NEW PERFORMANCE IMPROVEMENT TECHNIQUES OF CONTROL SYSTEMS USING EXPERIMENT-BASED TUNING

Goal of the project

- Enhancement and development of data-based (data-driven) techniques and algorithms for improving control system performances using experimental data.
- Enhancement and development of nature-inspired algorithms n optimization of control system performance.
- Development of optical character recognition (OCR) applications.
- Development of new fuzzy control solutions for a wide range of industrial processes.

Short description of the project

Enhance existing techniques, develop new ones for data-based control system performance improvement.

Project implemented by

Department of Automation and Applied Informatics of UPT
http://www.aut.upt.ro/~rprecup/grant2011.html

Implementation period

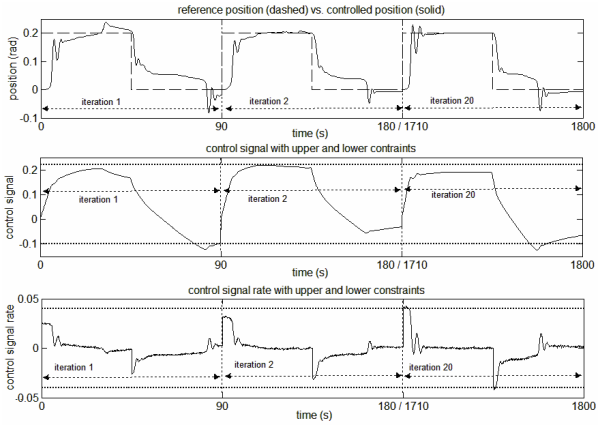
2011-2016.

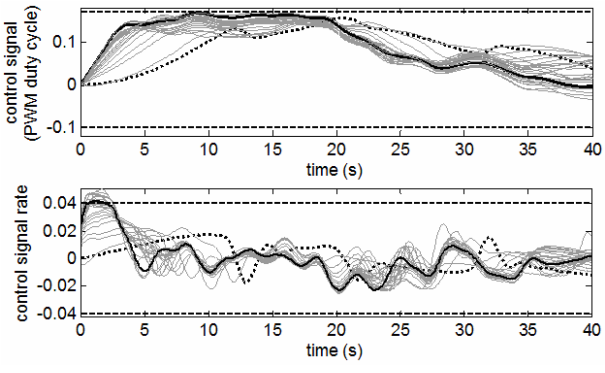
Main activities

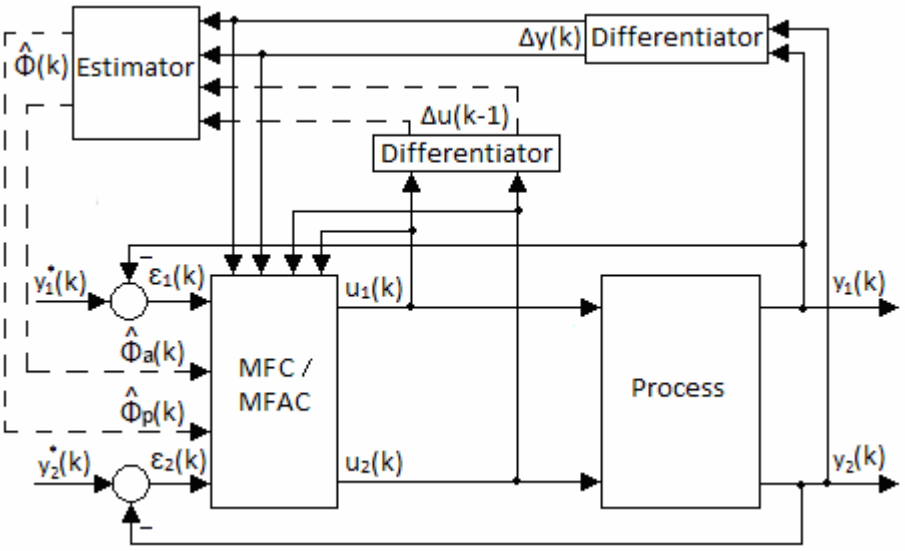
- Application of Iterative Feedback Tuning (IFT) to controller tuning for nonlinear control systems.
- Model-Free Adaptive Control strategies applied to aerodynamic systems.
- An experiment-based approach to Reference Trajectory Tracking optimal control problem with constraints.
- Validation of iterative techniques on laboratory equipment: liquid level control, motion control systems with motor actuation (speed and position control).
- Enhancement of control systems performance by fuzzy control, IFT and nature-inspired optimization algorithms.
- PI and fuzzy controller tuning to ensure a reduced process parametric sensitivity.
- Improve the training algorithm of Convolutional Neural Networks using mixed Back-Propagation and nature-inspired optimization algorithms.

Results

- 8 papers published in Thomson Reuters Web of Science (WoS) journals with impact factors.
- 7 papers published in conference proceedings indexed in WoS.
- 3 papers published in conference proceedings indexed in international databases.
- 1 book chapter published in a Springer-Verlag volume.
- More than 30 independent citations in 2016.







Applicability and transferability of the results

Control systems with a reduced parametric sensitivity, tools for the computer-aided design of controllers, computer-aided techniques in iterative data-based control, nature-inspired optimization algorithms in control design and image processing, tools for the systematic development of fuzzy control systems.

Financed through/by

Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI), Bucharest, Romania.

Research Centre

Automatic Systems Engineering Research Centre (CCISA).
http://www.aut.upt.ro/centru-cercetare/index.EN.php

Research team

Prof. Dr. Ing. Radu-Emil Precup - director, principal investigator
Prof. Dr. Ing. Stefan Preitl - senior staff member
Assoc. Prof. Dr. Ing. Florin Drăgan - senior staff member
Lect. Dr. Ing. Daniel Iercan - post doc
Lect. Dr. Ing. Mircea-Bogdan Rădac - post doc
Lect. Dr. Ing. Claudia-Adina Bojan-Dragoş - post doc
Assist. Lect. Dr. Ing. Alexandra-Iulia Szedlak-Stînean - post doc
M.Sc. Dipl. Ing. Lucian-Ovidiu Fedorovici - Ph.D. student

Contact information

Prof. Radu-Emil PRECUP, PhD
Politehnica University of Timisoara
Department of Automation and Applied Informatics
Bd. V. Parvan 2, 300223 Timisoara, Romania
Phone: (+40) 256 403229
Fax: (+40) 256 403214
E-mail: radu.precup@upt.ro
http://www.aut.upt.ro/~rprecup/

CONTROL ALGORITHMS AND OPTIMAL TUNING OF FUZZY MODELS FOR AUTOMOTIVE, MECHATRONICS APPLICATIONS AND MOBILE ROBOTS

Goal of the project

- Development of advanced control structures for automotive and mechatronics applications.
- Improvement and development of new Takagi-Sugeno (T-S) fuzzy models and control solutions for a wide range of industrial processes, mechatronics, mobile robots and automotive applications.
- Optimal tuning of fuzzy models for automotive and mechatronics applications.
- Improvement and development of control algorithms for mobile robots.

Short description of the project

Advanced control structures and optimal tuning of fuzzy models for a wide range of industrial processes are offered.

Project implemented by

Department of Automation and Applied Informatics of UPT as the P1 partner, coordinator: "Gheorghe Asachi" Technical University of Iasi (TUIASI), P2 partner: S.C. ROMUS Trading & Development SRL, director: Prof. Dr. Eng. Silvia Curteanu (TUIASI).

Implementation period

2012-2016.

Main activities

- Development and experimental validation of simple T-S fuzzy models, evolving fuzzy models and advanced controllers (2-DOF, predictive and fuzzy) for processes in automotive and mechatronics: anti-lock braking systems, nonlinear DC drive servo systems, magnetic levitation systems.
- Continuous development of the nRobotic platform for path planning and collision avoidance of mobile robots in missions.
- Modeling, simulation, analysis and development of: T-S PD + I fuzzy controllers, 2-DOF linear and fuzzy controllers, hybrid T-S fuzzy controllers for speed and position control of brushless DC drives with variable parameters and inputs.
- Optimal tuning of parameters of T-S fuzzy models using nature-inspired algorithms: charged system search, grey wolf optimization, gravitational search algorithms.

Results

- 12 papers published in Thomson Reuters Web of Science (WoS) journals with impact factors.
- 14 papers published in conference proceedings indexed in WoS.
- 26 papers published in conference proceedings indexed in international databases.
- 3 papers published in journals indexed in international databases.
- More than 50 independent citations in 2016.

Applicability and transferability of the results

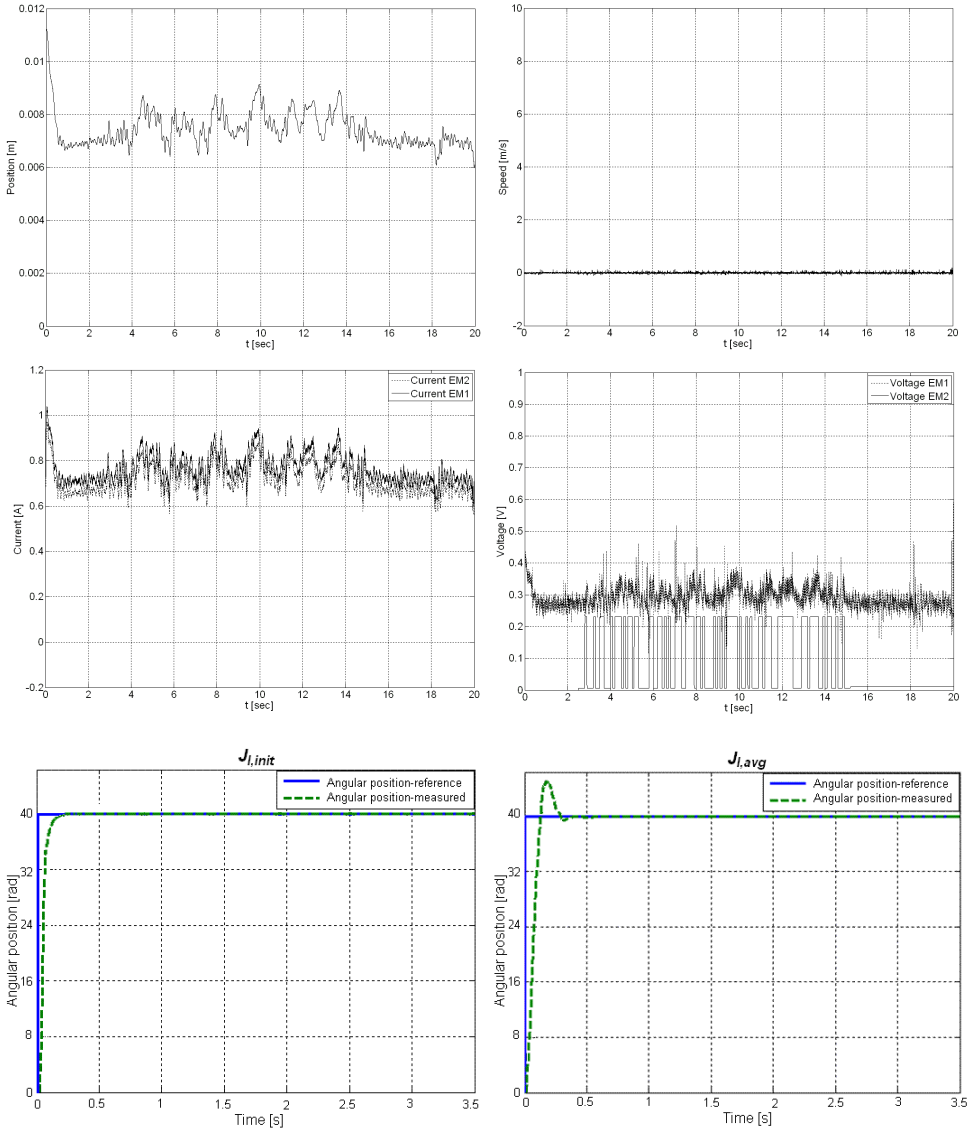
- Nature-inspired evolutionary-based optimization algorithms in modeling and control design.
- Cost-effective solutions for control problems in mechatronics, electrical drives, automotive and robotics.
- Tools for the modeling, optimization and design of fuzzy control systems.
- Real-time programming and operating systems for control and robotics.

Financed through/by

Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI), Bucharest, Romania.

Research Centre

Automatic Systems Engineering Research Centre (CCISA).
http://www.aut.upt.ro/centru-cercetare/index.EN.php



Research team

Prof. Dr. Eng. Radu-Emil Precup - director
Prof. Dr. Eng. Stefan Preitl
Prof. Dr. Eng. Ioan Filip
Assoc. Prof. Dr. Eng. Florin Drăgan
Lect. Dr. Eng. Adriana Albu
Lect. Dr. Eng. Ovidiu Baniaş
Lect. Dr. Eng. Daniel Iercan
Lect. Dr. Eng. Mircea-Bogdan Rădac
Lect. Dr. Eng. Claudia-Adina Bojan-Dragoş
Assist. Lect. Dr. Eng. Alexandra-Iulia Szedlak-Stînean, PhD student
M.Sc. Eng. Lucian-Ovidiu Fedorovici, PhD student
M.Sc. Eng. Constantin Purcaru

Contact information

Prof. Radu-Emil PRECUP, PhD
Politehnica University of Timisoara
Department of Automation and Applied Informatics
Bd. V. Parvan 2, 300223 Timisoara, Romania
Phone: (+40) 256 403229
Fax: (+40) 256 403214
E-mail: radu.precup@upt.ro
http://www.aut.upt.ro/~rprecup/

HYBRID SYSTEMS FOR CONVERTING RENEWABLE ENERGY OF SMALL VOLTAGE INTEGRATED INTO A MICROGRID

Goal of the project

The project is focused on the research, development and testing of an intelligent and flexible (configurable) small scale power system based on integration of three renewable energy sources: wind, hydro, and solar (photovoltaic) power, adapted to the available resources in Romania, in various regions of the country, working independently or connected to the grid.

Short description of the project

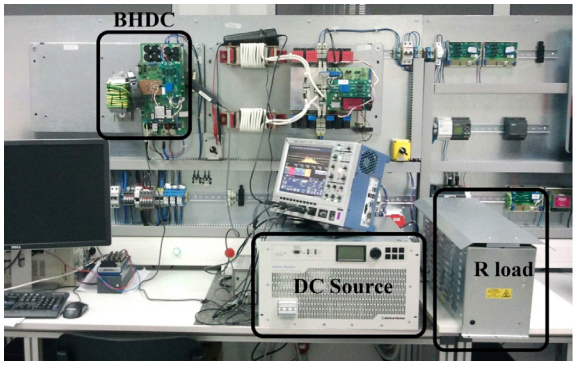
The project covers the entire power conversion structure, including the design of adequate prime movers and new types of generators and power electronic converters, storage devices, power flow management system and load control. Some configurable structures (wind, micro-hydro and PV, all or a part of them, including their integration in a microgrid) are proposed as experimental models, ready to be transferred to industry. There are proposed novelty elements regarding: low power wind turbine with integrated overspeed protection system, new generators configurations, and new topologies for power electronic converters and microgrid structures, optimal local control strategies and intelligent power system management.

