musical compositions and verified them at the same source. Moreover, his analytical techniques, much as his analytical concepts, are directly related to the performance and composition practices which lie at the core of tonal music's development.

Schenker deemed his analyses as tools that the performers should avail themselves [2] in view of a deeper understanding of the works they were performing.

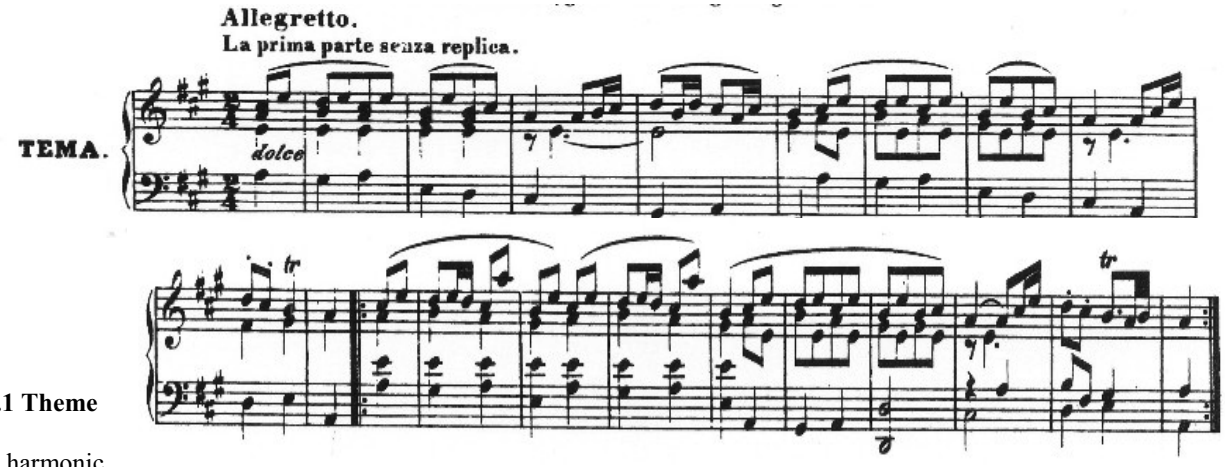
2. Variations in A Major WoO 71

Beside the development of the sonata form, Beethoven substantially contributed to the enrichment of the theme and variations. The variation procedure appears in both actual musical works and sonatas, quartets or symphonies. Along with thematic contrast, the variation procedure underlies Beethovenian symphonism. Within pre-Classical music, variations were conceived as a means of varied repetition of the theme. For Classical musicians, variations have an entertainment nuance, differentiating through different adornments. Starting from this principle, Beethoven extends the expressive sphere of the variations, enriching their dramaturgic content. He achieves the shift from the ornamental-type variations to the character variations, which is from the succession of still pictures to the evolving chain of essence-connected images.

Amongst Beethoven's piano works, more than 20 cycles of variations stand out, whereof most are youth ministry, not published during the composer's life, with opus number, catalogued in *Werke ohne Opuszahl* (abr.WoO). Their majority are not written on original themes, but on actually commonplace melodies, pertaining to his contemporaries (ex. Waltz by Diabelli,

which inspired the magnificent cycle of 33 Variations op.120), the great composer attempting thereby to further show off his mastery in the "art of diminution".The 12 Variations in A Major WoO 71 (1796-1797) were written on a Russian dance melody, extracted from the ballet *Das Waldmädchen* by Paul Wranitzky.

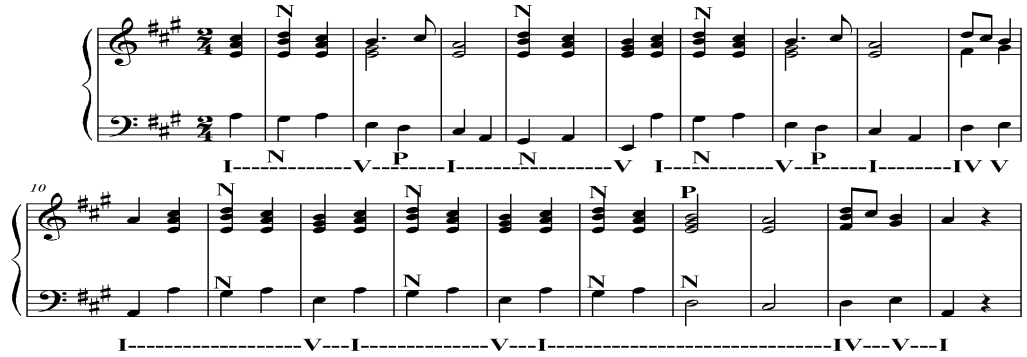
2.1 The theme is a simple bi-strophic form, in coral-type scoring in four voices. It consists in two asymmetrical periods (Per.1=10 measures; Per.2=9 measures) with self-same content. Clear and easy to remember, with simple melodic, rhythmic and harmonic structure, it represents a structural model for the 12 homophonous variations:



Ex.1 Theme

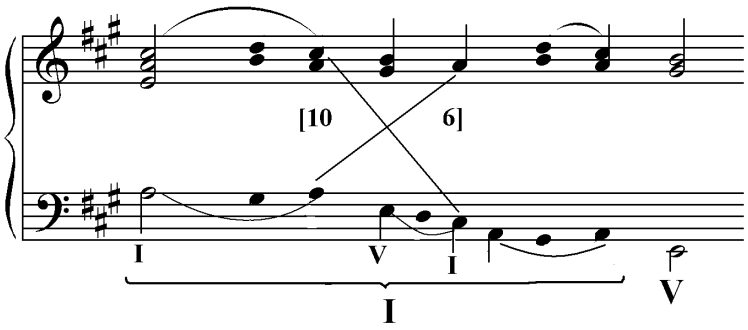
The harmonic model is kept during variations. The higher-transfer complete figure (N) constitutes the basic motif of the theme. The transfer note enhances the principal note of the higher voice (*C#),* whereas at bass, the tonic is emphasized (*A)* through the transfer with the inferior sound nearby (*Gl#).* The importance of this motif is underlined also through the slight dynamization, applied at the beginning of the theme's second period: separation of context, stopping on the inferior transfer (*B)* and repetition, with emphasis, by circumscribing, of the principal note (*C#)*.

The two basic diminutions – neighbor note (N) and passage (P) make up the motif surface of this theme, as it follows from the rhythmic-harmonic reduction, whereof the plan figured on the quint (*I)* was eliminated:



Ex. 2 Theme – Rhythmic-harmonic reduction

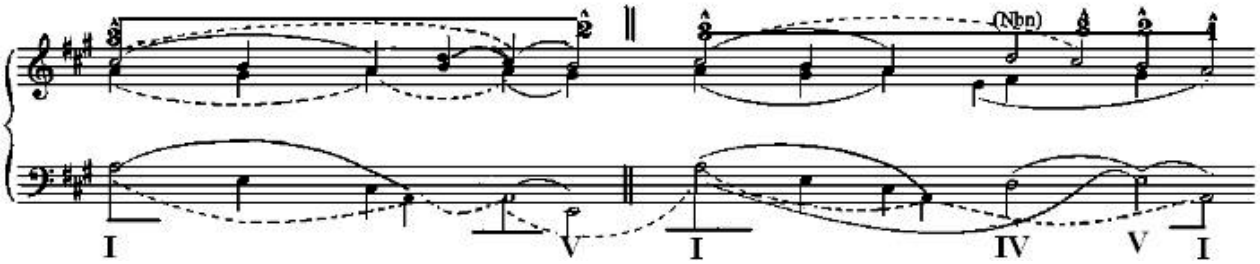
It may be noticed that the chords alternate among the scale steps I and V. The chords with no Roman figures are linear-tuning systems (resulting from the voices' melodic movements), being attached to the chords nearby. These ones are passing chords (P) or transfer chords (N). In reality, due to the pre-eminently gradual evolution (passage, transfer), the harmonic prolongations of the scale step I may be noticed, in the form of the progression I-V-I. In measure 5, a stop on the scale step V may be seen. Likewise, the scale step V, which precedes the final tonic, is, in its turn, prepared by the chord of the scale step IV. A voice transfer stands out, between the discant and bass, which underlines the most important interval of the basic structure – major third *A-C#*:



Ex. 3. Prolongation of the scale step I, measures1-5

At the end of each of the theme's two periods, the basic structural harmonic progression I-V is enriched with the scale step IV, which prepares the apparition of the scale step V.

.



Ex.4 Medium structural level of the theme (Middleground)

The structural harmonic progression I-V binarily divides (in equal phrases) the two periods of the theme.

Ex.5 Medium structural level of the theme (Middleground)

If we eliminate increasingly more the surface elements, we notice that we draw closer to the fundamental structural model in tonal music: arpeggio-evolution, typical to the bass I-V (*Bassbrechung*) and linear progression of descending third in the discant $\hat{3}$-$\hat{2}$-$\hat{1}$ (*Urlinie*), according to the Schenkerian principle [3]

.

Ex.6 Fundamental structure of the theme

While the harmonic component and the diminutions - motifs (in extended values) enunciated in the theme, namely the elements pertaining to the deep level of the musical structure, represent the constants of the musical work, the 12 variations reveal, through the technique of the diminution to smaller (in detail), the variables on the foreground of the musical structure. Therefore, we may consider that we deal with a cycle of strict ornamental variations, ending with an ampler Coda.

2.2 Variational procedures used throughout variations

Var.1 – achieve a rhythmical dynamization through syncope, which delay the thematic pillars by a quarter.