Project implemented by

Politehnica University of Timisoara – Project coordinator
Technical University of Cluj-Napoca – Project partner
SC EETIM SA – Project partner

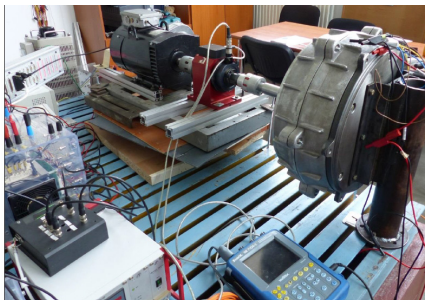
Implementation period

2012-2016



Main activities

- Microgrid components modeling, simulation and design.
- Microgrid components manufacturing, individual testing and integration in the experimental setup.
- Design, implementation and validation of the control strategies for microgrid components.
- Design, implementation and validation of the microgrid control strategy.
- Results dissemination and know-how exchange.



Results

- A new over-speed protection system for wind turbines.
- A new electrical reactive brushless dc generator with performances comparable with high energy PM generator, at low cost.
- A new RF-IPMSG with high efficiency, maintenance-free operation, and high-controllability.
- A new AF-PMSG optimized for modular design. A new multiphase inverter with adequate control for the proposed generators.
- New multi-input dc-dc converters with high efficiency.
- High power tandem inverters for load management.
- Hardware and software package for power management, power flow control, individual converter control, and MPPT and other control strategies.
- Experimental microgrid system with integrated photovoltaic, wind and hydro generation.
- Technical papers published in top international journals and conference proceedings.

Applicability and transferability of the results

All the research results are the property of the project coordinator and its partners..

Financed through/by

Joint Applied Research Projects - Partnership in S&T priority domains financed by the Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI).

Research centre

Research Centre for Automatic Systems Engineering

Research team

Octavian Prostean
Nicolae Muntean
Nicolae Budisan
Ioan Filip
Mircea Barglazan
Stefan Kilyeni
Ilarie Bordeasu
Teodor Milos
Cristian Vasar
Iosif Szeidert-Subert
Lucian Tutelea
Cristian Lascu
Sorin Deaconu
Gabriela Prostean
Dan Ungureanu
Andreea Robu
Adrian Bej
Radu Boraci
Octavian Cornea
Ovidiu Tirian
Rodica Badarau

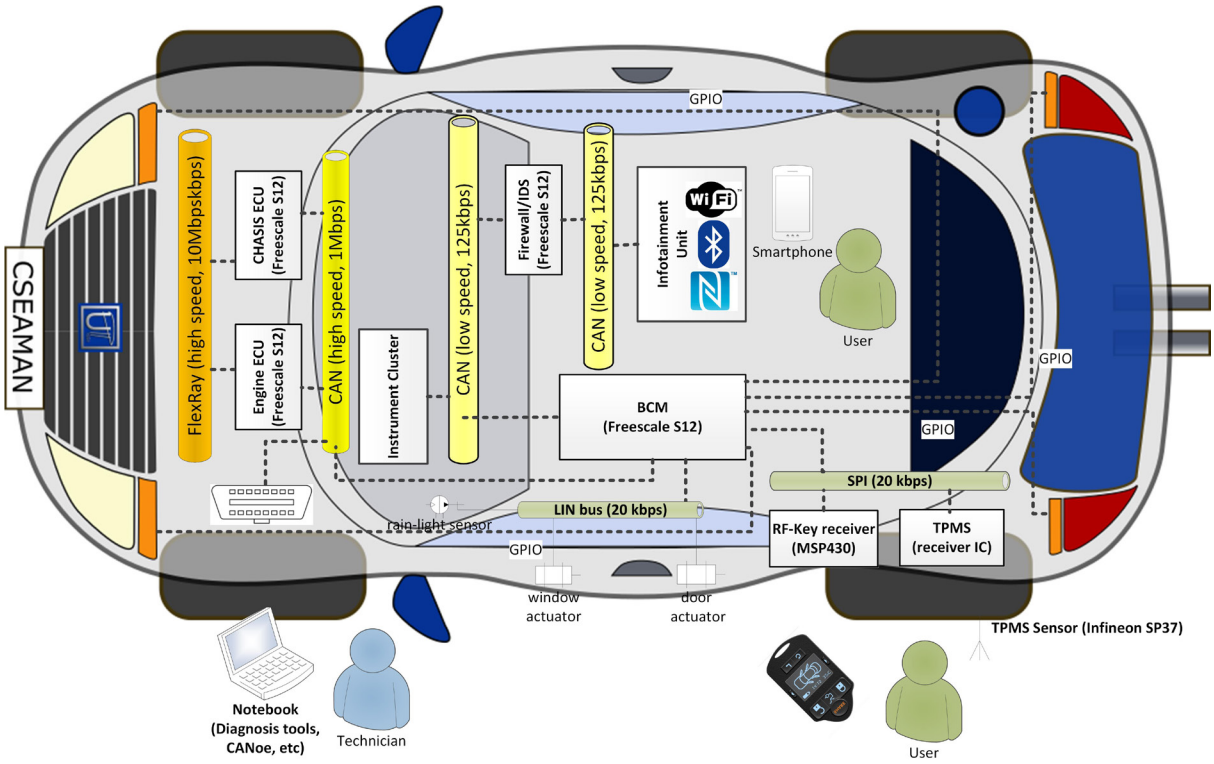
Contact information

Prof. Octavian PROSTEAN, PhD
Department of Automation and Applied Informatics
Address: Bv. Vasile Parvan, No. 2, 300223, Timişoara
Phone: (+40) 256 403 225
E-mail: octavian.prostean@upt.ro

CSEAMAN - CRYPTOGRAPHIC SECURITY FOR AUTOMOTIVE EMBEDDED DEVICES AND NETWORKS

Goal of the project:

The design and analysis of cryptographic security solutions for automotive embedded devices and networks



Short description of the project:

The project aims at the design and analysis of cryptographic security solutions with applications in the automotive domain. Our main challenge is to accommodate cryptographic security on automotive-grade devices with low computational and memory resources that communicate over in-vehicle networks with constrained bandwidth. We focus both on wired and wireless channels that open cars to outsiders and bring a complex adversarial setup. Existing security sub-systems in cars (e.g., wireless keys, TPMS units) are also within reach.

Project implemented by

Research Group on Embedded Systems and Security, Department of Automation and Applied Informatics, Faculty of Automatics and Computers (UPT)

Implementation period:

Oct. 2015 – Sept. 2017

Main activities:

- Implementation and security analysis of cryptographic functions on automotive grade embedded devices, e.g., AUTOSAR compliant cryptographic libraries,
- Design and analysis of cryptographic protocols for wired in-vehicle networks, e.g., CAN bus, J1939, FlexRay, etc.
- Design and analysis of cryptographic protocols for wireless in-vehicle connectivity, e.g., RF keys, TPMS systems, etc.
- Implementation of an experimental platform for security critical subsystems inside the car: communication buses linking various ECUs with potentially insecure third-party devices (e.g. infotainment units)
- Risk analysis and security implications within new automotive paradigms: optimized traffic flows, vehicle-to-vehicle communications, etc.

Results:

- Comprehensive performance analysis of cryptographic primitives on automotive-grade controllers
- Analysis of fingerprinting and randomness extraction mechanism from SRAM state
- Design of new security solutions for wireless vehicle access
- Design of new security solutions for the CAN bus
- Security analysis and fixes for the J1939 commercial-vehicle bus protocol
- Analysis of traffic models with adversarial vehicle behavior
- Risk analysis and security implications for attacks on BCM units

.

Applicability and transferability of the results:

Various applications in the automotive industry for securing critical vehicular systems and networks, e.g., wireless keys, CAN bus, ECU fingerprinting, etc.

Financed through/by

Romanian National Authority for Scientific Research and Innovation (CNCS-UEFISCDI) Project No. PN-II-RU-TE-2014-4-1501

Research team

Habil. PhD. Eng. Bogdan Groza - director
Phd. Eng. Stefan Murvay (postdoctoral researcher)
Phd. Eng. Horatiu Gurban (postdoctoral researcher)
Eng. Diana Pop (PhD student)
Eng. Catalin Briciu (PhD student)
Eng. Tudor Andreica (student)
Eng. Alexandru Matei (student)
Inf. Roxana Farcasescu (PhD student)

Contact information

Assoc. Prof. Bogdan GROZA, PhD
Faculty of Automatics and Computer,
Bd. V. Parvan, No. 2, 300236, Timisoara
Phone: (+40) 256 403242
E-mail: bogdan.groza@aut.upt.ro
Web: http://www.aut.upt.ro/~bgroza/Projects/cSEAMAN

LEARNING TECHNIQUES FOR IMPROVING CONTROL SYSTEMS PERFORMANCE USING MODEL-FREE APPROACHES

Goal of the project:

The main objective of this proposal is to develop the necessary tools, algorithms and theoretical framework in order to induce the learning-predictive behavior for control systems using model-free control approaches. Several reference input-controlled output behaviors are memorized as primitive tasks inside a library. The primitives are used in predicting the optimal behavior of the control system when a new complex task is to be executed. A planning mechanism similar to a brain will be built in order to achieve this task.

Short description of the project:

The proposed techniques endow control systems with learning and planning features.

Project implemented by

Department of Automation and Applied Informatics of Politehnica University of Timisoara
http://mbradac.info/te2015.html

Implementation period:

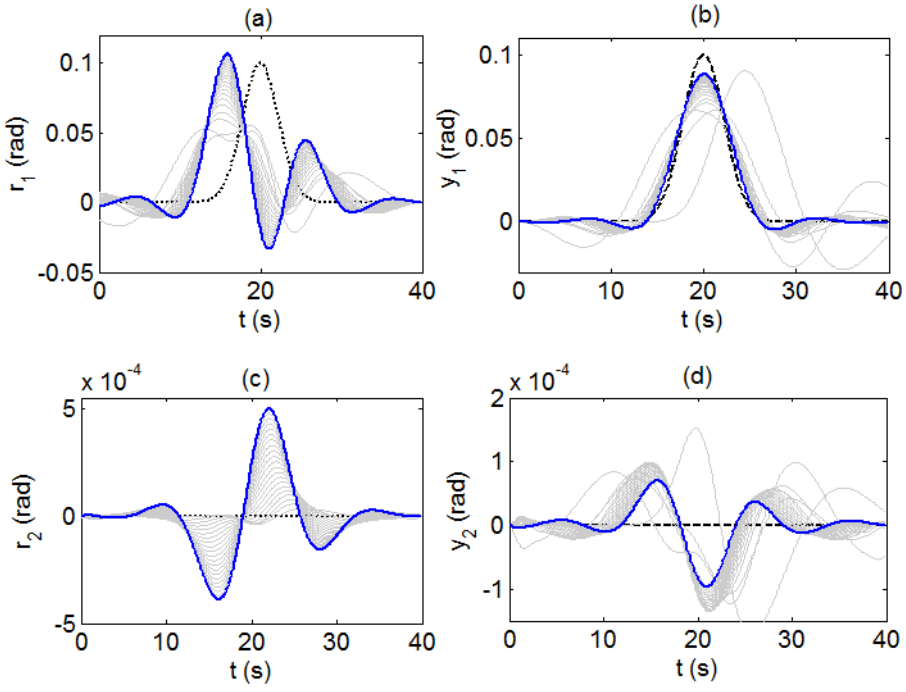
2015-2017

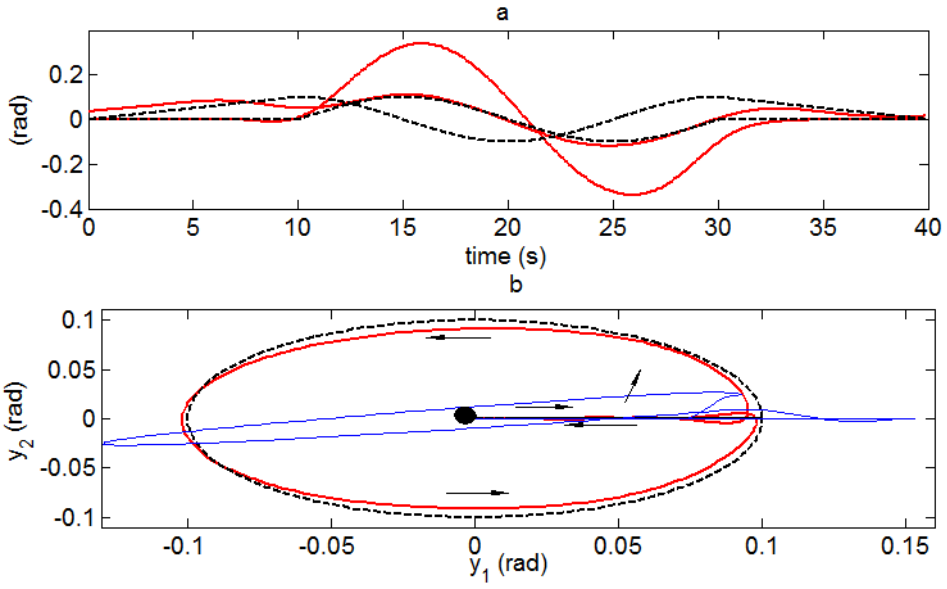
Main activities:

- Improvement of data-based (or data-driven) techniques and their combination for obtaining improved capabilities.
- Development and validation of a primitive-based learning and planning strategy for feedback control systems.
- Validation of the proposed theoretical approaches on real-world processes such as laboratory equipments.
- Dissemination of research results in highly visible journals and conferences.

Results:

- 4 papers published in Thomson Reuters Web of Science journals with impact factors;
- 8 papers published in conference proceedings (to be) indexed in international databases (ISI, IEEE Xplore, INSPEC, Scopus, DBLP);
- 1 book chapter published in a Springer-Verlag volume.





Applicability and transferability of the results:

Owing to the generality of the proposed theoretical framework, the primitive-based learning and planning approach for achieving optimal behavior can be applied to various (feedback) control systems such as mechanical, electrical, chemical, biological, or combinations of the above, in order to enhance them with optimal behavior ability in situations or scenarios never seen before. Thus, they imitate the living organisms. The results also connect several perspectives from the areas of feedback control and machine learning.

Financed through/by

Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI), Bucharest, Romania.

Research Center

Automatic Systems Engineering Research Centre (CCISA)
http://www.aut.upt.ro/centru-cercetare/index.EN.php

Research team

Lect. Dr. Ing. Mircea-Bogdan Rădac - director, principal investigator
Prof. Dr. Ing. Radu-Emil Precup - senior staff member
Assist. Lect. Dr. Ing. Alexandra-Iulia Szedlak-Stînean - post doc
M.Sc. Dipl. Ing. Raul-Cristian Roman - Ph.D. student
M.Sc. Dipl. Ing. Constantin Purcaru - Ph.D. student

Contact information

Lect. Mircea-Bogdan RADAC, PhD
Politehnica University of Timisoara,
Department of Automation and Applied Informatics,
Bd. V. Parvan 2, 300223 Timisoara, Romania
Phone: (+40) 256 403240
Fax: (+40) 256 403214
E-mail: mircea.radac@upt.ro
http://www.mbradac.info

TIME AND ENERGY EFFICIENT FRAMEWORK FOR INTER-OPERATION OF SMART DEVICES (TEEFIOS)

Goal of the project

Development of an integrated real-time and energy efficient inter-operation framework for networks of smart sensors and devices - TEEFIOS.

Short description of the project

- Wireless networks of sensors and smart devices (WSN) are an extremely interesting topic, at the confluence of engineering fields with enormous impact on worldwide society: digital networks, wireless communications, and miniature embedded digital devices.
- Aware of the severe requirements and challenges raised by current applications in this area, we propose a new paradigm - Time and Energy Efficiency (T: or TEE).

The main proposed objectives focus on three distinct layers:

- (a) T:Node, a hardware-software environment and methodology for designing and assessing real-time behavior and efficient energy consumption of embedded devices,
- (b) T:YNet, a system for the development and analysis of TEE communication in wireless ad-hoc networks, and
- (c) T:PIlot, a methodology for the power management of the entire network. An integrated set of tools, benchmarks and databases will also be created to help advanced developers and researchers in the WSN area apply the TEE paradigm to applications with high impact.

Project implemented by

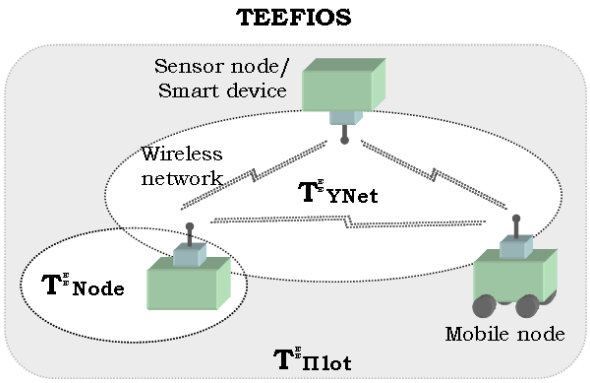
- DSPLabs - Digital Signal Laboratories Timisoara, Department of Computer and Software Engineering, Politehnica University of Timisoara.

Implementation period

01.10.2015 - 30.09.2017 (24 months)

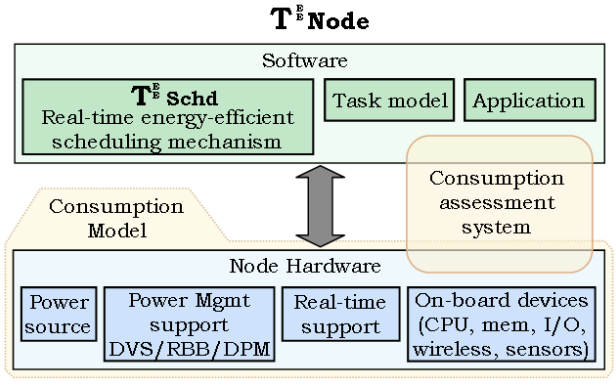
Grant value

548850 RON (~123337 EUR)



Main activities

- Energy consumption model and taxonomy for smart devices;
- Energy optimization real-time scheduling mechanism for smart devices;
- Methodology for node-level energy consumption assessment;
- Real-Time MAC protocol for ad-hoc wireless networks;
- Flexible real-time wireless module for smart devices;
- Framework for real-time communication in WSNs;
- Global power management methodology for networks of smart devices;
- Case studies to validate the TEEFIOS framework;
- Integrated set of databases and web-based tools;
- Information exchange, results dissemination and publication.



Results

- Integrated set of consumption models for smart devices;
- T:Schd, a real-time scheduling technique which optimizes energy consumption;
- Hardware/software methodology for the consumption evaluation of smart devices;
- Database with the energy efficiency evaluation and classification results for different types of smart devices;
- Real-time MAC protocol for ad-hoc wireless networks;
- Functional prototype of a flexible real-time wireless module for smart devices;
- A framework and a set of metrics for the evaluation of real-time wireless communication applications;
- A simulation testbed to evaluate the scalability of time and energy efficient WSN applications;
- T:Πlot, a global power management methodology for networks of smart devices;
- A collection of case studies that demonstrate the validity of the proposed framework and its individual components;
- An integrated set of web and database tools for public-level information and access to the TEEFIOS framework services.

Applicability and transferability of the results

- The real-time and energy efficient interoperation framework, along with the associated tool set and databases, will be of valuable use to the advanced developers and researchers in the field of wireless sensor/smart device networks.
- The results of this project will help them apply the TEE paradigm to applications with high impact in scientific, social, economic and environmental areas, such as: disaster recovery, smart buildings and structures, environment monitoring, smart energy grids and metering, robotic collectives, industrial process control, smart vehicles and transportation, security and surveillance.

Fields of interest

- Real-time systems;
- Energy efficiency;
- Sensors and smart devices;
- Wireless communication;
- Ad-hoc networks.

Financed through/by

UEFISCDI, Romanian Ministry of Education and Research, Bucharest, Romania.

Research team

Project director:
Prof. Dr. Eng. Mihai V. Micea

R&D team:
Prof. Dr. Eng. Vladimir Cretu,
A/Prof. Dr. Eng. Dan Pescaru,
Lect. Dr. Eng. Răzvan Cioargă,
T/Assist. Dr. Eng. Valentin Stângaciu,
T/Assist. Dr. Eng. Cristina Stângaciu,
PhD Stud. Eng. Lucian Ungurean,
Eng. Claudia Micea,
Eng. Adriana R. Tîrnovan.

Contact information

Prof. Mihai MICEA, PhD
Department of Computer Science
Address: Str. Bd. Vasile Pârvan, No. 2, RO300223, Timisoara,
Phone: (+40) 256 403271
Fax: (+40) 256 403214
E-mail: mihai.micea@upt.ro
Web: http://dsplabs.cs.upt.ro/grants/teefios/

DEVELOPMENT OF URBAN GREEN SPACE MONITORING TECHNIQUE WITH REMOTE SENSING AND ITS APPLICATION - COMPARATIVE STUDY TIMISOARA - ROMANIA AND BEIJING - CHINA

Goal of the project

The project aims to study the techniques used for monitoring urban green space by means of high resolution remote sensing data to support the application of high remote sensing in urban mapping and feature extractions. Other objectives refer to build information model to convert spatial and spectral information from remote sensing data to useful information, to evaluate urban environment by the analysis of the spatial configuration of urban buildings and urban green space, to promote scientific understanding of the interaction among buildings, green space and human beings.

Short description of the project

A city is the important area of earth's surface material, energy, and information exchanging; also it is the centre in national, regional political, economic, scientific and cultural aspects. Remote sensing imagery enables rapid and efficient quantification urban eco-environment and it gives a new insight for urban environmental research.

Project implemented by

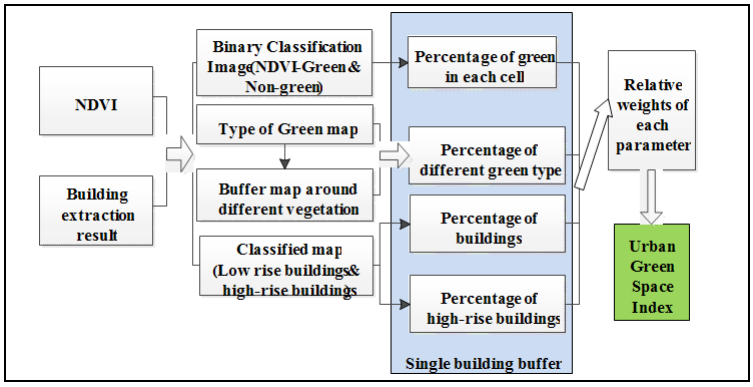
Politehnica University of Timisoara, Civil Engineering Faculty, Land Measurement and Cadastre Branch (UPT) and Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences.

Implementation period

September 2016 – December 2017

Main activities

1. Propose image classification method and urban features extraction algorithm.
   - Generation of the Normalized Height Model (NHM)
     (1) Collection of LiDAR data on urban areas.
     (2) Collection of DEM (Digital Elevation Model) on urban areas.
     (3) Generation of DSM (Digital Surface Model) from LiDAR data
     (4) Generation of the Normalized Height Model by subtracting the DEM from the DSM
   - Image segmentation algorithms
     (1) Design of a robust segmentation algorithm for urban feature segmentation
     (2) Segmentation accuracy assessment
   - Extraction of Urban Buildings.
     (1) Building mapping
     (2) Generation of Building Height model
   - 3D modeling of urban trees using LiDAR.
     (1) Urban green mapping
     (2) Tree detection and the 3D modeling of the urban trees.
   - Urban green mapping using Multi-spectral images
     (1) Machine learning techniques for classification of urban green
     (2) Shadow detection and removal
     (3) Accuracy assessment
2. Develop urban green space index to observe the urban green space at both horizontal and vertical dimensions.



Results

The project is intended to contribute to the knowledge in remote sensing domain and make progress in using the following techniques:

1. Techniques for multi-source remotely sensed data fusion;
2. Development of new classification algorithms for urban mapping using high resolution remotely sensed data;
3. 3D modeling of urban features based on high resolution remotely sensed data;
4. Development of an urban green space evaluation model;
5. Studying the urban green space parameters quantitative retrieval technology.

Applicability and transferability of the results

1. Develop an evaluating system for measuring the quality of the urban environment using remote sensing technology.
2. Probe the relations between green space and other environmental elements based on the space-time multi-scale urban green space model.
3. Demonstrate the urban green space monitoring technology among different cities.

Financed through/by

PN III - Unitatea Executivă pentru Finanțarea Învățământului Superior, a Cercetării, Dezvoltării şi Inovării

Research Centre

Research Centre of Infrastructures for Construction and Transportation

Research team

Assoc.prof. Sorin HERBAN, PhD – Principal Investigator –UPT
Prof. Meng Qing-Yan, PhD - Principal Investigator –RADI

UPT Team:
Prof. Carmen GRECEA, PhD;
Beatrice TESILA (Vilceanu), PhD;
Adrian ALIONESCU PhD.

Contact information

Assoc. Prof. Sorin HERBAN, PhD
Faculty of Civil Engineering/CCTFC
Address: Str., Ioan Curea 1A, Timisoara
Phone: (+40) 256 403978
Mobile: (+40) 722223952
E-mail: sorin.herban@upt.ro

NANO-ENHANCED ELECTROCHEMICAL GREEN TECHNOLOGY FOR ADVANCED INTEGRATED WATER TREATMENT AND QUALITY CONTROL

Goal of the project:

The main goal of the project is to develop the electrochemistry application field in water treatment and quality control, by creating the right framework for achieving the high research level.
This project aims to explore potential use of nano-enhanced electrochemical dual green technology to improve access to clean water.

Short description of the project

Based on the results obtained in our previous studies for the oxidation of pollutants in aqueous solutions for their degradation and/or their detection on the carbon-based electrodes, specific objectives have been set in this project:

1. Elaboration and manufacturing of some new electrodes types based on nanostructured carbon and Ag/Cu/TiO_2 modified zeolite with enhanced electro(photo)-catalytic activity;
2. Manufacturing, design and geometry conditions of electrodes for degradation and monitoring applications;
3. Setting-up the optimal conditions for the degradation and mineralization of priority organic pollutants (POPs) from water;
4. Elaboration of the electrochemical detection scheme;
5. Integration of the electrochemical detection methods within the control of the degradation and mineralization of POPs in aqueous solutions.
6. Development of a new nano-enhanced electrochemical green dual technology for integrated water treatment and control.

Project implemented by

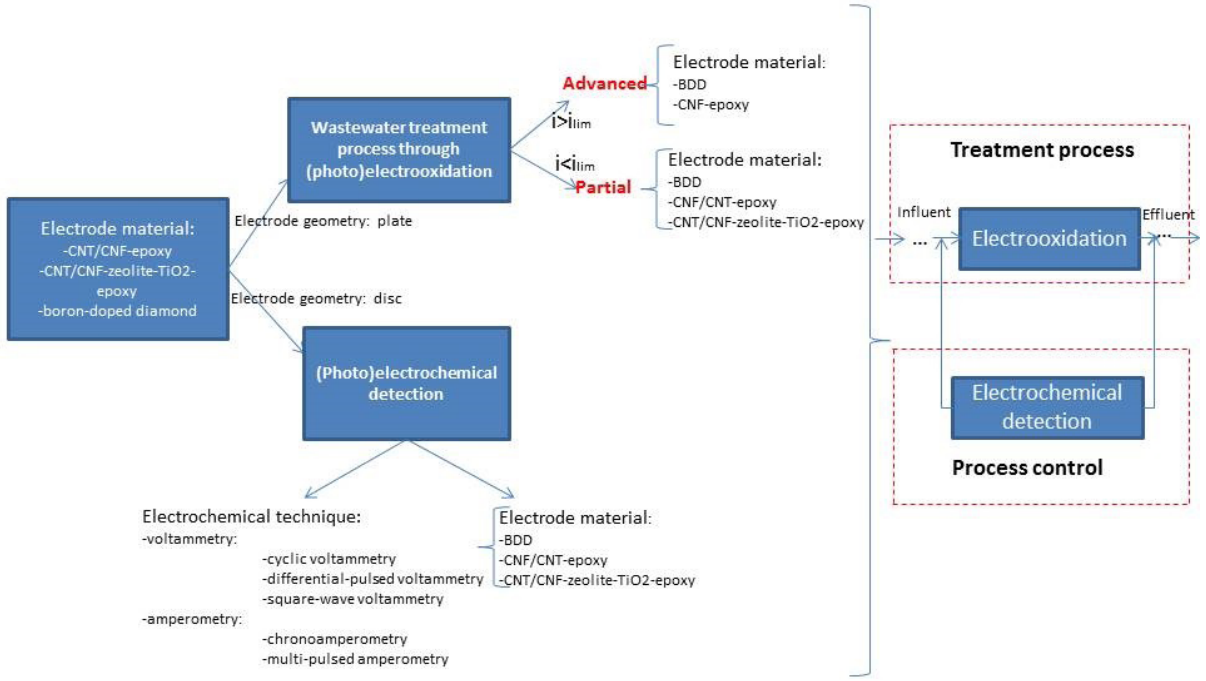
UEFISCDI

Implementation period

2011 - 2016

Main activities

1. Elaboration of new composite materials based on carbon nanotubes (CNT)/carbon nanofibers (CNF) in epoxy matrix as electrode materials for oxidation of POPs from water;
2. Characterization of new composite materials based on CNT/CNF in epoxy matrix and electrode design;
3. Composite electrode obtaining and selection for application in degradation and/or detection of POPs from water;
4. Assessment of electro(photo)catalytic performance of the selected electrodes in advanced degradation/mineralization of POPs;
5. Assessment of the electroanalytical performance of the electrode in detection of POPs from water. Optimization of the electroanalytical method;
6. Integration and optimization of the electrode materials and electrochemical techniques in advanced wastewater treatment and process control.



Results

- Comparative monitoring of optimized electrochemical treatment of priority organic pollutants from water using the electrochemical detection and conventional methods;
- Optimization of the composition of the electrode material and the electrochemical technique for integrative electrochemical degradation and process control;
- Published papers;
- Patent application " Electrode and method for fast electrochemical detection of arsenic (III) from aqueous solution"

Applicability and transferability of the results

The nano-enhanced electrochemical green dual technology could be scaled and tested for application at pilot level in water treatment.

Financed through/by

Executive Unit for Financing Higher Education, Research, Development and Innovation - UEFISCDI

Research team

Florica Manea - director
Rodica Pode - senior researcher
Aniela Pop - researcher
Anamaria Baciu - researcher assistant
Sorina Motoc - researcher assistant

Contact information

Prof. Dr. Eng. Florica Manea
florica.manea@upt.ro
http://www.3waves.ro/id165upt/

INTEGRATED SYSTEM FOR REDUCING ENVIRONMENTAL AND HUMAN-RELATED IMPACTS AND RISKS IN THE WATER USE CYCLE

Goal of the project:

The main goal of the project is to develop and implement an integrated system of innovative technologies and management instruments for reducing environmental impacts and associated human health risks caused by water quality aspects in the entire water use cycle: water abstraction, treatment, distribution, use, wastewater collection, wastewater treatment and discharge and reuse.