The pedal figured on *E,* characteristic element in the theme's accompaniment, distances itself by an octave against the main voice;

Var.2 – heterogeneous polyphonic scoring: the theme, doubled in octaves, rhythmically shifted through equal syncope, is constantly counterpointed in sixteenth values. A dynamization is achieved through raising the rhythmical values against the preceding variation;

Var.3 – isorhythmical harmonic scoring. A relaxation is attained after the two previous variations. The theme's ethos changes through modal inversion (*A minor,* homonymous tonality). Certain thematic pillars (the sound *A)* are circumscribed with chromatic transfer notes (*B b* ➔ *A; G#* ➔ *A*);

Var.4 – register variation: the theme passes to the tenor; rhythmical dynamization through figurative enrichment of the pedal on *E* (rhythmic-melodic diminution achieved with passing sounds);

Var.5 – harmonic variation: the theme is rendered by the arpeggio-spread harmonic figurations, as distinct plane of a compound melody wherein, beside arpeggios, also the delays of the thematic pillars intervene, through higher neighbor notes (measures 2-3);

Var.6 – imitative polyphonic variation with antiphonic character;

Var.7 – tonal contrast (minor homonym); climax as a result of the rhythmical rise to triolets of sixteenths, doubled by the dynamic plane (*forte).* After the incipit, the scoring continues on two isorhythmical planes;

Var.8 – re-moving closer to the rhythmic-melodic contour of the theme; relaxation of the tension after the accumulation wave achieved between the variations 4-7. Rhythmical variation in contretemps of the pedal on *E;*

Var.9 – marks the debut of a new wave of tensional accumulation, along with the variation 10. The heterogeneous polyphonic scoring, the theme in the discant are counterpointed with the ostinato of the pedal figures on *E;*

Var.10 – rhythmic crescendo with values of triolets of sixteenths; figurative harmonic scoring (broken arpeggios) whence the thematic plane stems;

Var.11 – a last re-moving closer to the rhythmic contour of the theme in modal inversion (*Minors),* which precedes the last variation and Coda through *attacca;*

Var.12 – elements of the character variation (agogic contrast – *Allegro -,* metro-rhythmic – measure of 6/8). Isorhythmical counter-punctual scoring. Along with the extended Coda (117 measures) it constitutes the climax of the entire work. If the variations have strictly observed so far the thematic pattern (number of measures, form, melodic and harmonic pillars, cadences, meter, tempo), the dynamization is now applied on the level of all these parameters. The complexity level of the score reaches a maximum. Evolving waves are achieved through motif remaking (fragmenting, repetition, sequencing, figuration, augmentation-diminution processes), with means pertaining, therefore, to the array of the *development* sector within the sonata form.

The diminution technique [4], which Beethoven had skillfully mastered ever since his early youth, is also doubled by a certain overall strategy, whereby the composer aims at equilibrating the tension-relaxation curves. This way, a group of variations prepares the accumulation in waves of dynamization, other variations constitute climaxes of various moments and, at last, the third type represents moments of tension relief, sometimes re-moving closer to the original. The farthest level in being away from the characteristics of the theme may be noticed in the end, in Coda, the apotheosis moment of the entire musical piece. According to these characteristics, variations may be grouped as it follows from the table below:

Table 1

Variations of accumulation	Variations of climax	Variations of relaxation
Var.1, Var.2 Var.4, Var.5, Var.6 Var.9,	➔ ➔ Var.7 ➔ Var.10 ➔ Var.12 + Coda	Var.3 Var.8 Var.11

2.3 Elements of harmonic prolongation, illustrated along the variations

1. Linear progressions I-V-I or I-IV-V-I as prolongations of the scale step I: along the overall cycle;
2. Linear intervallic model 6-6 (variation 1);
3. Delays 7-6, 4-3 (variation 2);
4. Linear intervallic model 7-5 (variation 3);
5. Higher stage of diminution, through diversifying the transfer notes (N) and the passages (P), with the intervention of the chromatics (variations 4, 5);
6. Diversification of the linear intervallic models: 6-6, 10-10; 6-8-10 (variation 6)
7. New aspects related to the apparition of the voice transfer (marked with slashes) and of the default sounds (IN) (variation 7, 8);
8. Utilization of the tonic or dominant pedals and simplification of the harmonies until the last variation, which is theme-closest from harmonic standpoint (the last 4 variations).

2.4 Performance-related elements

In line with the composition intentions and with the performing parameters of Beethoven's style, we may infer the following elements:

1. Expression legato will harmonize with the units of the linear progression of descending third (3̂-2̂-1̂)

which appear on the medium structural level of the musical foreground, with a slight descrecendo corresponding to the descending melodic scale and to the placement on the sound of the tonic.

2. Breathing corresponds to the internal caesuras at the interruption points achieved through the scale step V. This way, the harmonic prolongations of the scale step I will be enhanced and the harmonic progression at the scale step V will be emphasized.
3. Dynamics, although with more consistent nuances than the Classical predecessors' hues (Haydn, Mozart), will score lower tones, as there is about Beethoven's early creation, wherein he has not attained yet the grandeur of the scoring dedicated to the "Hammerklavier".

Although pertaining to the first creation period, the cycle of 12 Variations in A Major marks the moment wherein Beethoven begins to assert his own style, preceding by a year only, the creation of the Sonata "Pathetique" (1798), whereby he conveys a new note of tragicalness and he deepens the dramaturgic conflict.

3. Conclusions

Beethoven stands out as one of the great titans of classical music and is regarded, with reference to tradition, as one of "the three *B"*, together with Bach and Brahms. He was a central figure in the transition process from the eighteenth-century Classicism to the nineteenth-century Romanticism, strongly influencing the subsequent generations of composers.

Unclassifiable ("You make the impression of a many-headed, many-hearted, many-soul endowed man", Haydn would say, by the year 1793); his art is expressed in all genres and, although symphonic music is the main source of his popularity, he likewise significantly impacted piano scoring or chamber music[5].

Overcoming, through the force of his will, the suffering of his deafness-marked life, celebrating triumph and glee, through music, whereas fate doomed him to misery and isolation, Beethoven well deserves Romain Rolland's statement: "He is much more than the greatest musician ever. He is the most heroic force of modern art".

Beethoven's influence upon subsequent composers was decisive. Admired by Franz Schubert, Felix Mendelssohn-Bartholdy, Robert Schumann, Johannes Brahms, Richard Wagner, Arnold Schönberg, Beethoven is deemed a milestone in the evolution gone through by music of all times. Through the new role played by the composer within society, he molded and shaped the era of a new generation of musicians.

References

[1,2] Yeston,Maury. *Readings in Schenker Analysis and Other Approaches,* Yale University Press, ISBN 978-0300021141, New Haven, 1977.

[3] Forte Allen, and Gilbert Steven. *Introduction to Schenkerian Analysis,*W.W.Norton,ISBN 0-393-95192-8, New York, 1982.

[4] Cadwallader Allen and Gagne David. *Analysis of Tonal Music: A Schenkerian Approach*, Oxford Universiry Press, ISBN 0-19-510232-0, New York, 1998.

[5] Schenker, H. *The Art of Performance.* Oxford University Press, ISBN 0-19-512254-2, New York, 2000.

BIOMASS BEHAVIOR DURING ANAEROBIC FERMENTATION – EXPERIMENTAL APPROACH

Adrian Eugen CIOABLĂ[*], Ioana IONEL[*], Ion VETREŞ[*], Gabriela Alina DUMITREL[**]

[*] *"Politehnica" University of Timisoara, Mechanical Engineering Faculty, Bd. M. Viteazu, No. 1, 300222, Timisoara, Romania, cioablaadrianeugen@yahoo.com, ionel_monica@hotmail.com, vetres.i@gmail.com*

[**] "*Politehnica" University of Timisoara, Faculty of Industrial Chemistry and Environmental Engineering, Pta.Victoriei, No. 2, 300006, Timisoara, Romania, dumitrelalina@yahoo.com*

Abstract. The presented study underlines the specific behavior of one sort of material, concerning influence parameters of the process (pH, temperature) and there will be underlined the degradation involved during anaerobic fermentation with the help of images taken with the help of a microscope. Conclusions will be taken regarding the biomass potential and particularities of the process for the specific studied type of biomass.

Keywords: biomass, anaerobic fermentation, degradation process

1. Introduction

The imperatives of our time are to save resources (feedstock materials and energy) and to pollute less. Therefore, at present, one field of intense international activity is the exploration and the development of new potential renewable and sustainable energy sources as well as of environmentally friendly processes [1].

The use of biomass has for millennia helped human society to fulfill many of its fundamental energy needs, such as for domestic and industrial activities, or transportation. One of the technologies used for energy recovery from biomass residues is the production of biogas through anaerobic fermentation.

The important processes in anaerobic digestion are hydrolysis, fermentation, acetogenesis, and methanogenesis, where hydrolysis is subject to the fermentation process, while acetogenesis and methanogenesis are linked [2].

Methane is produced by methanogenic bacteria from acetic acid, hydrogen and carbon dioxide and from other substrates of which formic acid and methanol are the most important [3]

Anaerobic digestion and biogas production are promising means of achieving multiple environmental benefits and producing an energy carrier from renewable resources. Replacing fossil fuels with biogas normally reduces the emission not only of greenhouse gases, but also of nitrogen oxides, hydrocarbons, and particles [4].

Biogas from biomass represents one of the technologies which are evolving in Romania in present times and because of this aspect, different steps are taken in order to study ways and biomass types useful to produce biogas with good quality and in large quantities.

Connected with the information presented above, the present paper will underline some of the general characteristics of two different vegetal substrates, the process parameters during the anaerobic fermentation (pH, temperature), visual observations related to the degradation process evolution and a comparative correlation of pH with time, related with theoretical and experimental variation of the mentioned parameter.

2. Methods used

In Figure 1 is presented the general schematics for a small scale installation built in order to analyze some of the process characteristics of different substrates during the anaerobic fermentation process.

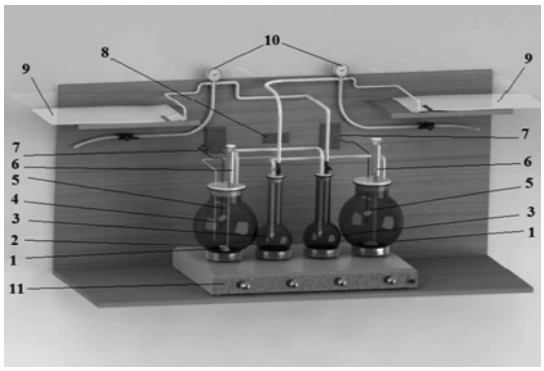


Fig. 1–General schematics for the small scale installation

Working principle of installation: inside the glass reactors (1) are inserted a semi-fluid suspension

composed from fine-granulated biomass and water. Each glass reactor has on the bottom part a magnet (2) used for the magnetic stirring process in order to have a relatively homogenous material. From the glass reactors, the formed biogas will pass into the smaller glass reactors (3) half filled with water in order to "wash" the impurities of the biogas. Each of the glass reactors (1) has inside a pH sensor (5) which is controlled with pH controllers (7), and also a thermocouple (4) controlled with the help of a temperature controller (8) in order to assure the necessary temperature for the process. The installation is equipped with special gas bags (9) in order to take samples if necessary and pressure control with the help of pressure gauges (10) in case of overpressure.