Short description of the project

The specific objectives were defined at the level of whole water usage cycle:

1. Development of specific instruments for the identification, quantification and control of environmental impacts and risks, over the water use cycle, applied to regional water operators;
2. Development of the capacity of collaboration and knowledge transfer between the universities and the regional water operators in Iasi and Timis counties for the control of the environmental impacts and human health risks in the water use cycle;
3. Development of the research and institutional capacities of the universities and water regional operators in Iasi and Timis counties for facilitation of the further cooperation at national and international scale;
4. Development of capacities and competitiveness of Romanian researchers and staff of regional water operator, as well as of the national partnerships contributing to environmental sustainability.

Implementation period

2012 – 2016

Main activities

1. Integrated evaluation of the water use cycle;
2. Studies on impact and risk minimization through innovative water treatment process (removal of nitrate, nitrite and natural organic matter);
3. Studies on impact and risk minimization through innovative wastewater treatment processes (removal of priority organic pollutants);
4. Pilot-scale studies on impact and risk minimization in water and wastewater treatment for reuse.
5. Development and testing of integrated management instruments for impact and risk prediction and minimization over the water use cycle;

Project implemented by

- SC Aquatim SA Timisoara
- SC Apavital SA Iasi

Results

- Schematic flow for the flexible pilot plant for the drinking water treatment;
- Workshop and training dedicated to experts of regional water operators
- Flexible pilot plant for the drinking water treatment
- Patent application "Installation and process for drinking water treatment"

Applicability and transferability of the results

Two regional water operators, i.e. Aquatim and Apavital are involved in this project in order to test and apply innovative technologies for water and wastewater treatment in direct relation with specific water quality problems.

Financed through/by

Executive Unit for Financing Higher Education, Research, Development and Innovation - UEFISCDI

Research team

Florica Manea - partner responsible
Rodica Pode - senior researcher
Laura Cocheci - researcher
Aniela Pop - researcher
Anamaria Baciu - researcher as.
Sorina Motoc - researcher as.
Magdalena Ardelean - researcher as.
Agnes Jakab - researcher as.

Contact information

Prof. dr. eng. Florica Manea
florica.manea@upt.ro
http://www.ch.tuiasi.ro/cercetare/parteneriate/watuser/Home.htm

NEW FABRICATION CONCEPT OF SILVER NANOWIRE / POLYANILINE TRANSPARENT, CONDUCTIVE AND FLEXIBLE ELECTRODES FOR SOLAR CELLS

Goal of the project

The aim of the project is to develop transparent, conductive and flexible electrodes for solar cells based on silver nanowire/polyaniline hybrid materials and to offer a new technical solution to decrease the sheet resistance of the silver nanowires embedded in the polymer matrix. Low melting point metallic nanoparticles will be deposited on the surface of silver nanowires, allowing to weld the nanowires and to obtain a network with high electrical conduction paths.

Short description of the project

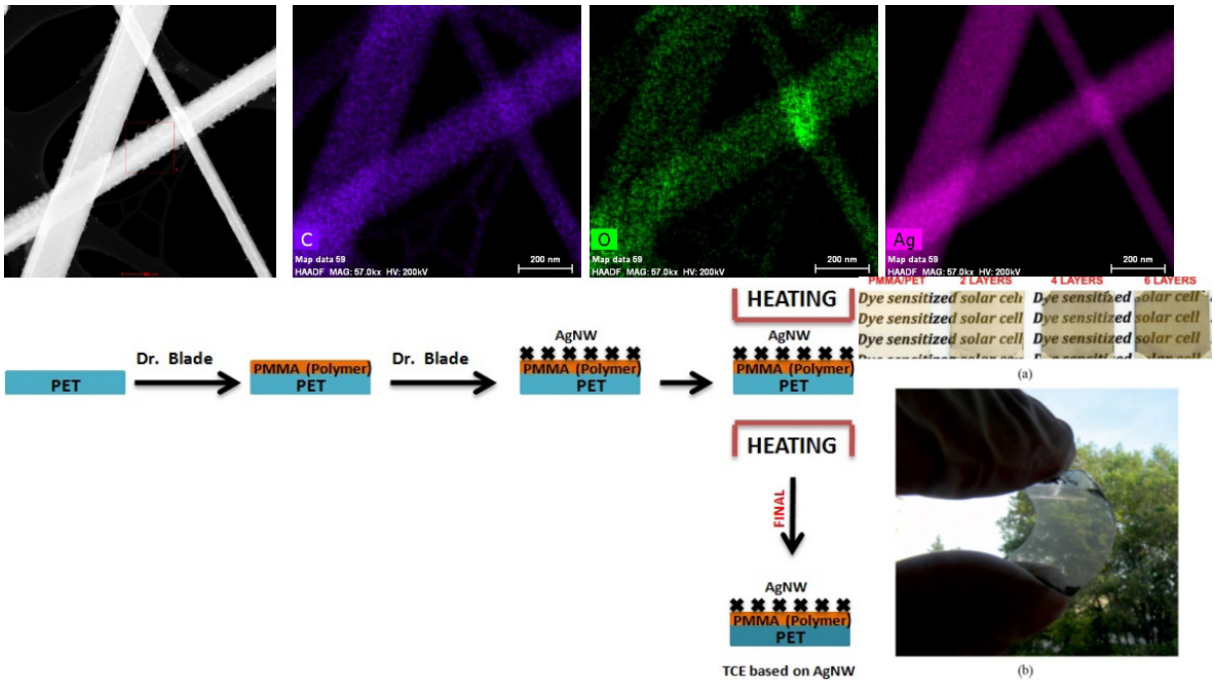
A great challenge in the actual research of solar-to-electricity conversion is the construction of flexible solar cells without using indium tin oxide (ITO). Silver nanowires (AgNWs) are a promising candidate to replace ITO due to their high electric conductivity and corrosion resistance, but there is still the issue of increased resistance on wire contacts. The proposed solution involves the modification of the AgNWs by deposition on their surface of metallic nanoparticles with low melting temperatures like tin and indium. The nanowires were deposited on flexible polymeric substrates to obtain transparent, flexible and conductive electrodes. The sheet resistance of the electrodes was reduced by 35% by hot pressing and by 30% after the deposition of conducting polymers on the silver nanowires.

Project implemented by

Politehnica University of Timisoara
Faculty of Industrial Chemistry and Environmental Engineering
Department of Applied Chemistry and Inorganic Compounds and Environmental Engineering

Implementation period

02.09.2013 - 30.09.2016



Main activities

- Synthesis and characterization of AgNWs with controlled aspect ratio (2013).
- Development and characterization of transparent conductive electrodes on flexible substrates using AgNWs and assessment of their electrical and optical properties (2014)
- Synthesis and characterization of indium and tin nanoparticles (2014)
- Synthesis and characterization of AgNWs modified with tin and indium nanoparticles (2015)
- Preparation of electroconductive inks based on AgNWs (2015)
- Optimization of AgNWs-based flexible, transparent and conducting electrodes to increase diffuse transmittance / resistance ratio (2016)
- Deposition of a conducting polymer on previously manufactured electrodes (2016)
- Construction of dye-sensitized solar cells using AgNWs-based transparent and conducting electrodes (2016)

Results

Patent application

- R. Bănică, A. Kellenberger, D. Ursu, L. Cseh, P. Linul, N. Vaszilcsin, Method for the synthesis of silver nanowires coated with low melting point metal nanoparticles

ISI publications:

- R. Bănică, D. Ursu, T. Nyari, A. Kellenberger, Two step polyol-solvothermal growth of thick silver nanowires, Mat Lett – accepted
- R. Bănică, D. Ursu, T. Nyari, A. Kellenberger, Polyol synthesis of silver nanowires in the presence of silver chloride, Optoelectron Adv Mat – under review
- R. Bănică, D. Ursu, P. Svera, C. Sarvaş, S.F. Rus, S. Novaconi, A. Kellenberger, A.V. Racu, T. Nyari, N. Vaszilcsin, Electrical properties optimization of silver nanowires supported on polyethylene terephtalate, Partic Sci Techn, 34 (2016) 217-222
- D. Ursu, R. Bănică, N. Vaszilcsin, Photovoltaic performance of (Al, Mg)-doped CuCrO2 for p-type dye-senzitized solar cells application, Nanosci Nanotech 6 (2016) 71-76

Applicability and transferability of the results

The manufacture of silver nanowires coated with metal nanoparticles with low melting points is expected to have an important economic impact and is subject of a patent application.
The transparent, flexible and conductive electrodes based on silver nanowires have been successfully tested in dye sensitized solar cells. Conductive inks based on silver nanowires may be used not only for flexible solar cells but also for other optoelectronic devices, such as flexible LEDs, organic thin film transistors, organic lasers and photo detectors, electronic paper and disposable sensors.

Financed through/by

UEFISCDI - Executive Agency for Higher Education, Research, Development and Innovation Funding,
Programme IDEAS, Exploratory Research Projects.

Research centre

Research Centre for Inorganic Materials and Alternative Energies

Research team

Assoc. Prof. Andrea Kellenberger - project manager
Prof. Nicolae Vaszilcsin - senior researcher
Terezia Nyari - senior researcher
Liliana Cseh - senior researcher
Radu Nicolae Banica - postdoctoral researcher
Cosmin Locovei - postdoctoral researcher
Radu Baies - postdoctoral researcher
Mircea Laurentiu Dan - PhD student
Alin Bucur - PhD student
Daniel Horatiu Ursu - PhD student
Paul Cristian Capota - master student

Contact information

Assoc. Prof. Andrea KELLENBERGER, PhD
Faculty of Industrial Chemistry / Department of Applied Chemistry and Inorganic Compounds and Environmental Engineering
Address: Parvan Boulevard, No. 6, RO300223, Timisoara
Phone: (+40) 256 404 178
E-mail: andrea.kellenberger@upt.ro
Web: http://chim.upt.ro/ro/cercetare/proiecte-de-cercetare/147-pn-ii-id-pce-2012-4-0398

NOVEL NANOMATERIALS BASED STRATEGIES FOR INNOVATIVE SENSING SYSTEMS APPLIED IN SAFETY AND QUALITY CONTROL OF NATURAL JUICE

Goal of the project

The main goal of the project is to contribute greatly exploratory research in developing new electrode materials with advanced properties linked to the original exploitation of certain electroanalytical techniques envisaging smart strategies for food quality control and safety.

Short description of the project

This research proposal envisage an important contribution to food quality control and safety through elaboration of new strategies for qualitative and quantitative evaluation of the potentially harmful compounds (residues of pesticides and preservatives) from natural juices, by involving well-controlled nanomaterials in the development of innovative detection systems with improved electroanalytical performances. Detection systems will be based on new glassy carbon sensors modified with carbon nanostructuresand metallic nanoparticles that will allow the elaboration of selective/ simultaneous detection protocols for preservatives and pesticides, potentially present in juices. Sensor surface modification with membrane will permit selective access of target analytes only to carbon nanostructures, allowing a specific concentration on the electrode surface.

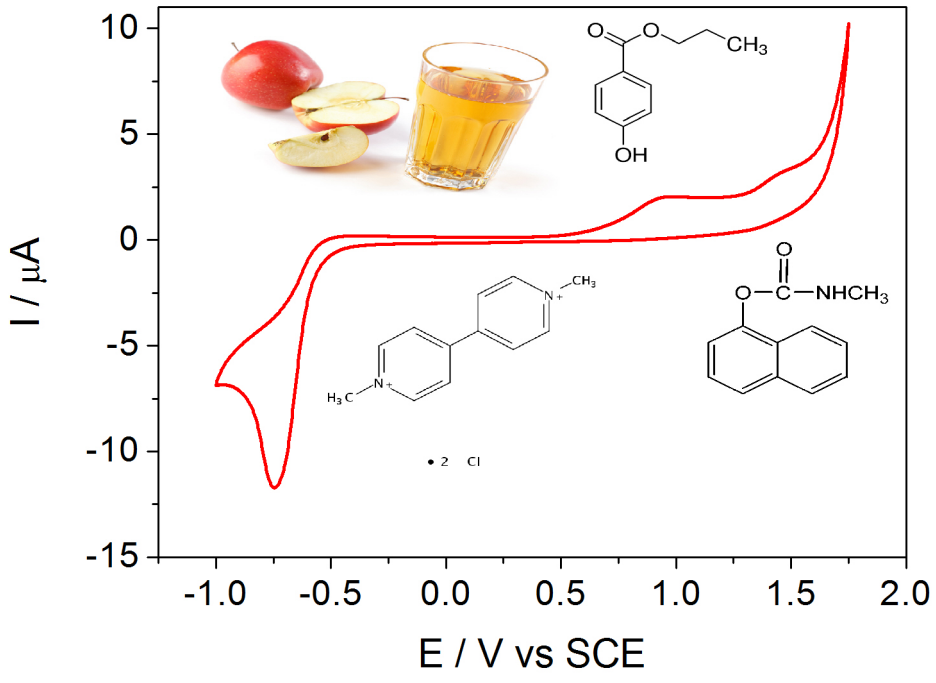
Expected performance of detection strategies proposed by project open the perspective of practical applications in the direction of their use by regulatory bodies for food quality control or even by natural juices producers, either before processing of the potentially contaminated fruits with pesticide residues, either on the production flow or final product quality evaluation/monitoring.

Project implemented by

Faculty of Industrial Chemistry and Environmental Engineering

Implementation period

01.10.2015 - 30.09.2017



Main activities

i. Obtaining new sensors based on nanostructured carbon by modifying classic glassy carbon (GC) electrode with CNT/CNF/ graphene/fullerene characterized by structural, morphological and electrochemical specific properties suitable for electrochemical detection applications.
ii. Sensors functionalization with metallic nanoparticles (Cu/Ag/Au/ Pt) by advanced electrochemical (multiple-pulsed amperometry – MPA, chronoamperometry – CA and cyclic voltammetry - CV) with morpho-structural and electrochemical properties characteristic to the electrochemical detection applications.
iii. Elaboration of procedure/detection schemes for target analytes from preservatives and pesticide residues categories based on obtained new sensors and their optimization.
iv. Development of detection techniques with intermediate preconcentration step on electrode surface for harmful compounds at trace levels from test sample, exploiting adsorbent properties of nanostructures carbon.
v. Elaboration of simultaneous and/or selective detection procedures/ schemes of selected target analytes, by sensors modification with selective membranes.
vi. Procedures checking through detection strategies elaboration for specific applications in juices quality control and safety.

Results

- New sensors modified with nanostructured carbon (carbon nanotubes (CNT), carbon nanofibers (CNF), fullerenes and graphene) and/or metallic nanoparticles (Cu / Ag / Au / Pt) for natural juices safety and quality control applications.
- Protocols for selective/ simultaneously detection of preservatives and pesticides potentially present in natural juices.

Applicability and transferability of the results

New sensors modified with nanostructured carbon (carbon nanotubes (CNT), carbon nanofibers (CNF), fullerenes and graphene) and/or metallic nanoparticles (Cu / Ag / Au / Pt) for natural juices safety and quality control applications.
Protocols for selective/ simultaneously detection of preservatives and pesticides potentially present in natural juices.