The temperature regime is assured with the help of the heating device (11) which allows 2 batches to be analyzed separately. The installation was built in order to support two batches of material under the same temperature conditions in order to better observe and make comparisons over the general particularities of each used material.

The materials which were used in this study are a recipe containing 40% degraded corn, 40% degraded wheat and 20% degraded sunflower seed husks.

For the presented materials there were determined the basic characteristics which are presented in Table 1.

Table 1 – General characteristics for the two types of cereal biomass

	Ash content [%]	Water content [%]	C content [%]	N content [%]
Degraded recipe	1.96	11.43	44.97	1.68
Degraded wheat bran	4.35	10.1	45.04	0.51

From Table 1 it can be observed that the C / N ratio for degraded mixture is close to 27/1 while for the degraded wheat bran the C/N ratio is around 88/1, being an indicator for the suitability of those materials regarding their potential during the anaerobic fermentation process. The value of the second ratio indicates that the degraded wheat bran has a smaller potential in producing biogas than the degraded recipe.

3. Results

In Figures 2 and 3 are presented the temperature and pH variation during the 40 days period of time.

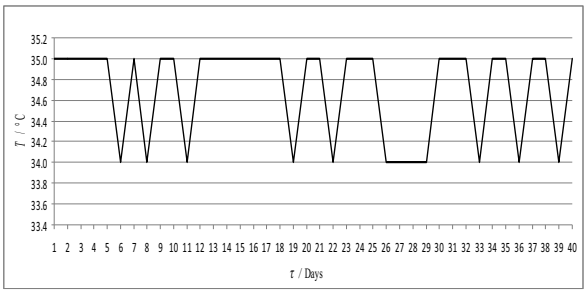


Fig. 2 – Temperature variation for the two batches

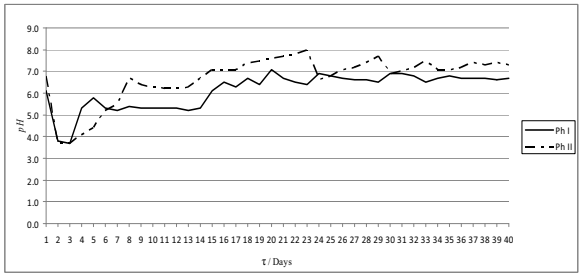


Fig. 3 – pH variation for the two batches

From Figure 2 it can be observed that the temperature regime is between 34 and 36 ºC with an average value of 35 ºC which is a corresponding value for the mesophilic temperature regime.

The pH variation presented in Figure 3 shows a starting acid tendency in the first time frame related to the initial biomass pH value which needs to be corrected using lime suspension and after a period of approximately 5 days for the first batch and 8 days for the second batch the value starts to increase to neutral levels which are maintained until the end of the batch. It also can be observed that the degraded wheat bran batch has alkaline tendencies in the second period of the process, the pH being corrected by using acetic acid.

For an accurate description for the pH variation with temperature and time it was proposed a polynomial equation of second degree expressed by equation 1 [5, 6].

$$y = a_0 + a_1 \cdot x_1 + a_2 \cdot x_2 + a_3 \cdot x_1 \cdot x_2 + a_4 \cdot x_1^2 + a_5 \cdot x_2^2 \quad (1)$$

where: a_i – equation coefficients;

y – pH;

x_1 – temperature [ºC] ;

x_2 – time, [days].

The coefficients values in the case of second degree polynomial regression are corresponding to the minimum of the function (Eq. 2):

$$S = \sum_{j=1}^{m} (\hat{y}_j - (a_0 + a_1 \cdot x_{1j} + a_2 \cdot x_{2j} + a_3 \cdot x_{1j}^2 + a_4 \cdot x_{1j} \cdot x_{2j} + a_5 \cdot x_{2j}^2))^2 \quad (2)$$

Through annulment of the partial derivates of S function in connection with ai coefficients, resulted a linear equations system. The coefficient matrix for the system A and the free coefficients vector, B (Eq. 3):

$$A=\begin{bmatrix} \sum_{j=1}^{m} 1 & \sum_{j=1}^{m} x_{1j} & \sum_{j=1}^{m} x_{2j} & \sum_{j=1}^{m} x_{1j}^2 & \sum_{j=1}^{m} x_{1j}\cdot x_{2j} & \sum_{j=1}^{m} x_{2j}^2 \\ \sum_{j=1}^{m} x_{1j} & \sum_{j=1}^{m} x_{1j}^2 & \sum_{j=1}^{m} x_{1j}\cdot x_{2j} & \sum_{j=1}^{m} x_{1j}^3 & \sum_{j=1}^{m} x_{1j}^2\cdot x_{2j} & \sum_{j=1}^{m} x_{1j}\cdot x_{2j}^2 \\ \sum_{j=1}^{m} x_{2j} & \sum_{j=1}^{m} x_{1j}\cdot x_{2j} & \sum_{j=1}^{m} x_{2j}^2 & \sum_{j=1}^{m} x_{1j}^2\cdot x_{2j} & \sum_{j=1}^{m} x_{1j}\cdot x_{2j}^2 & \sum_{j=1}^{m} x_{2j}^3 \\ \sum_{j=1}^{m} x_{1j}^2 & \sum_{j=1}^{m} x_{1j}^3 & \sum_{j=1}^{m} x_{1j}^2\cdot x_{2j} & \sum_{j=1}^{m} x_{1j}^4 & \sum_{j=1}^{m} x_{1j}^3\cdot x_{2j} & \sum_{j=1}^{m} x_{1j}^2\cdot x_{2j}^2 \\ \sum_{j=1}^{m} x_{1j}\cdot x_{2j} & \sum_{j=1}^{m} x_{1j}^2\cdot x_{2j} & \sum_{j=1}^{m} x_{1j}\cdot x_{2j}^2 & \sum_{j=1}^{m} x_{1j}^3\cdot x_{2j} & \sum_{j=1}^{m} x_{1j}^2\cdot x_{2j}^2 & \sum_{j=1}^{m} x_{1j}\cdot x_{2j}^3 \\ \sum_{j=1}^{m} x_{2j}^2 & \sum_{j=1}^{m} x_{1j}\cdot x_{2j}^2 & \sum_{j=1}^{m} x_{2j}^3 & \sum_{j=1}^{m} x_{1j}^2\cdot x_{2j}^2 & \sum_{j=1}^{m} x_{1j}\cdot x_{2j}^3 & \sum_{j=1}^{m} x_{2j}^4 \end{bmatrix}$$

$$B=\begin{bmatrix} \sum_{j=1}^{m} \hat{y}_j \\ \sum_{j=1}^{m} x_{1j}\cdot \hat{y}_j \\ \sum_{j=1}^{m} x_{2j}\cdot \hat{y}_j \\ \sum_{j=1}^{m} x_{1j}^2\cdot \hat{y}_j \\ \sum_{j=1}^{m} x_{1j}\cdot x_{2j}\cdot \hat{y}_j \\ \sum_{j=1}^{m} x_{2j}^2\cdot \hat{y}_j \end{bmatrix} \qquad (3)$$

Using MATLAB, a mathematical high-level programming language and interactive environment, the equation system was solved and there were analyzed the experimental data.

The obtained data together with the generated surfaces from the statistical mathematical models are presented in Figures 4 and 5.

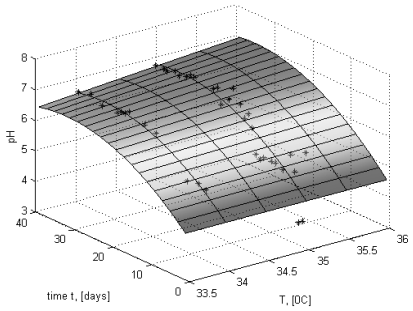


Figure 4: pH evolution - degraded recipe batch

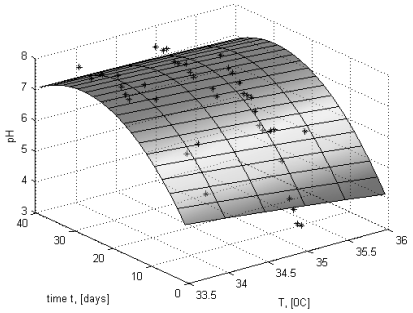


Figure 5: pH evolution - degraded wheat bran batch

From the graphics it can be observed that the pH variation has an evolution form acid to neutral or basic levels in time. This process can be explained by the characteristic pH values connected with the phases from which the material starts to degrade (acid phase) until the biogas production where the degradation process is much more intense and the pH tends for a neutral value.

The equations for the obtained mathematical statistical models after the linear multiple regressions are presented in Table 2. They are valid on the studied field of values.

Table 2 **-** Equations of the obtained statistical models

Batch	Equation for the statistical mathematical model
Degraded recipe	$y = 0.2628\cdot x_1 - 0.0489\cdot x_2 + 0.0055\cdot x_1\cdot x_2 - 0.0039\cdot x_1^2 - 0.0021\cdot x_2^2$
Degraded wheat bran	$y = 0.5580\cdot x_1 - 0.0086\cdot x_2 + 0.0063\cdot x_1\cdot x_2 - 0.0125\cdot x_1^2 - 0.0040\cdot x_2^2$

After the computation of the model coefficients it is necessary to make a comparison between model predictions and experimental data. For adequacy indicators there were used the dispersion and R correlation coefficient (Table 3).

- dispersion (Eq. 4) :

$$\sigma^2 = \frac{\sum_{i=1}^{n}(y_{iexp} - y_{icalc})^2}{n-1} \qquad (4)$$

R correlation coefficient (Eq. 5):

$$R = \sqrt{1 - \frac{\sum_{i=1}^{n}(\hat{y}_i - y_{icalc})^2}{\sum_{i=1}^{n}(\hat{y}_i - \bar{y})^2}} \qquad (5)$$

Table 3 - Indicators for determined statistical model

Batch	Dispersion, σ^2	Correlation coefficient, R
Degraded recipe	0.1986	0.8418
Degraded wheat bran	0.3674	0.8305

The values for the presented adequacy coefficients in Table 3 are indicating a satisfactory correlation between the determined statistical model and experimental data. This confirms the fact that obtained

mathematical equations describe with sufficient accuracy the pH evolution in time as a function of temperature.

Related to the degradation process occurring during anaerobic fermentation, in Figures 6 to 9 are presented images with the substrates at the beginning and the end of the process, after 40 days, using a binocular magnifier.

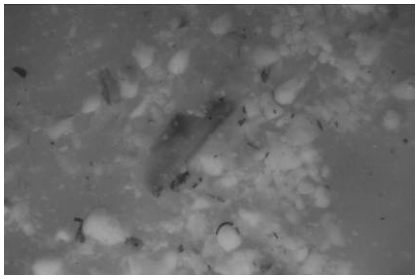


Fig. 6 – Degraded recipe, first stage, 6X

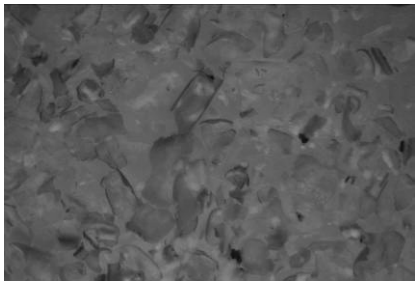


Fig. 7 – Degraded wheat bran, first stage, 6X

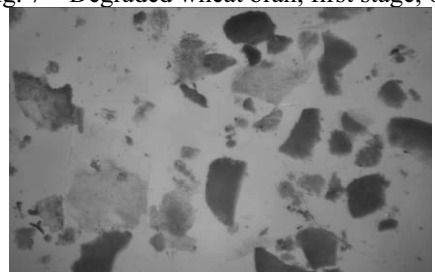


Fig. 8 - Degraded recipe, final stage, 20X

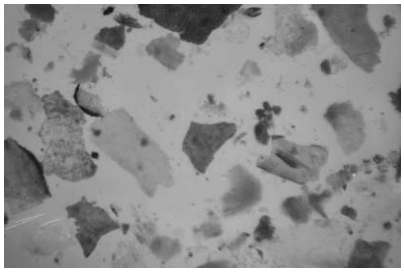


Fig. 9 – Degraded wheat bran, final stage, 20X

From the figures it can be observed the parallel degradation for the two different types of degraded agricultural biomass, from the first stage (Figures 6 and 7), the initial phase of the process, until the final stage where the general aspect presents bacterial formations, lack of color and differentiate degrees of degradation related with the cellular structure of the substrate.

4. Conclusions

Cereal degraded materials can be used in anaerobic fermentation processes with good results related to the behavior during the fermentation and potential in obtaining biogas in large quantities and good quality in larger scale installations.

It has to be kept in mind that the C/N ratio is one of the factors which can be potentially related with the behavior of the material during the anaerobic fermentation.

The correlation between the theoretical and experimental results shows a good evolution of pH in time related with the temperature regime that was chosen in the presented case.

Acknowledgment

This paper was supported by the project "Develop and support multidisciplinary postdoctoral programs in primordial technical areas of national strategy of the research - development - innovation" 4D-POSTDOC, contract nr. POSDRU/89/1.5/S/52603, project co-funded from European Social Fund through Sectorial Operational Program Human Resources 2007-2013.

References

[1] Converti A. et al - Biogas production and valorization by means of a two-step biological process, Bioresource Technology 100, 2009 p. 5771–5776;

[2] S. Karellas, I. Boukis, G. Kontopoulos, *Development of an investment decision tool for biogas production from agricultural waste*, Renewable and Sustainable Energy Reviews, 14, 2010, p. 1273–1282.

[3] F. Fantozzi, C. Buratti, *Biogas production from different substrates in an experimental Continuously Stirred Tank Reactor anaerobic diges*ter, Bioresource Technology, 100, 2009, p. 5783–5789.

[4] Borjesson Pal, Maria Berglund, Environmental systems analysis of biogas systems, Part I: Fuel-cycle emissions, *Biomass and Bioenergy*, No. 30, 2006, p. 469–485.

[5] Todinca T., Geantă M., *Modelling and simulation of chemical processes. MATLAB applications* (Modelarea si simularea proceselor chimice. Aplicatii in MATLAB), Politehnica Publishing House, 973-9389-32-5, Timişoara, 1999.

[6] Borse G. J., *Numerical Methods with MATLAB®*, PWS Publishing Company, ISBN:0534938221, Boston, 1997.

CONCEPTUAL AND ELEMENTARY FRAMEWORK OF THE ORGANIZATIONAL CONFLICT

Stela SEARS
Academy of Economic Studies, Chisinau, Moldova, stelaphd@gmail.com

Abstract. Conflict is an intrinsic and inevitable aspect of human life. In the organizational environment conflict is a frequent phenomenon, affecting a number of organizational processes and outcomes. The studies of organizational conflict are of particular interest to managers and scientists and contribute to a better understanding of the complex nature of organizational behavior and organizational processes. The perspectives on conflict in the organizational environment have evolved over the years. So far, organizational conflict is considered a legitimate and unavoidable element, which, incidentally, is also an indicator of an effective organizational management. Organizational conflict has not only dysfunctional (negative) effects, but also functional (positive) effects. Recognition of different types of conflict and the different styles of conflict management provides a vital tool for understanding organizational conflict and its management. Conflict management provides no single reccommendation for dealing with conflicts, but rather offers a variety of ways, the practical application of which is conditional on several factors: an analysis of the specific situation, determining the causes and nature of conflicts and their possible consequences. A better management of organizational conflicts can have a significant impact on productivity, thus turning the organization into a better and more pleasant working environment for the employees.

Keywords: conflict; organizational conflict; conflict management.

¶

1. Introduction

Conflict is an intrinsic and inevitable aspect of human life and has always been part of human interaction, even in times less subject to dynamic changes. The conflict is a social phenomenon. During the interaction of two or more individuals, a potential for conflict can appear. In organizational life conflict is a frequent phenomenon, affecting a number of organizational processes and outcomes.

The organizational culture of contemporary businesses is characterized by globalization, technological change, demands for increased productivity and efficiency, and increased participation by employees in the decision process. All these attributes of organizational culture of today create an environment which promotes the appearance of conflict.

In light of the above, it is clear that the study of organizational conflict is of particular interest to people with management jobs and scientists, facilitating a better understanding of the complex nature of organizational behavior and organizational processes.

Despite the voluminous study of organizational conflict, there is no clear and universally accepted definition of this term. In general, the conflict appears as a form of human interaction in which two or more members of a community disagree partially or completely about a problem. Since the goals of both parties are often incompatible, goal achievement by one of the parties makes it impossible to achieve this goal by the other party. Thus, conflict can be defined as "... a process in which one party perceives that its interests are adversely affected by the other side" [1]. In the same context, Hocker and Wilmot [2] consider the conflict as "... an explicit struggle between at least two interdependent parties who perceive incompatible goals, scarce rewards, and interference of the other party to achieve its goals." A particularly interesting and evocative definition of the term of conflict is found in the work of Pondy [3]: "The term conflict refers neither to its previous conditions, nor to its recognition by the individual or to certain emotional states or at events open to any repository of emotions, past, or structure, but nevertheless taken together ...".

Despite semantic differences in the definition of conflict, there are some common elements in all definitions, namely: the existence of two or more parties whose interests appear to be incompatible; the perception of conflict by all parties involved; the state of some sort of opposition; the struggle for limited resources.

2. The historical evolution of the concept of conflict.

Conflict research and empirical studies devoted to this phenomenon have an extensive history. The perspectives on conflict in the organizational environment have evolved over the years.

A synopsis of the evolution of the concept of conflict theory is found in the work of Robbins [4], which describes the following stages of historical evolution of perspectives on conflict:

1. Classical or traditional perspective on conflict, based on the idea that conflict is destructive to the organization, and therefore it must be eliminated.
2. Behavioral perspective, which recognizes that organizational conflict is inevitable, accepts the presence of conflict and even promotes the idea of encouraging conflict to improve organizational efficiency.
3. Interactionist perspective, by contrast, recognizes conflict as an absolute necessity and encourages explicit opposition. In this perspective, conflict management combines methods for both encouraging conflict, as well as for resolving it.

In the traditional view conflict was considered as something destructive, while the role of management was to eliminate conflict in the organization. The behavioral perspective viewed conflict as an inevitable part of the complex organizational structure and something to be accepted. By contrast, interactionist perspective considered conflict as absolutely necessary in the organizational life, with management's role being to support and encourage conflict in the organization.

At present, conflict is considered a legitimate and unavoidable element in the organizational environment, which, incidentally, can also be an indicator of effective organizational management.

3. Types of conflict

In the works devoted to organizational conflict management, particular attention is paid to the typology of conflicts. Thus, conflicts can be classified according to the essence (substantive or emotional conflict), the degree of intensity (discomfort, incident, misunderstanding, tension and crisis), the form of conflict (latent conflicts and manifest conflicts), the level at which conflicts occur (intrapersonal conflicts, interperosnal, intragroup, intergroup), and direction of evolution (vertical, lateral and oblique), and the effect (functional and dysfunctional).

Rahim argues that the recognition of different types of conflict and the different styles of conflict management provides a vital tool for understanding organizational conflict and conflict management [5]. Therefore, conflict management strategies must incorporate recognition of the different types of conflict which may have a positive or negative impact on the individual or group performance [6].