Financed through/by

Executive Unit for Financing Higher Education, Research, Development and Innovation - UEFISCDI

Research centre

Research Institute for Renewable Energy – ICER TM
Research Centre in Environmental Science&Engineering

Research team

Assist. Prof. Aniela POP, PhD
Prof. Florica MANEA, PhD
Postdoctoral researcher Anamaria BACIU, PhD
Postdoctoral researcher Agnes JAKAB, PhD
PhD. student Adriana (BĂLĂȘOIU) FLUERAȘ
PhD. student Ianina BÎRSAN

Contact information

Assist. Prof. Aniela POP, PhD
Department of Applied Chemistry and Inorganic Compounds and Environmental Engineering
Address: Bd. Vasile Pârvan, No. 6, RO 300223, Timisoara
Phone: (+40) 256 403 069
E-mail: aniela.pop@upt.ro
Web: https://sites.google.com/site/sensojuice

DEVELOPMENT OF NANOSTRUCTURED MAGNETIC COMPOSITES USED AS NANO-ADSORBENTS AND NANO-CATALYSTS WITH HIGH PERFORMANCE IN ENVIRONMENTAL APPLICATIONS

Goal of the project:

Developing new efficient synthesis variants of oxide nanoparticles in order to obtain nanomaterials, magnetic nanostructures based on iron oxides (gamma-Fe_2O_3, Fe_3O_4, ferrites spinels MFe_2O_4) with tailored properties for their use as nano-adsorbents and nano-catalysts for remediation of water.

Short description of the project:

Water pollution by heavy metals and organics has become a serious problem because of their extremely hazardous effects on humans and the ecological systems.

The present project is focused on the developing of nanostructured magnetic materials based on iron oxides (magnetite, maghemite, spinel ferrites) with special properties (magnetic properties, specific surface area and morphology) that can be used as high performance nano-adsorbents and nano-catalyst for the removal of inorganic (metals ions: Cd(II), Pb(II), Cr(VI), Cu(II), Co(II), Zn(II)) and organic (dyes and phenols) pollutants from wastewaters. In order to achieve this we will develop new, original versions of the two unconventional synthesis methods of nanopowders and nanocomposites: solvothermal method and thermal decomposition of precursors. In order to develop high performance nanostructured magnetic oxides (iron oxides and ferrites) with high specific surface area, porosity and adequate magnetic properties composites like magnetic oxides/carbon will be synthesized by these methods, using different common carbon precursors in order to obtain low cost final materials. Also, the functionalization of surface will be performed with different organic modifiers in order to make the nanoparticles specific for certain applications.

Finally, the obtained iron oxides based magnetic nanostructures materials (oxides, ferrites and composites) will be tested as nanoadsorbants and catalyst for the removal of water pollutants.

Project implemented by

University Politehnica Timisoara

Implementation period:

01.10.2015-30.09.2017

Main activities:

I. Synthesis of magnetic oxide nanopowders (Fe_xO_y, MFe_2O_4) by new, original variants of solvothermal method and of thermal decomposition of the precursors and powders characterization.

A.I.1 Study of the influence of organic solvents' nature on the structure and morphology of the oxide particles obtained by solvothermal method. Determination of the most appropriate solvent for the synthesis of a series of solvents which have not been reported in the literature.

A.I.2 Study of the influence of polyols nature and polyol: metal nitrates ratio and of the presence of surfactants on the structure, morphology, magnetic properties of nanopowders synthesized by the method of decomposition of precursors.

A.I.3 Characterization of materials obtained by thermal analysis, FT-IR spectroscopy, X-ray diffractometry, specific surface area and porosity measurements, Mosbauer spectroscopy, X-ray diffractometry, SEM, TEM electron microscopy, magnetic measurements.

A.I.4 Writing scientific report and disseminate the results through participation in an international conference. Making the project web page

II. Synthesis of the nanocomposites type Fe_xO_y / C and MFe_2O_4 / C by original synthesis methods and their characterization

A.II.1 Study of the influence of process parameters: temperature and autoclaving time on the structure, morphology and properties of synthesized nanocomposites

A.II.2 Study of the influence of organic solvents' nature on the structure and morphology of the oxide particles obtained by solvothermal method. Determination of the most appropriate solvent for the synthesis of a series of solvents which have not been reported in the literature

A.II.3 Study of the influence of initial oxide precursor: carbon precursor ratio on the carbon content of the composite.

A.II.4 Study of the influence of carbon precursor nature on the carbon content of composites with carbon and their morphology

A.II.5. The obtaining of composites by thermal decomposition of precursor method: influence of decomposition atmosphere, calcination temperature and time and of the presence of other carbon precursors in addition beside the polyol used as a reductant.

A.II.6 Characterization of the obtained nanocomposites by thermal analysis, FT-IR, X-ray diffractometry, the specific surface area and porosity measurements, Mössbauer spectroscopy, X-ray diffractometry, electron microscopy, SEM, TEM, magnetic measurements.

A.II.6 Writing scientific report and disseminate the results through participation in an international conference and publication of an ISI

article.
III. Testing of magnetic powders synthesized as adsorbent materials and catalysts for removal of inorganic and organic pollutants in water
A.III.1 Testing of oxide nanopowders Fe_3O_4, Fe_2O_3, MFe_2O_4 compared to the corresponding nanocomposite Fe_3O_4 /C, Fe_2O_3 /C, MFe_2O_4 /C as a metal ion adsorbents: Cd (II), Cr (VI), Pb (II), Cu (II), Ni (II), Co (II
A.III.2 Testing of oxide nanopowders Fe_3O_4, Fe_2O_3, MFe_2O_4 compared to the corresponding nanocomposites Fe_3O_4 /C, Fe_2O_3 /C, MFe_2O_4 /C as adsorbents for organic contaminants: colorants and phenolic compounds.
A.III.3 Testing of functionalized oxide powders as adsorbents for inorganic and organic pollutants studied. Study on the influence of nature of surface functional groups on pollutant removal efficiency
A.III.4 Testing of Fe_xO_y and MFe_2O_4 magnetic powders as catalysts for catalytic oxidative degradation of organic pollutants: dyes and phenolic compounds
A.III.5 Study the possibility of regeneration of the adsorbent material by controlled desorption of adsorbed species in different solvents or by changing the pH.
A.III.6 Study of adsorbent material reuse on its performance (maximum capacity of adsorption of pollutant removal efficiency). Proposing a technological schemes for use in remediation of water nanopowders
A.III.7 Preparing final scientific report. Dissemination of results: patent proposal preparation and submission and publication of 2 ISI papers..

Results:

Published papers:
1. Stoia M., Istratie R., Pacurariu C., Investigation of magnetite nanoparticles stability in air by thermal analysis and FTIR spectroscopy, Journal of Thermal Analysis and Calorimetry (2016) 125, 1185–1198
2. Stoia M., Pacurariu C., Istratie R., Barvinschi P, Locovei C., Thermoanalytical techniques: Excellent tools for the characterization of ferrite/SiO2 nanocomposites and their precursors, Journal of Thermal Analysis and Calorimetry (2016) 125, 1249–1263,
3. Stoia M., Pacurariu C., Muntean E.C., Thermal stability of the solvothermal-synthesized MnFe2O4 nanopowder, Journal of Thermal Analysis and Calorimetry,
Conferences
1. Cornelia Muntean: The XXXVIII National Congress on Calorimetry, Thermal Analysis and Applied Thermodynamics (AICAT-GICAT 2016) Ischia (Naples), Italy, September 25-28, 2016
Cornelia Muntean, Marcela Stoia, Geza Bandur: Thermal evolution OF MnFe2O4 precursors obtained by co-precipitation in organic medium
2. Eliza Muntean: 25-th Symposium on Thermal Analysis and Calorimetri - Eugen Segal, Bucuresti, Romania, Ferbuarie, 2016
Stoia M, Muntean Eliza, Pacurariu C, Study on thermal evolution of MnFe2O4 /C composites synthesized by solvothermal method
3. Muntean Eliza: "New trends and strategies in the chemistry of advanced materials with relevance in biological systems, technique and environmental protection" 9th Edition, June 09-10, 2016
Muntean E., Stoia M., Pacurariu C. Solvothermal synthesis of manganese ferrite nanopowders using different surfactants

Applicability and transferability of the results:

This project will develop innovative and original solutions, both in terms of getting nanomaterials used as nano-adsorbents or nanocatalysts in wastewater treatment processes and in terms of regeneration of adsorbents / catalysts and their reintroduction in the process of treatment the waste water, so as to minimize the impact on the environment.
The project aims to find effective solutions as easy to achieve as practical and cheap for treatment of effluents loaded with ions of heavy metals and organic pollutants (dyes and phenols) using as adsorbents the magnetic oxide nanopowders to be obtained.

Financed through/by

Executive Agency for Higher Education Research, Development and Innovation Funding (UEFISCDI)

Research Center

Research Institute for Renewable Energy , University Politehnica Timisoara

Research team

Project leader: Lecturer eng. Stoia Marcela Elena, PhD
Senior researcher: Lecturer eng. Muntean Cornelia Veronica, PhD
Postdoctoral researcher: Lecturer. eng. Lupa Lavinia, PhD
Postdoctoral researcher : Assist. eng. Moaca Alina, PhD
PhD student: eng. Muntean Eliza
PhD student: eng. Gabor Andreea

Contact information

Lecturer. Marcela STOIA, PhD
Faculty of Industrial Chemistry and Environmental Engineering/ Department CAICAM
Address: Bvd. Vasile Parvan., No.6, 300223, Timisoara
Phone: (+40) 256 404158
Mobile:
E-mail: marcela.stoia@upt.ro

BIOCATALYST- CLICK CHEMISTRY DOWNSTREAMING TANDEM BASED INNOVATIVE KIT FOR OPTICALLY PURE FINE CHEMICALS SYNTHESIS

Goal of the project:

The project main objective is to develop an innovative kit for efficient and cost-effective sequential continuous flow large-scale (multigram) preparation of optically pure chiral building blocks useful for synthesis of pharmaceutical compounds and agricultural chemicals, based on the tailor-made immobilized lipases mediated kinetic resolution of various racemic substrates and a subsequent click chemistry like efficient downstreaming of the reaction mixture. Such an innovative approach of coupling kinetic resolution of a broad range of racemic substrates with click chemistry type downstreaming was not yet carried out.

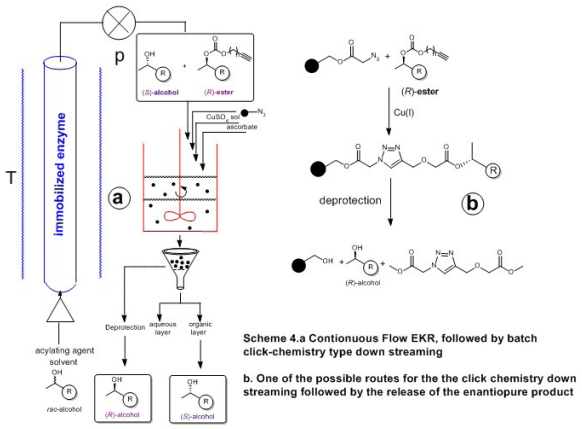
Short description of the project

Biocatalysis is an important tool to implement new, efficient, selective, cost effective and greener technologies, defining a new strategy in the industry of the future. For industrial applications, the stability and reusability of the biocatalysts are important requirements which can be achieved by immobilization, improving also their activity and selectivity. Optimization of the biocatalytic function, as well as the biocatalytic process design became essential topics in industrial biotechnology.

In this project a chemo-enzymatic process which integrates several innovative steps in both biocatalytic and down streaming parts will be set up. The utilization of tailor-made biocatalysts in industrial processes is an innovative approach, technically comparable to the synthetic solutions but with higher economic benefits. The use of immobilized biocatalysts-click chemistry tandem will permit to design easily scaled-up continuous flow procedures for industrial manufacturing of the target compounds, underlining the economic relevance of the proposal.

Project implemented by

- Politehnica University of Timişoara - Project leader
- University "Babes-Bolyai" Cluj Napoca - Partner 1
- Natural INGREDIENTS R&D S.R.L - Partner 2



Scheme 4.a Contionuous Flow EKR, followed by batch click-chemistry type down streaming

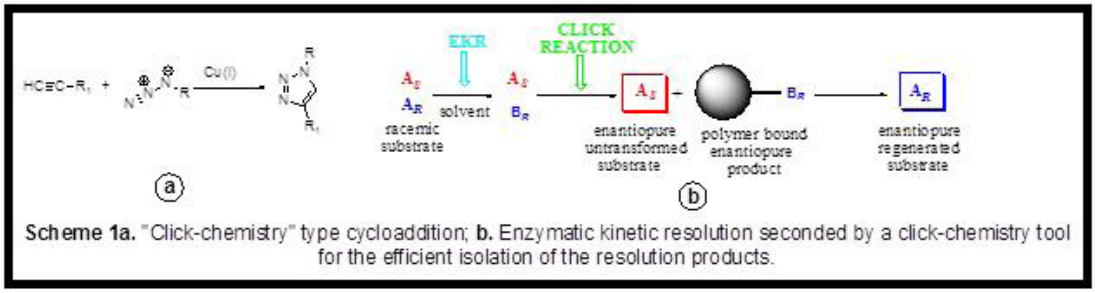
b. One of the possible routes for the the click chemistry down streaming followed by the release of the enantiopure product

Implementation period

01.07.2014-30.06.2016

Main activities

1. Preparation of various precursors: (hetero)aryl-ethanols, hydroxy- and amino acids and synthesis of various propargylic esters as O- and N-acylating agents used in enzymatic kinetic resolution (EKR).
2. Development of optimal EKR and click-chemistry type down streaming procedures.
3. Immobilization of lipases.
4. Development of the continuous flow procedure



Scheme 1a. "Click-chemistry" type cycloaddition; **b.** Enzymatic kinetic resolution seconded by a click-chemistry tool for the efficient isolation of the resolution products.

Results

1. Multi-gram amounts of various racemic compounds and various propargylic esters as acyl donors for the EKR;
2. Enantiomeric separation protocol for previously synthesized racemates, chromatographic protocols for testing the enantioselectivity of the enzymatic reactions;
3. Scientific article submitted to an ISI quoted journal;
4. Scientific presentation, published in the abstract book of an international conference;
5. Experimental protocol of down streaming procedures;
6. Immobilization protocols and analysis procedures for tailor-made immobilized lipases;
7. Integrated EKR-click-chemistry type down streaming procedure;

Applicability and transferability of the results

The obtained kit, as well as the high-value products, will be marketable, but the process will be appropriate for further scaling-up, depending on the customer demands.

In the forthcoming period, a strong impact of industrial biotechnology can be expected in the fine chemicals sector. As lipases demonstrated the highest application capability among industrial enzymes, the efforts to improve their operational stability and catalytic efficiency led to a remarkable development of the immobilization methods. Certainly, the manufacturing of high value optically active compounds represents the main large-scale process where biocatalysis with lipases will replace the presently employed procedures.

Enzymatic kinetic resolution (EKR) of the racemic mixtures represents the most efficient way to obtain high optical purity compounds. However, in large scale EKR an important challenge remains the isolation and purification of the products, which generally involves expensive and laborious physical procedures, decreasing the global process yields and the optical purities of the isolated compounds.

To the best of our knowledge the use of click chemistry involving large carriers, as a tool for easy EKR product separation is still unknown and it could be a practical solution for the efficient large scale isolation and purification of the enzymatic resolution products. Performing the click reaction between a preactivated polymer and one of the appropriate functionalized reaction products in the enzyme free reaction mixture obtained by EKR, would circumvent the tedious isolation and purification procedures.