4. Functional and dysfunctional effects of conflict

Conflict is a natural part of organizational life and is not necessarily a bad thing. Thus, organizational conflict may have not only dysfunctional (negative) effects, but also functional effects (positive). On the one hand, constructive conflict is functional when it helps to improve the quality of decisions, encourages interest and curiosity, promotes creativity and innovation. On the other hand, conflict can be dysfunctional and destructive, leading to reduced group effectiveness.

Among the most frequently cited undesired consequences of conflict are communication problems, reduced group cohesion, and subordination of group goals to the struggle for supremacy of its members. Several studies have shown that the existence of conflict in groups is a sign of strength, not weakness [7]. In extreme cases, conflict undermines the functioning of the group and calls into question its existence [8].

Conflict in organizations often leads to disturbances of the established order and has an impact on stability and harmony. In this case, conflict seems to be something that should be avoided and eliminated. However, conflict can be seen as an inevitable feature of human interaction and something that through constructive management methods can attain a positive value and contribute to an enhanced organizational performance. In this case conflict can lead to beneficial changes in the institutional framework. However, attempts to foster constructive conflict can also indirectly lead to destructive conflicts [9].

Conflicts have constructive or destructive effects depending on the intensity of the conflict itself and, in a second place, depending on how they are managed. If not properly managed, conflict escalation can lead to negative emotions, high staff turnover and increased court costs. Thus, conflicts become one of the biggest tests for managers and one of the most frustrating and unpleasant experiences for the parties involved.

5. Sources of organizational conflict

Detection and identification of the causes of conflict at an early stage is essential in business management and enables managers to take appropriate measures to enhance the positive effects of conflict and reduce the negative consequences. The role of effective management is to identify ways and means by which it is possible, on the one hand, to reduce the negative effects of conflict, and on the other hand, to boost its positive effects.
The causes of conflict are varied. Understanding these causes isessential for ensuring the best choice of methods and strategies for effective management of conflict situations. Robbins [10] groups the most important factors that cause conflicts in the following way:
1) Communication factors: conflicts arising from communication deficiencies.
2) Structural factors: organizational conflicts related to roles.
3) Personal factors: conflicts that arise due to personal differences.
Katz [11], in turn, highlights three sources of conflict:
1) Structural conflicts: conflicts arising from the interdependence of organizational subunits.
2) Role conflict: conflict related to individual behavior.
3) Limited resources: the competition for organizational resources.

Several authors, including Martin and Felenz [12], classify sources of organizational conflict in relation to the

organizational levels where these conflicts arise. The sources of conflict may be intrapersonal, interpersonal, intragroup, intergroup, inter- and intraorganizational.

In a newer perspective on the topic of causes of organizational of conflict, Taylor [13] highlights, among other things, the differences between the old generation and new generation, old knowledge versus new, adaptation to new technologies, as well as ideological changes.

6. The concept of conflict management

Studying conflict in general and in the organization, in particular, is of great practical utility for managing an organization, since conflicts left unresolved in time can generate both tangible and intangible costs.

Thus, the urgent question that arises for the company's management is not how to avoid the conflict, but how to tackle it. If the conflict is not managed in an appropriate manner, the company's productivity, operational efficiency and employee morale will suffer.

It is important to distinguish between conflict resolution and conflict management. Once it has been established that the nature of the conflict can be both functional (constructive) and dysfunctional (destructive), the following research emphasis has shifted from attempts to eliminate the conflict through resolution to efforts of conflict management through management.

For some researchers, the terms of conflict resolution and conflict management are interchangeable. For others, they are two different concepts: while conflict management is a process that seeks to bring the conflict under control, then conflict resolution is a process that tries to stop the conflict.

The term conflict management is favored by many researchers. Rabies [14] argues that "The conflict can never be eliminated, it only may be managed in order to minimize its negative effects, to reduce the intensity, and to facilitate its positive role on development. Conflicts are rarely solved. Most often, conflicts can only be temperated and regulated."

Rahim [15] is of the opinion that "The contemporary organizations need conflict management, not conflict resolution". Conflict management does not necessarily prevent, reduce or end the conflict. Management means developing effective strategies at the macro level designed to minimize conflict malfunctions and increase constructive functions of conflict, which would contribute to increasing the level of organizational learning and organizational effectiveness.

7. Theoretical models of conflcit

The development of theory and practice in human resources management has generated theoretical models of conflict, which allow a better understanding of the causes and mechanisms of conflict situations, but also formalize the conceptual framework of how to address the questions of conflict management. Depending on the characteristics of the conflict model, managers may use different methods to address and resolve conflicts.

Structural conflict models are used to identify conditions that initiate or end the conflict activities. Their basic purpose is to specify the most important factors related to the occurrence of conflict in the organization [16].

By contrast, process models study the evolution of conflict through temporal parameters. These models attempt to highlight specific stages in the development of conflict and to determine the interrelationship between these stages.

In figurative language, structural models attempt to represent the static image of the conflict, by identifying its main causes and components, while the process model emphasize the active character of conflict through its stages of time.

8. Conflict management strategies

A lot of literature on management and human resources refers to the existence of specific strategies used by individuals in organizations for conflict management. Some works refer to a wide range of strategies, while others would focus on developing a single strategy. Some scholars attempt to couple conflict management strategies with conflict management styles, while others view them separately.

Regarding conflict management styles one can speak of a certain uniformity of views on this subject. Scientists generally refer to a finite number of conflict management styles, the most recognized classifications being presented in the works of Blake and Mouton (1964) [17] and Killmann and Thomas (1975) [18].

Thomas's model is the most frequently used by managers to address organizational conflict. It describes five basic strategies or styles of delaing with conflict by the individual:

1. Conflict avoidance style. This style is used to describe a behavior that is unassertive and uncooperative.
2. Competitive style. This style is used to describe a behavior that is assertive and uncooperative.
3. Accommodation style. This style is used to describe a behavior that shows unassertiveness combined with a high degree of cooperation.
4. Collaboration style. This style is characterized by assertiveness and cooperation. Both parties will try to find creative solutions acceptable to all and will try to achieve goals and optimum results for all parties.
5. Compromising style. This style is characterized by a moderate level of assertiveness and cooperation.

The effectiveness and the applicability of all five styles of management depends on the context of specific situations, personal traits of the parties involved, the desired results and the time available. For a successful conflict management to take place, it is essential to understand the advantages and disadvantages of each of these styles.

Research on the main strategies of conflict management theory and practice provides a framework for managers to choose the most appropriate conflict management strategy, according to the specifics of the case and the organizational needs. The analysis of conflict management styles led to two major conclusions: each conflict management strategy may be useful in specific conflict situations, and, most often, conflict management cannot be reduced to a single strategy.

9. Conclusions

Studying conflict in general and organizational conflict in particular, is of great practical utility for managing an organization, because conflicts unsolved in time can generate both tangible and intangible costs.

Organizational practice shows that conflict situations are used as important strategies to achieve a better result. The conflict within certain limits can play a crucial role for organizational productivity [19]. Successful organizational management requires an early identification of sources of conflict and factors that influence the direction the conflict will take.

Conflict management provides no single recipe for dealing with conflicts, but rather many ways of action, the practical application of which is conditional on several factors: an analysis of specific circumstances, determining the causes and nature of conflicts and their possible consequences.

Dealing with conflict superficially, lack of understanding constructive and destructive effects of conflict, constitute the main reason why some organizations record poor performance despite moderate financial, technological, human resources, because the most part of these are consumed in conflict. Better management of organizational conflicts can have a significant impact on productivity, turning, at the same time, the organization in a very pleasant working environment for the employees.

References

1. Wall, J.A., Callister, R.R.: *Conflict and its Management*. Journal of Management, Vol. 21, No. 3, 1995, pp. 515-558
2. Hocker, J.L., Wilmot, W.W.: *Interpersonal Conflict.* (2nd edition), Dubuque, IA: W. C. Brown., 1985, p.23
3. Pondy, L.R.: *Organizational Conflict: Concepts and Models*, Administrative Science Quarterly, Vol. 12, 1967, pp. 296-320
4. Robbins, S.P.: *Managing Organizational Conflict: A Nontraditional Approach.* Englewood Cliffs, NJ: Prentice-Hall, 1974, pp.13-14
5. Rahim, M.A.: *Managing Conflict in Organizations* (2001). Praeger Publishers, 2001, pp. 312
6. Rahim, M.A.: *Towards a Theory of Managing Organizational Conflict.* International Journal of Conflict Management, Vol.13, No.3, 2002, pp.206-235
7. Hall, J., Williams, M.S.: *A Comparison of Decision Making Performance in Established and Ad-Hoc Group.* Journal of Personality and Social Psychology, 1966, February, pp.217
8. Hoffman, R.: *Homogeneity of Member Personality and Its Effect on Group problem Solving*. Journal of Abnormal and Social Psychology, January 1959, pp.27-32
9. Amason, A. C.: *Distinguishing the effects of functional and dysfunctional conflict on strategic decision making: resolving a paradox for top management teams.* Academy of Management Journal, 1996, Vol. 39 No.1, pp.123-148
10. Robbins, S.P.: *Managing Organizational Conflict: A Non-Traditional Approach.* Englewood Cliffs, N.J.: Prentice-Hall, 1974
11. Katz, D.: *Approaches to Managing Conflict*, *Power and Conflict Organizations.* ed. Bz R.L. Kahn and K.E.Boulding (new Zork: Basic Books, 1964), pp. 105-114
12. Martin, J., Fellenz, M.: *Organizational Behavior and Management.* South Western Educational Publishing, 2010, IV Edition, pp.642
13. Taylor, R.L.: *Leadership strategies for department chairs and program directors.* Lecture at Faculty Development Workshop, American Dental Education Association Annual Session, March 3, 2001, Chicago, IL.
14. Rabie, M.: *Conflict resolution and ethnicity*. Westport, CT: Praeger Publishers,1994
15. Rahim, M.A.: *Managing conflict in Organizations.* New York: Praeger, , 1992, p.76
16. Baron, R. *Conflict in Organizations*. In Psychology In Organizations: Integrating Science And Practice, Murphy, K.R., Saal, F.E., 1990, Psychology Press, pp. 197-200
17. Blake, R.R., Mouton, J.S.: *The managerial grid: Key orientations for achieving production through people*. Houston, TX: Gulf Publishing, 1964
18. Kilmann, R.H., Thomas, K.W.: *Interpersonal conflict-handling behavior as reflections of Jungian personality dimensions*. Psychological Reports, 1975, Vol. 37, pp. 971-980
19. Rahim, M.A.: *Managing Conflict in Organizations,* Praeger Publishers, 2001, pp. 312

BIODEGRADABLE POLYMERS USED IN THE PACKAGING INDUSTRY: A REVIEW

Alexandru SMARANDA[*], Dumitru TUCU[*],
[*] Mechanical Engineering Faculty, Bv. Mihai Viteazu, No. 1, Timişoara, RO-300222, România,
e-mail: dumitru.tucu@mec.upt.ro, smaranda.alexandru@gmail.com

Abstract. The present paper aims to present a brief review of the researches conducted in the last decades in order to develop and process biodegradable polymeric biomaterials. The increasing need to use these materials is triggered by the growing awareness over the climate changes and depletion of fossil fuel resources used for traditional plastics. Bioplastics can be easily produced from widespread natural polymers such as starch, cellulose, chitin and soy. Being perceived only as a substitute for crude oil plastic has represented a limitation for a more common use of biobased products. Although they have thermoplastic characteristics and can be processed using similar techniques as for traditional plastics (especially injection moulding), most bioplastics also have typical characteristics which require further study in order to become an opportunity for new designs and geometries.

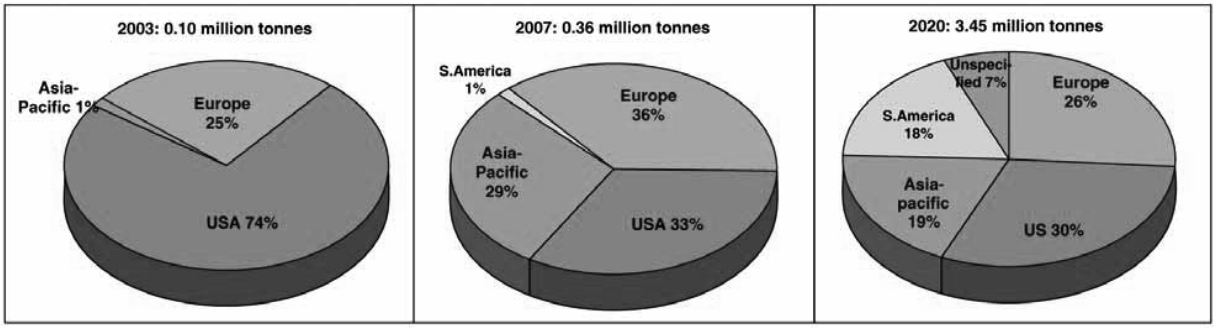
Keywords: bioplastic, biodegradable, thermoplast, injection molding

1. Introduction

With the growing awareness over the climate change and the limitation of resources, thermoplastics produced from renewable agricultural and forest resources (biomass), also called bioplastics, are gaining in popularity (Fig.1).

Consumers are demanding food-packaging materials that are more natural, disposable, potentially biodegradable as well as recyclable [1].With bio-based polymers, new functionalities
are being achieved. These include biodegrade- bility, compostability and anaerobic digestion (for some biobasedproducts).

Therefore it becomes necessary for the companies to show interest in food-packaging systems in which the polymer matrix has low environmental impact[2] and to find ways of improving their productivity in terms of maintaining safety, using sustainable materials in packaging, implementing flexible and standardized technology, and adopting proven technologies and its implementation



Note: "Unspecified region" in the right figure means that there are no concrete plans about the location of these capacities.

Figure 1. Biowerkstoff-Report, ISSN 1867-1217, Edition 7, April 2010

management principles[3]. Reducing wastes and shortening lead times becomes all the more imperative in the food industry due to the perishable nature of the product.

Even though researchers have focused on applying these techniques to the food industry, there seems to be a gap between research and its implementation in the industry [4]. For this matter Arora and Kempkes [5] are outlining the huge gap between research in the field of food processing in the industry. The objective of this paper is to present a review of biodegradable materials and some processing aspects in food industry especially packaging in order to bring the academic world and the industry to a collaborative work.

2. Materials

The most commonly used plastics in packaging industry today are based on petrochemical products such as polyethylene terephthalate (PET),

poly vinyl chloride (PVC), polyethylene(PE), polypropylene (PP), polystyrene (PS), polycaprolactone (PCL). Both synthetic polymers and biologically derived (or natural) polymers have been extensively investigated as biodegradable polymeric biomaterials. Bioplastic material types can mainly be categorized into 3 groups :

Biodegradable/ Compostable	Biodegradable/ Compostable and Biobased	Biobased
Synthetic Polyester	Starch based material	Bioethanol based PVC, PE, PET, PP
Polyvinyl Alcohol	Cellulose based materials	Bio-PDO based polymers
	Soy based materials	Polyamide s PA 6.6.9/6.10/11
	Chitin and chitosan based materials	
	Polylactic Acid PLA	
	Polyhydroxyalkanoate PHA	

Table 1. Bioplastic material types

(ASTM) and the International Standards Organization (ISO) to come up with an official definition for biodegradable as follows: capable of undergoing decomposition into carbon dioxide, methane, water, inorganic compounds, or biomass in which the predominant mechanism is the enzymatic action of microorganisms, that can be measured by standard tests in a specified period of time, reflecting available disposal condition [6].

Given the complexity and the range of applications polymeric biomaterials are currently used, there is not just one polymeric system available that could be considered as an ideal biomaterial.

Biodegradation of polymeric biomaterials involves cleavage of hydrolytically or enzymatically sensitive bonds in the polymer leading to polymer erosion [7].

Since about 41% of plastics production is used for packaging industry, and 47% of this is used for food packaging [8] the need of replacing the petroleum based products and reduce the dependence of the economy on crude oil we are going to discuss only biodegradable polymers from chemically modified natural products.

2.1. Starch

Starch is a major plant storage from glucose. It consists of a mixture of 20-30% amylose and 70-80% amylopectin. Starch is abundant in plants such as maize, wheat, potato,
-Birice, and pea, and is thus cheap and readily available. Biodegradation of starch-based polymers is due to enzymatic attack at the glycosidic linkages between the sugar groups. The thermoplastic starch (TPS) has high moisture uptake, it is water solvable, its mechanical properties change in time and has high shrinkage after it is processed by injection moulding. Although there are numerous literatures dealing with the investigation of TPS, there is almost no information about the effect of the high plasticizer content of TPS on the processing, and also there is no information about the effect of the holding pressure – like a shrinkage decreasing parameter – on the high shrinkage of TPS [8]. Starch can be applied in four different technological modes that result in diverse groups of products:

2.1.1 Starch composites with low amount of starch (≈10-20 %);

The low amount of starch mixed with traditional oil-based plastics enhances the disintegration of the blend in nature, but it is not biodegradable. It is very often used as a composite with PHA and PLA plastics.

2.1.2. Starch composites with medium amount of starch (≈40-60 %);

This sort of plastics exhibits similar properties to conventional plastics thus it is also called plastified starch materials. They are fully biodegradable and compostable, and can replace traditional plastics in food service, food packaging, personal health, etc. Novamont with its patented material Mater® is recognized as a pioneer with 41 articles, 27 patents and 4 awards to testify its scientific contribution. This material is thermoplastic and can be processed by injection molded.

2.1.3. Starch composites with high amount of starch (≈90 %);

Bioplastics with high amount of starch are usually referred to as thermoplastic starch (TPS). The most cited paper [9] according to Web of Science described the preparation of thermoplastic starch as a combined process consisting of extrusion cooking and plastic compounding. Shin [10] reported about the relationship between mechanical properties and biodegradability of thermoplastic starch–polycaprolactone blends, confirming that the degree of biodegradation of starch composites is proportional to starch content and the material degrades in 6 weeks during composting [11]. Similar results were obtained for mechanical properties of multilayer films based on thermoplastic wheat starch. Bioplast® by *Biotec GmbH* is manufactured by compounding and melting starch and other completely biodegradable ingredients and then processed to granules; they can be processed on only slightly modified machines for thermoplastic resins and used same way as traditional synthetic plastics [12].

2.1.4 Foamed starch

Foamed starch is an antistatic, insulating and shock absorbing material made entirely out of starch, therefore a good replacement for polystyrene foam as a fully biodegradable and compostable packaging

material. Foamed starch can be environmentally blown into a foamed material using water steam or a compression-explosion process. The porous structure of starch foam allows disposing of food packaging and serving articles after use by composting. The spectrum of microorganisms that can degrade foamed starch products is broad.

2. 2.Cellulose

Cellulose is one of the most abundant biopolymers on earth. It is the major constituent of plant cell walls, and more than half of the organic carbon on earth is found in cellulose. Cellulose is isolated from its crystalline state in microfibrils by chemical extraction. It is fusible and soluble in hydrogen bond-breaking solvents such as N-methylmorpholine-N-oxide. Because of its infusibility and insolubility to others, its derivatives can also be used to make it easier to process, a property that find its use in many packaging applications.

There can be distinguished two main groups of cellulose-materials: cellulose composites suitable only for reinforcement and thermoplastically processable cellulose derivates which can be used for extrusion and molding.

Cellulosic biocomposites are made completely from biologically renewable resources. Under the name Fasal®, *Austel* markets injection molding granules of renewable raw materials. It is a thermoplastic granulated material which contains about 50 % wood, *e.g.*, waste wood or weak wood in chip form or as sawdust. *Tecnaro GmbH* develops, produces and markets Arboform® (Figure 2), a sustainable thermo-

Figure 2. Arboform® Granulates and Product (http://www.tecnaro.de/english/willkommen.htm?section=we)

plastic material. The product is made from 100 % renewable raw materials (lignin and cellulose) and is mainly used for injection molded wood applications. The Treeplast® product is a *Craft* project of six companies, funded by the *European Commission*. The standard version of Treeplast® is absolutely natural renewable and biodegradable. It is made from wood chips 50-70 %, with crushed ground-corn 20% and natural resin and additives 10% .
But the minimum thickness in moulded parts cannot be smaller than 3 mm.