Financed through/by

Executive Agency for Higher Education, Research, Development and Innovation Funding, UEFISCDI

Research team

Prof. Francisc Peter, PhD
Assist. Prof. Cristina Paul, PhD
Valentin Badea, PhD
Emese Biro Phd
Eng. Anamaria Todea
Eng. Adinela Cimporesu
Eng. Claudiu Marcu

Contact information

Prof. Francisc PETER, PhD
Department of Organic and Natural Compounds Engineering
Address: Carol Telbisz Street, No. 6, RO300001, Timisoara
Phone: (+40) 256 404216
Mobile: (+40) 745637530
E-mail: francisc.peter@upt.ro
Web: http://chim.upt.ro/Facultatea-de-Chimie-Industriala-si-Ingineria-Mediului_PN-II-PT-PCCA-2013-4-0734_qqpYW.html

NEARLY ZERO ENERGY BUILDING AND PASSIVE HOUSE – SUSTAINABLE SOLUTIONS FOR RESIDENTIAL BUILDINGS

Goal of the project

The idea of this project arose from the need to develop energy efficient solutions that reduce the energy need in the Romanian building sector. The main goal of the NEZEBUILD research project is related to the design and detailing of technical solutions in order to achieve the nearly zero energy building standard, resulting in the validation of such designs through extensive monitoring. Design, detailing and execution include the construction elements, finishes and installations system.

Short description of the project

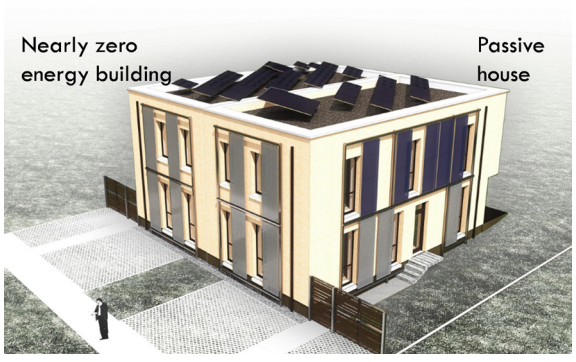
A pilot project was developed consisting in a residential building composed of two detached houses, the passive house (PH) standard and the nearly zero energy building standard (NZEB). The two houses are equipped with monitoring systems. All project activities aim at developing a recommendation design guide regarding PH an NZEB based on experimental research.

Project implemented by

Project Partnership comprising Politehnica University of Timisoara - CCI Department and Arhitim.

Implementation period

2012 - 2016

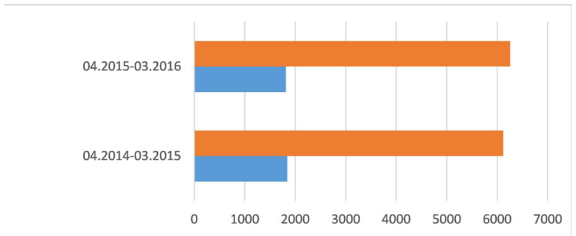


Main activities

- Design and detailing of NZEB system including procurement of materials and equipment.
- Design of the monitoring system and set-up of equipment and accessories for NZEB
- Evaluation of monthly energy consumption for the two houses. Evaluation of main consumption, energy produced and consumed from renewable sources.
- Overall investment cost assessment and lifetime of the building. Analysis of the overall cost of the investment.
- Evaluation of elements with significant impact in terms of environmental protection
- Lifecycle assessment using specialized software SimaPro - LCA with different scenarios.
- Elaborating a comparative PH vs. NZEB study on energy efficiency.
- Dissemination of recommendations and general rules for implementing energy efficient residential houses in the Romanian temperate climate.

Results

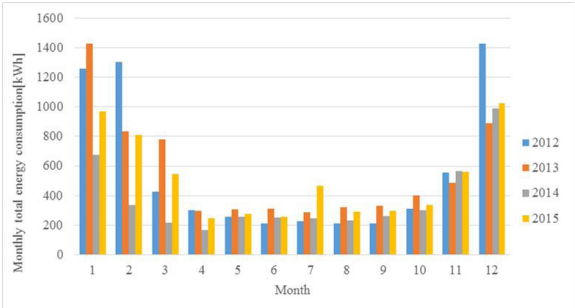
The research project ended in December 2016. The research initiated through this project is continued by the research team. The monitoring process of the two houses continues and also the processing and interpretation of the obtained data. Real time monitoring graphs from the two houses can be viewed online at the address http://www.sdac.ro/site/archives/category/monitoring. The results of the project were published in several scientific paper among which a scientific paper was published in a prestigious scientific journal in the energy efficiency domain. Also, based on the experience from this project, the research team developed o series of guidelines and recommendations useful in the design of energy efficient buildings.



	04.2014-03.2015	04.2015-03.2016
Annual energy production [kWh]	6120	6258
Annual energy consumption [kWh]	1840	1815

Applicability and transferability of the results

The topic of the project is closely related with the increasing concern of nowadays society on reducing the energy consumption in buildings. The targeted groups of the project are scientist, specialists in the energy efficiency field and stakeholders. The project deliverables will assure the transfer of knowledge, generating further „know-how" for scientific community and for practicing specialists (civil and environmental engineers, electrical and energy engineers, architects, technicians).



Financed through/by

This work was supported by a grant of the Romanian National Authority for Scientific Research, CNDI – UEFISCDI, project number PN-II-PT-PCCA-2011-3.2-1214-Contract 74/2012.

Research centre

Research Centre for Retrofitting of Constructions – RECO, within CCI Department

Research team

PROJECT MANAGER:
Prof. Daniel DAN, PhD

U.P.T. TEAM MEMBERS:
Prof. Valeriu STOIAN, PhD
Prof. Tamas NAGY-GYORGY, PhD
Lect. Sorin-Codrut FLORUT, PhD
Lect. Cosmin DAESCU, PhD
Assist. prof. Simon PESCARI, PhD
Assist. prof. Calin SEBARCHEVICI, PhD

ARHITIM TEAM MEMBERS:
Dan STOIAN, PhD student
Cristina TANASA, PhD student

Contact information

Prof. Daniel DAN, PhD
Department of Civil Engineering and Building Services
Str. Traian Lalescu, No.2, RO300223, Timisoara
Phone: (+40) 256 403 005
E-mail: daniel.dan@upt.ro

STRUCTURAL CONCEPTION AND COLLAPSE CONTROL PERFORMANCE BASED DESIGN OF MULTISTORY STRUCTURES UNDER ACCIDENTAL ACTIONS (CODEC)

Goal of the project

The main goal of the project is the development of a design methodology for mitigation of progressive collapse of multi-storey steel frame buildings against extreme load events caused by both natural and human-made hazards.

Short description of the project

During their designed lifetime, buildings can be affected by accidental actions, which might result in structural collapse, loss of life, or severe injury to occupants. The existing design codes, standards, or other documents do not contain explicit and consistent provisions and approaches to check the structural integrity of the buildings. In addition, the experimental data are insufficient and further studies are still necessary. The project aims at evaluating the structural components that can reduce the risk of collapse and developing new methodologies for assessing the structural integrity of steel frame buildings. Different structural systems and connection details were tested experimentally under static and dynamic loading conditions, and the main response parameters were quantified. Numerical models were validated against experimental data and used for an extensive numerical parametric study. The numerical simulations allowed us to improve the global response of the steel frame structures by using new or improved structural solutions and methodologies.

Project implemented by

- Coordinator (CO) – Politehnica University Timisoara
- Partner 1 (P1) - Technical University of Cluj-Napoca
- Partner 2 (P2) - URBAN-INCERC (Cluj-Napoca Branch)
- Partner 3 (P3) - INSEMEX Petrosani
- Partner 4 (P4) - SC ACI SA Cluj-Napoca

Fig. 1a. Joint specimen after the test

Implementation period

July 2012 – December 2016

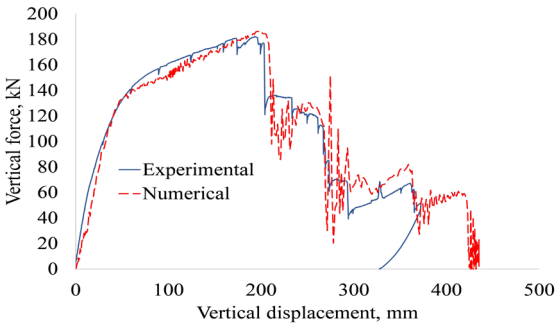


Fig. 1b. Experimental vs. numerical force-displacement curve

Main activities

- Preliminary investigations (Review of existing methods, identification of research needs; Preliminary analysis and selection of case study structures)
- Design of experimental and numerical simulation programs
- Experimental program on materials, weld details and connection macro-components
- Experimental program on joints (column loss scenarios, direct blast conditions)
- Experimental program on sub-assemblies (column loss scenarios)
- Validation of numerical models against experimental tests; Numerical simulation program

Fig. 2a. Experimental T-stub

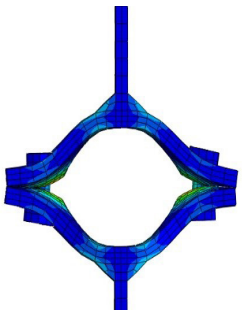


Fig. 2b. Numerical simulation T-stub

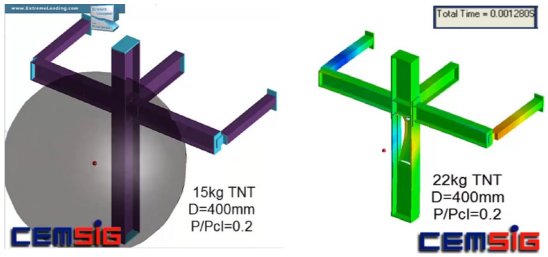


Fig. 3a (left) and 3B (right) Direct blast effect on steel assemblies

Results

- Experimental results (characteristic curves, failure modes, robustness) on T-stubs and weld detail tested in extreme conditions (loading rate, temperature)
- Experimental results on steel joints under column loss scenarios (characteristic curves, failure modes, robustness)
- Experimental results on steel and composite frame systems under column loss scenarios (characteristic curves, failure modes, robustness)
- Direct blast effects on steel elements and connections (influence of stand-off distances, charge size, charge characteristics).
- Numerical models validated against experimental tests
- Numerical simulations on different case study buildings to improve the robustness and mitigate the progressive collapse
- Recommendations for progressive collapse mitigation under column loss scenarios

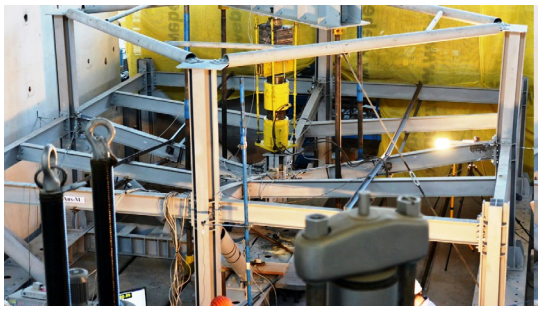


Fig. 4a. Experimental test on 3D steel frame system

Applicability and transferability of the results

- Building construction and design practice; drafting revised guidelines, codes, manuals

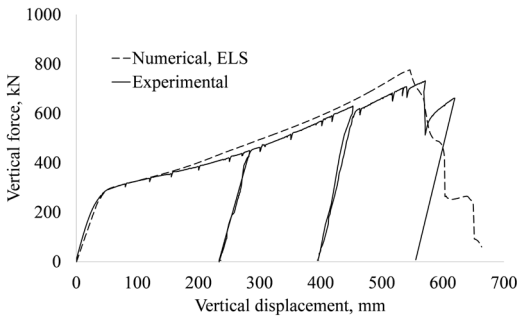


Fig. 4b. Experimental vs. numerical force displacement curve for 3D steel frame system

Fig. 5. Experimental test on 3D composite frame system

Financed through/by

The Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI), Romania, under grant PN II PCCA 55/2012.

Research Centre

The Research Center for Mechanics of Materials and Structural Safety – CEMSIG (www.ct.upt.ro/centre/cemsig/index.htm)

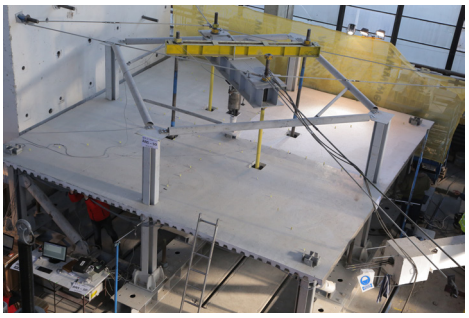


Fig. 6. Composite slab system during construction

Research Team

(UPT): Prof.dr.ing. Florea Dinu (Project Director)
Prof.dr.ing. Dan Dubina
Prof.dr.ing. Raul Zaharia
Conf.dr.ing. Adrian Ciutina
Sen.lect.dr.ing. Ioan Both
Assist.prof.dr.ing. Neagu Calin
PhD.stud.ing. Ioan Marginean

Contact information

Prof. Florea DINU
Faculty of Civil Engineering, CMMC Department, Ioan Curea 1,
300224, Timisoara
Phone: +40 256 403 912
Mobile: +40 722 460 349
E-mail: florea.dinu@upt.ro
Web: www.ct.upt.ro/centre/cemsig/codec.htm

SEISMIC PROTECTION OF ENGINEERING STRUCTURES THROUGH DISSIPATIVE BRACES OF NANO-MICRO MAGNETO-RHEOLOGICAL FLUID DAMPERS – SEMNAL-MRD

Goal of the project:

The goal of the project is to develop a seismic protection system, which uses magneto-rheological fluid (MRF) dampers, acting as semi-active structural control system. Particular objectives are:

- To develop nano-micro MRF compatible with application in seismic MR dampers;
- To design and built a 10tf capacity MR damper;
- To provide type tests, based on EN 15129-2009: Anti-seismic devices, aimed to validate, calibrate and model the damper;
- To design, execute and test a brace-damper assembly in order to validate the integration of damper and brace, including connections;
- To propose structural application schemes for implementation in practice of semi-active control brace-MRD systems.

Short description of the project:

There are three strategies for the seismic protection of structures:
(i) reduce seismic demands,
(ii) enhance structural damping, and
(iii) use active or semi-active structural control.
The current project involves the third approach focusing on semi-active systems. Semi-active devices have properties that can be adjusted in real time but cannot inject energy into the controlled system. Many of them can operate on battery power alone, proving advantageous during seismic events when the main power source to the structure may fail. The most promising devices suitable for implementation into a semi-active control appear to be magneto-rheological (MR) dampers, which succeed in overcoming many of the expenses and technical difficulties associated with other types of semi-active devices.

Response characteristics of MR devices can be changed by varying the magnetic field through different current inputs. In addition to its small power requirement, the MR damper can transfer large forces at low velocities. Currently there are MR dampers with capacities up to 200 kN and research results proved the possibility to obtain capacities up to 400-500 kN.

Project implemented by

The Research Centre for Mechanics of Materials and Structural Safety – CEMSIG, Politehnica University of Timişoara.