2.3. Chitin and chitosan

Chitin is one of the three most abundant polysaccharides in nature. It ranks second to cellulose as the most plentiful organic compound on earth. Chitosan, known as soluble chitin, is a natural product obtained from deacetylated chitin. Usually, chitin is extracted from shells of crustaceans and cell walls of fungi. It is biodegradable, nontoxic and readily biocompatible.

Goosen [13] published a book dedicated to the application of chitin and chitosan. Now, chitin and chitosan are applied in the textile industry, in medicine and in food production.

Jenkins and Hudson (2001) evaluated the recent state of art (178 references) in the field of preparation of biodegradable polymers with chitin or chitosan blends. In the USA *Biopolymer Engineering* with ChitoPure® is one of the world's premier manufacturers of chitosan products. Its trade competitors on the Atlantic coast are *Primex*, *Iceland* with ChitoClear® .

2.4. Soy based plastics

The raw, hulled soy beans contain, depending upon variety, approximately 18 % oil, 38 % protein, 30 % saccharides, and 14 % moisture and ash. The saccharide component is normally about 15 % of soluble saccharides and 15 % of starch. Since 1940, when Henry Ford presented in public the strength of a car body made of a soybean-based material, this material is taken as highly prospective for production of soybean–formaldehyde-based thermoset composite from renewable resources. During composting soy protein films samples degraded with 50 % mass loss in about 10 days and with up to 95 % mass loss in 30 days [14]. Soy plastics can possess significantly higher Young's module (4.4 GPa) than those of petrochemical plastics and show good potential as an alternative for replacing petrochemical, nonbiodegradable plastics for engineering applications..
Urethane Soy System Company (Illinois) is now producing soy-based polyols for rigid and flexible urethane foams under the name SoyOyl®. *Dow Chemical* developed soy-based biodegradable material BioBalance® which is used in carpet backings.

2.5. Poly-beta-hydroxyalkanoates (PHB)

PHB, a member of poly hydroxyl alkanoates, degrades under the presence of various microorganisms which upon contact with the polymer secrete enzymes that break the polymer into smaller parts. The three most unique properties of PHB are 100% resistance to water, 100% biodegradability and of course thermoplastic process ability. Metabolix Company uses their registered products as Mirel® and Biopol® for the following markets: packaging, single use and

disposable items, housewares, etc. At the moment they use as conversion processes like injection molding, cast film, thermoforming, extrusion but they are extending the range of technologies to blown film, blow molding and foam.

2.6. Polylactic Acid (PLA)

PLA is emerging as one of the most attractive packing material because of its excellent biodegradability, process ability, and biocompatibility. Its degradation is dependent on time, temperature, low molecular weight impurities, and catalyst concentration). PLA films have better ultraviolet light barrier properties than low density polyethylene (LDPE). It has lower melting and glass transition temperatures. PLA is mainly composed of lactic acid (2-hydroxy prop ionic acid) and contains pendent methyl group on the alpha carbon atom which gives rise to a specific structures. This in turn increases the molecular weight and when sufficiently high it becomes insoluble in water, weight impurities, and catalyst concentration. PLA picks up ambient moisture very rapidly and most of the problems experienced on PLA arise from inadequate drying. Hence, PLA is required to be properly dried before processing. Because it is a condensation polymer, the presence of even a very small amount of moisture during melt processing causes degradation of polymer chains and loss of molecular weight and mechanical properties. Less than 200 PPM is better because viscosity is more stable. PLA needs a dehumidifying (desiccant) dryer. Amorphous grades used for heat seal layers in film are dried at 60 degree C for 4 hours. Crystallized grades used to extrude sheet and film are dried at 80 degree C for 4 hours. Processes with long residence times or higher temperatures like fiber spinning need more drying, to less than 50 PPM of moisture [15]. Like PET, PLA requires crystallization so it will not clump together in a dryer.

PLA is used for producing loose-fill packaging, compost bags, food packaging, disposable tableware or biodegradable and compostable disposable cups for cold beverages. Also, Applying an antimicrobial polylactic acid (PLA) coating to apples inhibits the formation of foodborne pathogens such as E.coli and Salmonella[16]. A company which started using this material is Danone – its switch from polystyrene to PLA for its Activia yoghurts has reduced the carbon footprint of the packaging by 25 per cent and cut fossil resource use by 43 per cent [17].

3. Conclusions

Most of the material being thermoplastic and so one of its main processing technologies is injection moulding, there is only a little amount of information about the shrinkage and warpage characteristics of the materials, which data is indispensable for designing an injection moulding product. At the moment, the experience available for processing, injection moulding of biodegradable polymers and for the designing and usage of a biodegradable polymer product is low.

Although there are numerous literatures dealing with the investigation, blending and biodegradability of these materials there is no information about the effect of the holding pressure – like a shrinkage decreasing parameter – on the high shrinkage of TPS for example. A current limitation for applying biobased plastics is that they are often seen as substitutes for existing plastics in existing products. This may be sufficient for some materials but for unique bio-based plastics such as lignin based, PLAs and PHBs. A typical material characteristic thus becomes an opportunity for new designs rather than a limitation in existing molds. The challenges for low shrinkage materials can be addressed in new moulds adjusting draft angles and the ejector systems.

4. Acknowledgement

This work was partially supported by the strategic grant POSDRU 107/1.5/S/77265, inside POSDRU Romania 2007-2013 co-financed by the European Social Fund – Investing in People.

4. References

1. Cha, D.S., Chinnan, M.S., *Biopolymer-based antimicrobial packaging: a review.* Critical Reviews in Food Science and Nutrition, Vol.14, No. 44, October 2004
2. Jin T., Zhang H., *Biodegradable Polylactic Acid Polymer with Nisin for Use in Antimicrobial Food Packaging,* Journal of Food Science, Vol. 73, No. 3, February 2008
3. Cheruvu,P.,Kapa,S., Mahalik, N.P., *Recent advances in food processing and packaging technology.* International Journal of Automation and Control, Vol. 2, Nr. 4, 2008
4. Mahalik, N.P., Nambiar A.N., *Trends in food packaging and manufacturing systems and technology,*Trends in Food Science & Technology, Vol 21, Nr. 3, March 2010
5. Arora V.K, Kempkes M., *Industry perspectives and roles*, Food Science and Technology International, Vol. 14, No. 5, October 2008
6. http://www.astm.org/ Accessed: 2011-05-29
7.11.12 Flieger M., Kantorova M., Prell A.,Rezanka T.,Votruba J., *Biodegradable plastics from renewable sources,* Folia Microbiologica, Vol.48, Nr. 1, 2003. Availabe online: http://www.cssm.info/priloha/FM2003_027.pdf
8. Tabi T., *The analysis of processing and usage of injection moulded biodegradable polymers made of starch and poly(lactic acid*), PhD thesis booklet,2010 .Available online: http://www.omikk.bme.hu/collections/phd/Gepeszmernoki_Kar/2011/Tabi_Tamas/tezis_eng.pdf
9. Fomin V. A., Guzeev V. V., *Biodegradable Polymers, their present state and future prospects*. Progress in Rubber and Plastics Technology, Vol.17, Nr.3, 2001.
11. Wiedmann, W., Strubel, E., Compounding of thermoplastic starch with twin-screw extruders,

Starch – Starke, 1991 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim

12. Shin C.H., Kim Y.J.,Kim, B.S., Shin B.Y., *Mechanical properties and biodegradability of PCL/TPS blends,* Polymer Korea,, Vol.24, 2000
13. Goosen M.F.A., *Applications of Chitin and Chitosan,* Technomic, Lancaster, 1997
14. Park S. K., Hettiarachchy N. S., Were L., *Degradation behavior of soy protein-wheat gluten films in simulated soil conditions. Journal of Agricultural and Food Chemistry*, Vol. 48, Nr.7, June 29, 2000
15. http://www.plastemart.com/upload/Literature/ProcessingofPLA%28biopolymer%29.asp Accessed: 2011-05-23
16. http://www.foodproductiondaily.com/Processing/PLA-coating-cuts-foodborne-pathogens-on-apples Accessed: 2011-06-01
17. http://www.dairyreporter.com/Processing-Packaging/Danone-explores-recycling-for-PLA-with-NatureWorks Accessed: 2011-06-01

Polimeri biodegradabili folositi in industria ambalajelor – lucrare de sinteza

Rezumat

Scopul prezentei lucrari este de a face o trecere in revista a principalelor cercetari desfasurate in ultimii ani in ceea ce priveste producerea si procesarea de polimeri biodegradabili din resurse regenerabile. Necesitatea din ce in ce mai mare de a folosi astfel de materiale este cauzata de cresterea gradului de constientiazre asupra schimbarilor climatice si epuizarii resurselor de combustibili fosili utilizati pentru producerea plasticului clasic. Bioplasticurile pot fi produse cu usurinta din polimeri naturali cu o larga raspandire cum ar fi amidonul, celuloza, chitina sau soia. Fiind perceputa doar ca si substitute pentru plasticul clasic a reprezantat o limitare in adaptarea tehnologiei de procesare a acestora. Desi au proprietati termoplastice si pot fi procesate folosind tehnici similare ca si pentru plasticul traditional (in special injectia de mase plastice) majoritatea bioplasticurilor au de asemenea si caracteristici specifice care necesita o studiere aprofundata pentru a dezvalui noi oportunitati de proiectare si procesare.