Implementation period:

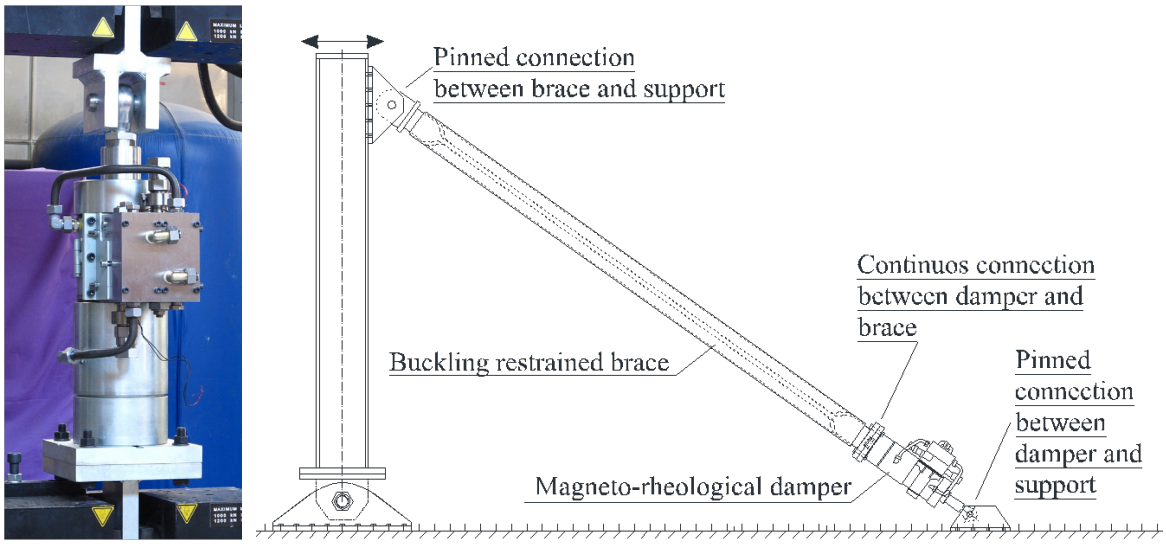
01.07.2014 – 30.09.2017

Main activities:

The activities of the project are divided in four stages (I/2014, II/2015, III/2016, IV/2017). The first three stages are completed. The fourth stage is in progress, covering several main activities:
(i) testing of MR damper of 10tf capacity,
(ii) testing of the brace-damper assembly,
(iii) numerical modelling of single- and multi-degree of freedom systems.
The MR damper will be tested under different loading conditions (triangular, sinusoidal, random excitations). In addition, numerical hysteretic models will be calibrated based on the tested MR damper enabling the modeling of structural response. Since the dampers in structural systems will be coupled with braces, both single damper and brace-damper assembly tests will be performed. With a numerically simulated control unit, structural systems equipped with brace-damper assemblies will be numerically tested in order to observe and characterize their behavior.

Results:

TThe results of the third stage (III/2016) comprise the fabrication of the MR damper prototype, development of the testing protocol and control parameters for the MR fluid, design and fabrication of the brace-damper assembly. In the current research phase, besides the testing of the damper and brace-damper assembly, the following activities will be performed:
(i) numerical evaluation of effectiveness of MR dampers in reducing seismic effects in structural applications;
(ii) design and numerical testing of the control algorithm on single degree of freedom systems.



Applicability and transferability of the results:

Considering the seismicity of Romanian territory and the effectiveness of the dissipative devices targeted in the project (once under fabrication, the implementation in new and existing structures would be quite easy), the national market potential is very large. On the other hand, this market can comprise all the Balkan's area, including Turkey and Greece, with development potential towards neighboring Asian Countries.

Financed through/by

The project is supported by a grant of the Romanian National Authority for Scientific Research, CNDI–UEFISCDI, project Nr. 77 / 2014 (PN-II-PT-PCCA-2013-4-1656).

Research Center

The Research Centre for Mechanics of Materials and Structural Safety – CEMSIG, Politehnica University of Timisoara.

Research team

- UPT – Politehnica University of Timișoara (project coordinator)
- S.C. ROSEAL S.A.
- IMS-AR – Institute of Solid Mechanics of the Romanian Academy
- AR-FT – Timișoara Branch of the Romanian Academy
- S.C. TITAN S.A.

Contact information

Prof.dr.ing Dr.H.C. Dan Dubină
Member of Romanian Academy
Department of Steel Structures and Structural Mechanics,
Faculty of Civil Engineering
Politehnica University of Timișoara
e-mail: dan.dubina@upt.ro
tel: 0256 403 920

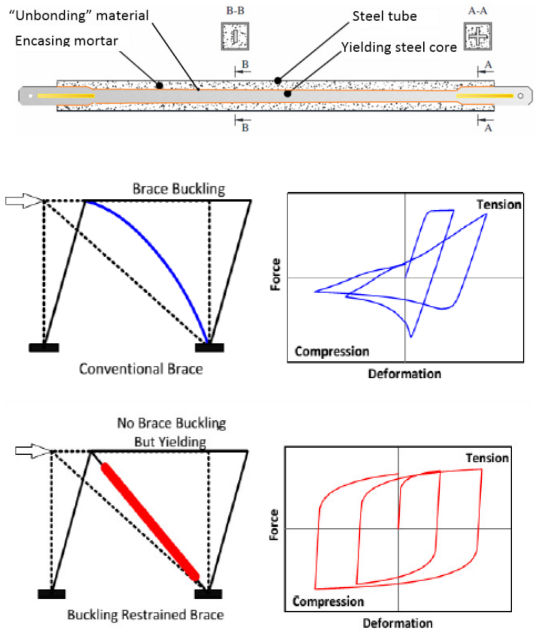
IMPLEMENTATION INTO ROMANIAN SEISMIC RESISTANT DESIGN PRACTICE OF BUCKLING RESTRAINED BRACES (IMSER)

Goal of the project:

The goal of the project is to create the background for quick implementation of the steel frames with buckling-restrained braces (BRB) into Romanian practice design.

Short description of the project:

The latest version of the Romanian seismic design provisions (P100-1/2013) have introduced, for the first time in Europe, design provisions for buckling restrained braced frames (BRBF). Buckling restrained braces have a great potential in the field of seismic design of structures due to their large ductility and symmetrical cyclic response, as compared with conventional braces.



BRBF can be used both for new construction, as well as for strengthening of existing reinforced concrete, steel or masonry structures. BRB frames are able to provide two key properties of a seismic resistant structure: stiffness (for reducing interstorey drifts under moderate earthquakes) and ductility (for energy dissipation capacity under large earthquakes). BRBs were studied extensively worldwide over the past 30 years and have many practical applications especially in Japan and United States. Though researched in Europe as well, BRBs were applied in a very few applications here.

The main reasons for lack of application into practice are believed to be the absence of design provisions in EN 1998-1, not enough acquaintance with the system by practicing structural engineers, need for experimental validation, and proprietary character of most BRB devices.

Project implemented by

CEMSIG - The Research Center for Mechanics of Materials and Structural Safety - Research and Technical Development unit of Politehnica University Timisoara, at the Faculty of Civil Engineering, Department of Steel Structures and Structural Mechanics.

Implementation period:

01/07/2014 - 30/09/2017

Main activities:

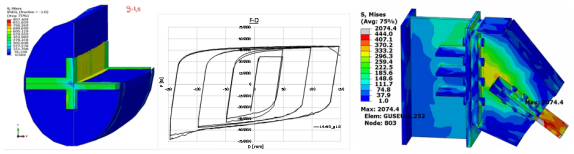
- Development of two different types of BRB prototypes: "conventional" (steel core / mortar / steel casing) and "dry" (without mortar), followed by a prequalification testing program on a set of BRBs of different capacity. This will provide an initial database on prequalified BRBs, rendering project-specific experimental programs unnecessary, at least for most common design situations;
- Transfer of the "know-how" on design and production of two types of BRBs to the industrial partner, who will be able to set up quantity production of these devices;
- Development of design guidelines for buckling restrained braces (at the device level). It will allow production of generic BRBs by local producers at more competitive prices than imported ones. "Dry" (or "steel-only") BRBs are believed to be especially suited for this purpose, as they can be easily adopted by steel fabricators;
- Development of design guidelines and design examples for steel BRB frames (at system level).
- Dissemination of the project outcomes to practising engineers, through presentations in annual conferences of the Association of Structural Engineers (AICPS) and through two workshops organised in Bucharest and Timisoara.

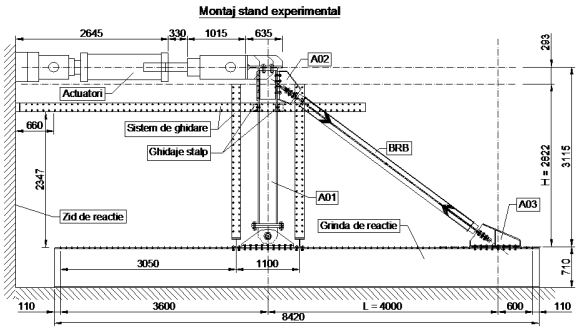
Results:

The following results were achieved up to the present date:

1. Design of prototype structures. There were designed 16 structures (MRFs, BRBFs, D-BRBFs, and CBFs), located in Bucharest and Timisoara.
2. Selection of typical capacities of BRBs. Two typical BRB capacities were selected (300 kN, respectively 700 kN).
3. Synthesis of existing information on performance and design of BRBs was performed identifying options for component materials, technology and design methods.
4. Seismic performance evaluation of structures was performed using nonlinear static analyses for different seismic performance levels.

5. Development and design of BRBs. Different BRB concepts were analysed and numerically tested. A total of 14 BRBs (conventional and "dry") were designed. Code-based design and FEM analyses were performed for the parts of the experimental stand (connections, column).





6. Manufacturing. 14 BRBs, 9 specimens for investigating the transition zone, experimental stand, and specimens for material testing were manufactured.
7. Experimental pretesting. 9 specimens were tested cyclically in order to investigate the behaviour of different BRB concepts, cutting technology.

Applicability and transferability of the results:

A Design Guide for BRBs for manufacturers, as well as a Design Guide for steel BRB frames for practising engineers will be produced within the project. Moreover, a set of BRBs will be prequalified, eliminating the need of project-specific testing. The design guidelines and the prequalification will facilitate the use of BRBs

Financed through/by

The project is supported by a grant of the Romanian National Authority for Scientific Research, CNDI–UEFISCDI, project Nr. 99 / 2014 (PN-II-PT-PCCA-2013-4-2091).

Research Center

CEMSIG - The Research Center for Mechanics of Materials and Structural Safety

Research team

- Politehnica University Timisoara, (coordinator);
- SC Popp & Asociații SRL, Bucharest;
- SC HYDOMATIC SISTEM SRL, Timisoara.

Contact information

Assoc.prof. Aurel Stratan, PhD.
Politehnica University Timisoara
Faculty of Civil Engineering
Department of Steel Structures and Structural Mechanics
Str. Ioan Curea nr. 1
300224 Timisoara, Romania
Phone: +40 (0) 256 403 923
Fax: +40 (0) 256 403 917
E-mail: aurel.stratan@upt.ro
Web: http://www.ct.upt.ro/centre/cemsig/imser.htm

"SIMULTANEOUS BIOHYDROGEN PRODUCTION AND WASTEWATER TREATMENT BY SELECTIVELY ENRICHED ANAEROBIC MIXED MICROBIAL CONSORTIUM" (BIOSIM)

Goal of the project:

- Developing a selectively enriched anaerobic mixed microbial consortium able to metabolize complex, dynamic, unsterile substrates like wastewaters resulting significant amount of biohydrogen;
- Increasing the hydrogen production yield by optimizing the various physico-chemical parameters that influence the biohydrogen production process;
- Developing a novel biohydrogen production technology, in order to replace the existing methane production phase used in wastewater treatment plants.

Short description of the project:

- Developing a microbial consortium able to metabolize organic substrates with biohydrogen production

Project implemented by

- CO - University of Politehnica Timisoara,
- P1 - University of Agricultural Sciences and Veterinary Medicine of Banat "King Mihai I" Timisoara,
- P2 - National Research Institute of Development in Electrochemistry and Condensed Matter Timisoara.

Implementation period:

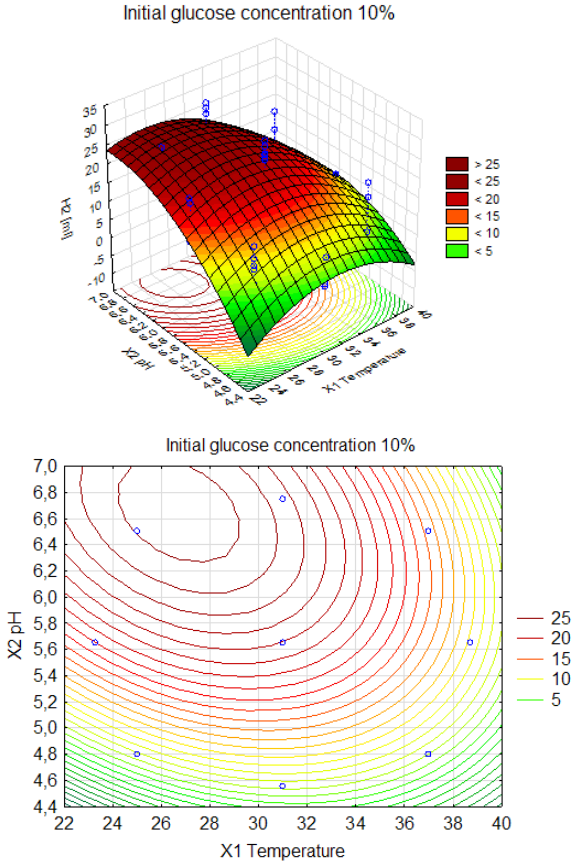
01.09.2012 - 15.12.2016

Main activities:

Main activities of BIOSIM proposal were:
- Establishing an anaerobic mixed consortia capable of wastewater treatment with simultaneous biohydrogen production;
- Determining the influence of different physic-ochemical factors influencing wastewater treatment with simultaneous biohydrogen production and process optimization;
- Mathematical modeling of the biohydrogen production process with the development of a novel microbiological wastewater monitoring system and design of a test fuel cell system for the energy conversion of the produced biohydrogen.

Results:

Main results of BIOSIM proposal were:
1. Establishing the ideal starting inoculum capable of wastewater treatment with simultaneous biohydrogen production;
2. Design and optimization of the wastewater treatment process in order to increase the biohydrogen yield;
3. Development of a novel microbiological wastewater monitoring system and development of a logistics system model.
4. Wide-scale dissemination of the project's results, materialized through 22 articles with an impact factor to 25.



Applicability and transferability of the results:

BIOSIM proposal combine novel high tech genomic approaches with the appropriate pretreatment of wastewaters in order to enhance hydrogen gas evolution efficiency in wastewater plants. Important efficiency increasing factor is the re-utilization effort (carbon mobilization) of the otherwise byproduct anaerobic sludge coming out from the bioconversion process.
Our technology makes possible the determination of the rate of the bacterial participants in the consortium. These information provide guidelines for the proper adjustment of the conditions in each step of biohydrogen formation process.

Financed through/by

Executive Unit for Financing Education, Research, Development and Innovation (UEFISCDI)

Research Center

ICER Politehnica Timisoara

Research team

A. CO - University of Politehnica Timisoara
1. Dr. Gergely MARÓTI – project director
2. Ş.I. Dr. Vasile GHERMAN –UPT team leader
3. Prof. Dr. Ing. Francisc PETER
4. Sl. Dr. Ing. Narcis Mihai DUȚEANU
5. S.I.Dr.Ing. Cristian-Marius STĂNILOIU-THEIS
6. Conf.Dr.Ing. Constantin FLORESCU
7. S.I.Dr.Ing. Mariana ILIE
8. Ş.I. Dr. Ing. Adina NEGREA
9. Dr. Iulian BOBOESCU
10. Dr. Gabriela GHERMAN
11. Drd. Paul MOLNAR.