INDEX OF AUTHORS

A

AILINCĂ, Alina Georgeta 55
AVRAM, Iulian 133
AVRAM, Rodica 133

B

BALINT, Mihai 133
BALOGH, Ramon-Mihai 213
BANCIU, Viorica 33
BASSIM, Malan 92
BĂDILEANU, Maria 260
BENEA, V. G. 223
BERBENTE, Corneliu 159
BERBENTE, Sorin 159
BERZAN, Rodica 51
BLÂNDUL, Valentin Cosmin 294
BOSTAN, Ionel 43, 47
BRUMĂ, Inesa 79

C

CALINOIU, Delia 102
CERNESCU, Anghel 125
CIOBANU, Magdalena Adina 117
CIOABLĂ, Adrian Eugen 313
CIOCÂRLIE, Tudor 137
COJOCARU, I. A. 223
COLOMEICO, E. P. 223
CRICLIVAIA, Diana 79
CRISTE, Adina 55
CROITORU, Victor 196

D

DAMIAN, Valeriu 219, 227
DATSKO, Tatiana 241
DEMENESCU, Veronica 04
DICU, Maria Magdalena 238
DINITA, Alin 151
DOROBANȚU, Dorel 231, 238
DOSPINESCU, Andrei 260
DRĂGULIN, Stela 304, 308
DUCU, Cătălin 231, 238
DUMITRACHE, Alexandru 167, 171
DUMITREL, Gabriela Alina 313
DUMITRESCU, Horia 167, 171
DVORNIKOVA, Elena 241

E

EBRASU, Daniela 231
ENĂCHESCU, Marius 231, 238

F

FAUR, Nicolae 125
FLEŞER, Traian 125, 163, 200, 204
FRUNZULICA, Florin 167, 171

G

GAVAT, Cristian 197
GHEORGHIAN, Adina 88
GHEORGHICĂ, Daniel 196
GHIMIŞI, Ştefan 209
GIURGI, Cătălina 142

H

HANGANU, Marius 3

I

IONEL, Ioana 92, 102, 213, 313
IOSIFESCU, Cristian 227
IOVU, M. A. 223
IOVU, M. S. 223
IRIMESCU, Adrian 88
IZBASH, Olga 298

J
JIREGHIE, Angela 37

L
LELEA, Dorin 106
LEONTE, Dinu 19
LEOVARIDIS, Cristina 71
LONTIS, Nicolae 213
LUPU, Iulia 55

M
MACOVEI, Anamaria G. 274, 278
MALINOVSCHI, Viorel 231
MANDRAVEL, Cristina 175
MATIUTI, Carmen – Luminița 96, 129
MATIUTI, Marcel 96, 129
MICUŞA, Diana 23, 287
MICUSA, Dumitru 269
MILEA, Camelia 55
MISTREAN, Denis 84
MISTREAN, Larisa 84
MÎNDRILĂ, Giorgiana C. 175
MOGA, Victor Dan 137
MOGA, Mariana 137
MOGA, Sorin 231, 238
MORGOVAN, Valentin 33

N
NĂSTASE, Adriana 147
NEAGU, Cornelia 255, 260
NEGREA, Denis 231, 238
NGUYEN, Thi Hoa 219, 227
NISULESCU, Cătălin 102

O
OLTEANU, Alexandru 12, 75
OPREA, Ştefan 184

P
PERETETCU, Sergiu 188
PICIU, Gabriela Cornelia 59, 63
POP – CALIMANU, Marius 163
POPA Dan 282
POPA, Ilie 117
POPESCU, Francisc 106
PREOTU, Octavian 167, 171

R
RADOI, Mădălina Antoaneta 12, 75
RAȚIU, Mefodie T. 301
ROŞU, Dan 184, 197
ROŞU, Liliana 184, 197

S
SABĂU, Carmen 247, 251
SABĂU, Isabelle 247, 251
SASU, Constantin 8, 67
SASU, Luciana 8, 67
SEARS, Stela 317
SMARANDA, Alexandru 321
STEPAN, Dan Simion 213
STOICA, Virgil 106
SZUHANEK, Camelia 121, 125, 200, 204

T
TAZLAVAN, V. E. 223
TODOROI, Dumitru 188, 264
TODOROI, Nicoleta 23, 287
TODOROI, Zinaida 269
TRICĂ, Carmen Lenuța 59, 63
TUDORAN, Cristina 142
TUDORAN, Mariana 142

Ț
ȚUCU, Dumitru 321

V
VETRES, Ion 92, 313

Z
ZECHERU, Gheorghe 151
ZELENTSOV, Veacheslav 241

ARTICLE'S TITLE (TNR 14, CAPITALS, BOLD, CENTERED, max. 3 lines)

Name1 SURNAME1[*], Name2 SURNAME2[**] (TNR 12, bold, centred no titles)
[*] Represented institution (TNR 11, centred), address, e-mail
[**] Represented institution (TNR 11, centred), address, e-mail

Abstract. The abstract should be written using the justified format, single space, Times New Roman font, size 9. The abstract should be brief, concise and have 10 ... 20 lines. It should be informative giving the scope and emphasizes main conclusions, results, or significance of the work described. Use short, direct and complete sentences

Keywords: 3 … 5 significant key words (TNR font, size 11, single space, justified format)

1. Introduction (TNR 10, bold, left alignment)

The paper has to be written in English. Its contents should be structured in the following way (recommendation): problem description, application field, research stages, methods used, results, further research, conclusions, and references.

The paper has to offer the answers for the following questions: description of the problem, what is done by other people, what the authors did, what is new, what is my contribution.

2. Editing instructions(TNR 10, bold, left alignment)

2.1. Text format (TNR 10, bold, left alignment)

In MS Word, under the File menu, choose Page Setup and set the Top, Bottom, Left & Right Margins as 2 cm, the Gutter as 0 cm, and the Header and Footer to 1.2 cm and choose Apply to: Whole Document. Then select the Paper Size tab and set the Paper Size: Letter and Orientation: Portrait. To setup the two-column format, select Columns under the Format menu. Here set number of columns to 2 and check the Equal column width box on the lower left corner. Then set the Column Width to 8.15 cm and Spacing to 0.69 cm and choose Apply to: This point forward. It is also requested that the contributions should include an abstract, an introduction, conclusions and relevant references in addition to the paper itself.

2.2. Language, Stile Spelling

- Use common technical terms.
- Use concise and intelligible phrases.
- Use English Spelling.

2.3. Soft copy

Use the name and surname of first author to identify you, e.g. **Name_SURNAME.doc**.

3. Figures & Tables

Figures have to be made in high quality and only black and white (greyscale), which is suitable for reproduction and print. Place figures (centre aligned) as close as possible to their first reference in the paper.

Figures and tables larger than the column width can be placed on the whole width of the page.

The text inside the figures and notations has to be 10 pt. Figure number, 10 pt, centre aligned, followed by figure title 11 pt, regular.

Insert draw/image, centred
Figure 2 Name of the figure (TNR, 10pt, centred)

Figures and tables must fit into a single column (8.45 cm). Wider figures may be placed in single columns but only as an exception as long as the paper does not exceed its 4-page limit. Figure and table titles must be typed in bold and should appear below the figures and above the tables.

TimesNew Roman 10p, single.

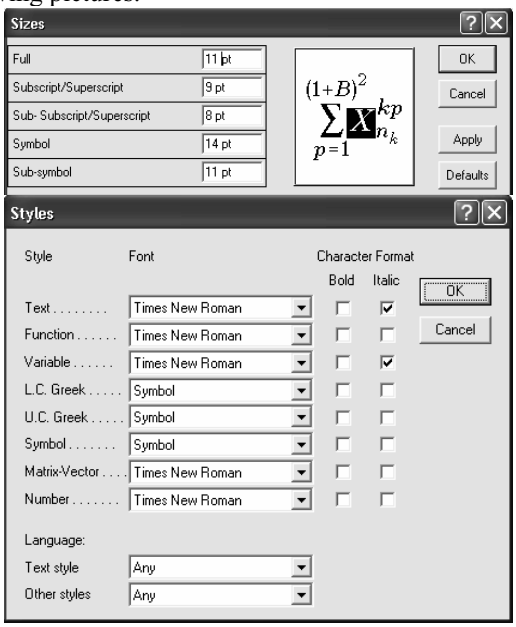
Table 1 Title of the table

TNR 10		

Pictures drawn with Microsoft Office tools will be grouped, using Group function (from Drawing toolbar).

4. Mathematical relations

Use only Microsoft Equation Editor, according to following pictures.



Equations are centred and numbered consecutively, starting at 1.

Equations must also fit into a single column (8.45 cm). Please use *italics* for symbols, **bold** face for vectors and normal fonts for standard functions (i.e. log, ln, exp) and subscripts (i.e. H_{appl}).

$$x = \sum_{i=1}^{n} \sqrt[3]{\frac{\cos\alpha}{\ln 35}} \qquad (1)$$

Equations are centred in a table with no line borders and cell text centred.

Aknowledgment (if is necessary)

References

References should be complete and have to include at least 10 items.

References will be written only in English language with the mention of the original language.

When a publication is mentioned in text, enclose its number in brackets, for example [1] or [2, 7, 8, 12].

All references will be directly cited in the body of the paper text. References will be arranged in the order of citation.

Text references will be TNR 10, single space, justify, formatted accordingly to following examples.

1. Surname11, N11., Surname12, N12.: *Name of Book, in Italics*. Publisher, ISBN, Place of Publication, Year, p. xx-yy (optionally) (in Language, if is not in English)
2. Surname21, N21.: *Title of conference paper*. Proceedings of Conference Name, Editor Name (Ed.), p. xx-yy, ISBN, Conference location, month and year, Publisher, City, Country (in Language, if is not in English)
3. Surname31, N31., Surname32, N32.: *Name of paper*. Name of Journal, Vol., No., month and year of the edition, p. (first-last), ISSN, Place of Publication (City, Country) (in Language, if is not in English)
4. Surname41, N41., Surname42, N42.: *Name of paper*. In: Name of Book, Name(s) of Editor(s), (Ed.), p. xx-yy, Publisher, ISBN, Place of publication (City, Country), Year (in Language, if is not in English)
5. Surname51, N51., Surname52, N52.: (2000). *Name of Paper*. Available at: http://www.exact-address-of-site. Accessed: YYYY-MM-DD
6. Surname71, N71., Surname72, N72.: *Name of patent*. Patent Symbol of country no. XXXXXXX, Int.Cl. xxxxxx (optionally), Year
7. Surname81, N81.: *Name of PhD thesis*. PhD thesis. Institution, City, Country, Year, p. xx-yy (optionally) (in Language, if is not in English)