B. P1 - University of Agricultural Sciences and Veterinary Medicine of Banat "King Mihai I" Timisoara:
1. Ş.I. Dr. ing. Teodor VINTILĂ – P1 team leader
2. Dr. ing. Nicolae POPA
3. Dr. ing. Daniela VINTILĂ
4. Ing. Dumitru POPESCU
5. Ec. Victoria PÂRVA
6. Ec. Cornelia CHEȚ

C. P2 - National Research Institute of Development in Electrochemistry and Condensed Matter Timisoara:
1. Dr.Fiz. Paula SFARLOAGA - P2 team leader
2. Dr.Fiz. Ioan GROZESCU
3. Dr. Ștefan NOVACONI
4. Dr.Chim. Paulina VLAZAN
5. Dr. Anamaria DABICI
6. Th. Ioan PATEANU
7. Th. Radu GURGU
8. Drd. Fiz. Daniel DAMIAN
9. Mioara ONEA

Contact information

Prof. Gergely Maroti, PhD
Faculty of Civil Engineering /Department of Hydrotechnics
Address: Str. George Enescu, No. 1A Postal Code 300022, Timisoara
Phone: (+40) 256 404118
Mobile: 0763684710
E-mail: vasile.gherman@upt.ro

PERFORMANT POWER TRAIN FOR HYBRID AND ELECTRIC VEHICLES WITH DUAL ROTOR SINGLE STATOR AXIAL SYNCHRONOUS MACHINE AND SINGLE INVERTER - HELSAX

Goal of the project:

The project goal of bilateral cooperation between the UPT-TUIASI and UTM proposed, is of major scientific and practical importance in reducing pollution from vehicles classic using hybrid vehicles or electric drive systems performance, and aims to develop and enhance knowledge of joint research teams from Romania and Moldova, as well as enhance mobility of researchers, exchange of experience and mutual access to research infrastructure of medium and high scale, existing in the three universities.
The basic priority of the collaboration is to develop, during the implementation of the joint project, of a scientific project for participation in competitions announced by Horizon 2020 of the European Union and other international programs.

Short description of the project:

It proposes an international original solution in which the two electrical machines (generator and motor) and static converters related are replaced by a single synchronous permanent magnet machine having axial air gap, a central stator with slotes on both sides and two different windings supplied from a single PWM inverter having two output frequencies, and two independent rotors.

Project implemented by

Politehnica University of Timisoara (UPT),
Technical University "Gheorghe Asachi" Iaşi (TUIASI) and
Technical University of Moldova (UTM)

Implementation period:

September 2016 – March 2018

Main activities:

The aim is to exploit the potential of joint research of the two teams for creating a system of electric drives for hybrid vehicles and electrical overall dimensions and low weight; reduce carbon emissions from vehicles; have a static converter that is simple and inexpensive; broadcast transmission system using differential electric vehicles; control of the two rotors so that they can operate in the same mode or in different modes at the same rotational direction or in opposite directions at the same speed value at slightly different speeds or at much different speeds. Specific objectives: increasing electrification of the vehicle; reducing vehicle weight; increasing the speed of operation of the electrical machine rotors for reducing the size of the actuator; sizing model for which the design (impose conditions of power, size, weight); design model for the electric drive system and the stand of experimental tests; increasing efficiency for the electric drive system; the practical design of the machine, inverter and battery accumulators; exhibition experimental test setup; implementation and testing of the various experimental control solutions; creating an intelligent system for managing production and electricity consumption per vehicle. Expected results: a much easier vehicle with an electric drive system; low inertia rotor at high speeds; a compact electric drive system with high torque and simple control; an inverter that manages various operation modes with different speeds equal to or in the same direction or in opposite directions of the two rotors.

Results:

The work plan in 2016 was based on regular meetings of members of both teams alternately in Romania and Moldova. First visit was in Moldova, by a team from Romania. On this occasion the Romanian members met the team members from Moldova, visited research labs, they did contact with their scientific concerns. During this movement, a conference occurred, in order to launch the project in Chisinau, where teachers and students from the Technical University of Moldova and specialists in electrical engineering enterprises in Chisinau, Balți and Tiraspol were invited .
Then followed a visit by a team from UTM to Faculty of Electrical Engineering and Energetics in Timisoara and the Faculty of Engineering Hunedoara. On this occasion contact were established with all members of the project team from Romania, were visited research laboratories of the two faculties, and there was group discussions between members of both teams according to scientific areas of joint research. One conference was organized in order to launch the project in Timisoara, where teachers and students at the University Politehnica Timisoara and specialists of enterprises of Timisoara and Arad with automotive profile were invited. There was a travel team from Chisinau to visit industrial companies in the automotive industry in Hunedoara and Deva (Lisa Draexlmaier Hunedoara, Sews Deva).

Applicability and transferability of the results:

The motors excited by permanent magnets in a variety of designs, gaining more ground in the competition with the DC classics, because of high technical and economic achievements, especially under current conditions, in association with improved electronic supply sources and assisted computer systems that are more and more competitive. Obtaining reasonable torque values for a wide range of variation of speed, drive systems through simple procedures, are no longer a difficulty that cannot be solved. Using motors excited by permanent magnets and brushless fractional number of slots per pole and phase engines in particular, as actuators in servo-drives for low power and area, has expanded compared to the classic DC due to the progress of power electronics and information technology, without which one can not conceive an elastic system containing modern drive controllable speeds in wide range. With integrated systems for the electric drive, having adequate topologies actuators as execution elements , through the use of more evolved control algorithms and integrating functionality at both hardware and software, may lead to dynamic and superior performances, more precise control of speed or position, high electromagnetic torque, higher energy efficiency and high accuracy while simultaneously reducing overall system cost consistently. The project results will contribute to community social objectives to combat climate change. The main contribution is to reduce emissions of CO2 and emissions of greenhouse gases. The project proposes new technologies and contributes to sustainable economic development.

Financed through/by

UEFISCDI

Research Center

UPT members of the research team are also members of the University's two research centers: the Institute for Renewable Energy and Research Centre for the intelligent control of power conversion and storage.

Research team

The research team consists of UPT coordinator conf.dr.ing. Sorin Ioan DEACONU, teachers (PhD's): Nicolae MUNTEAN, Lucian Nicolae TUTELEA, Liviu MIHON, Octavian CORNEA, Ciprian ŞORÂNDARU, Marcel TOPOR, engineers and PhD students: Loredana GHIORMEZ and Csaba GHEORGHIU.

Informbusiness Chişinău laboratory for experimental work.

Helsax project launch conference in Chisinau.

Helsax project launch conference in Hunedoara.

Contact information

Associate Prof. Sorin Ioan DEACONU, PhD
Faculty/Department Address: Revolutiei Str., No. 5,
Postal Code 331128, Hunedoara
Phone: (+40) 254 207529
Mobile: (+40) 744 544846
E-mail: sorin.deaconu@fih.upt.ro
Web: www.fih.upt.ro

EXPLORATION SYSTEM FOR OPTIMIZATION OF SHAPE MEMORY ACTUATION IN COMPOSITIONAL SPREADS

Goal of the project

The project had as main fundamental objectives the development of an exploration system that would allow:
- a combinatorial optimization of actuation using the sputtering technique to generate compositional spreads;
- the development of models for combinatorial systems adapted for investigation of actuation;
- the implementation of the combinatorial exploration system for the case of intelligent materials, with focus on shape memory alloy families;
- the development of microactuators with controlled and optimized functionality;
- the investigation or modelling of systems for the exploration, and
- the microfabrication of materials with "on demand" properties, adapted for applications in microsystem engineering.

Short description of the project

The project aims to design, fabricate and develop a combinatorial exploration system for optimization of microactuation using the sputtering technique of thin film compositional spreads.

Project implemented by

Politehnica University Timisoara, Romania

Implementation period

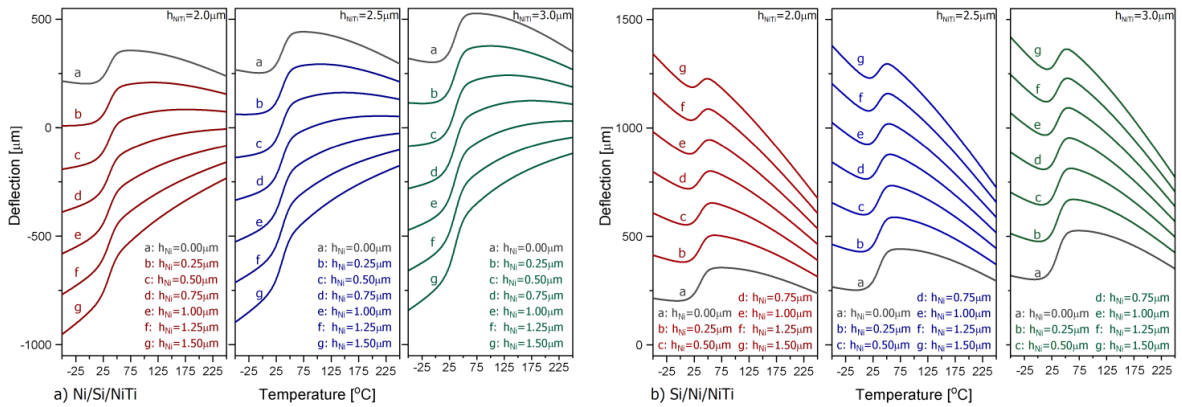
03.10.2011 - 02.10.2017

Main activities

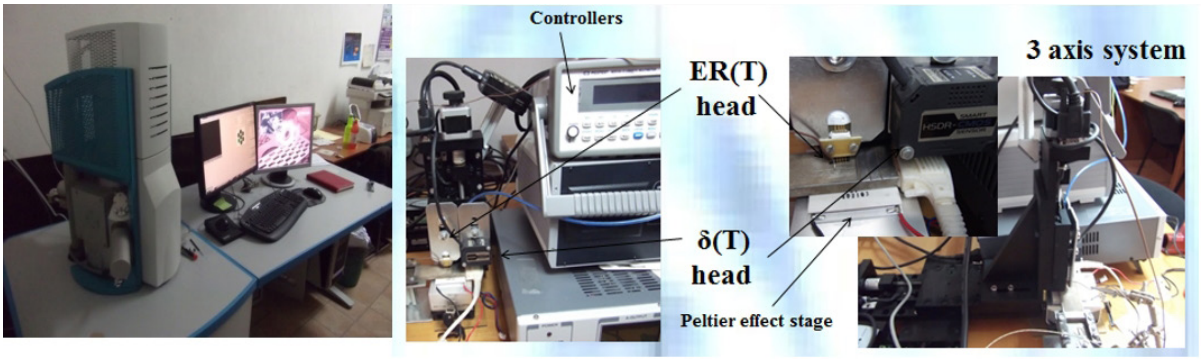
The experimental objectives of the project were:
- identification of specific design requirements for a system dedicated to generating combinatorial libraries of metallic materials;
- design of an exploration path for specific functionalities;
- design and fabrication of an exploratory system that allows sputtering of compositional spreads;
- design and microfabrication of substrates for the investigations of functional libraries;
- microfabrication of sputtered compositional spreads based on shape memory alloy compostions;
- microstructural-compositional characterization of libraries;
- design of an actuator based on thin film microfabrication.

Results

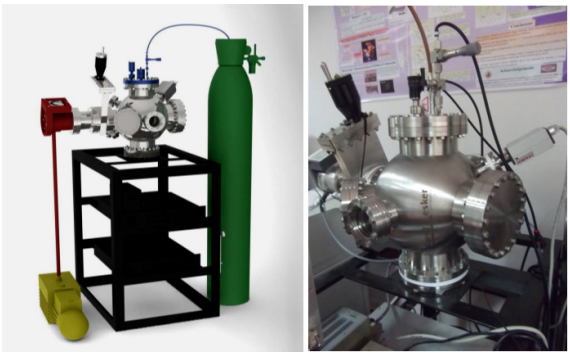
Actuation prediction in bimorphs based on shape memory alloy films



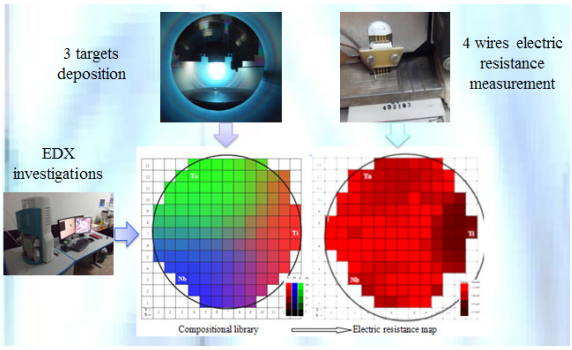
Acquisition of an electron microscope and development of a 3 axis measurement system for electric resistance and deflection as a function of temperature



Design and fabrication of an equipment for combinatorial exploration



Fabrication and characterization of shape memory alloy libraries



Dissemination:
- 15 ISI Papers with impact factor
- 6 ISI Proceedings papers
- 3 published books

Applicability and transferability of the results

In the field of micro and nanoengineering and in the research of new materials

Financed through/by

Romanian National Authority for Scientific Research CNCS – UEFISCDI

Research centre

Center for Smart Materials Micro and nanoengineerin

Research team

Prof. Corneliu M. Craciunescu
Prof. Ion Mitelea
Prof. Victor Budau
Assoc. Prof Aurel Ercuta
Ing. Roxana Sprancenatu

Contact information

Prof. Corneliu Marius CRACIUNESCU, PhD, Ing. Habil.
Faculty of Mechanical Engineering /Department of Materials and manufacturing Engineering; Address: Bd. Mihai Viteazul, No. 1, 300022, Timişoara
Phone: (+40) 256 403655
Mobile: not supplied by university, therefore not public
E-mail: corneliu.craciunescu@upt.ro
Web: http://www.upt.ro/img/files/2016-2017/cercetare/ppr/ESOP_2011-2016.pdf

IMPROVEMENT OF THE TITANIUM WEAR RESISTANCE BY ELECTRON BEAM REMELTING OF THE PRE-DEPOSITED THERMAL SPRAYED COATINGS

Goal of the project

Improvement of the exploitation performance of the titanium, especially wear behavior, without influencing its good corrosion resistance

Short description of the project

Titanium is one of the most promising metals in field of high specific strength engineering. Although it offers attractive mechanical, chemical and physical properties, its surface properties are deficient, possessing poor fretting fatigue resistance and poor wear resistance properties. Thermal spray coatings is one of the most common ways to improve the surface characteristics of the materials being used in a wide range of industries to improve the abrasive, erosive, and sliding wear of machine components.

The proposed theme focuses on the improving of the titanium wear resistance by electron beam (EB) remelting of the pre-deposited oxidic powder Al_2O_3-TiO_2 using the high velocity oxygen fuel (HVOF) and atmospheric plasma spraying (APS) methods. The EB treatment may lead to the elimination of porosity, enhancement of the coating strength and chemical homogeneity, and the development of metallurgical bonding at the coating-substrate interface producing strengthened coatings adhesion.

Project implemented by

University Politehnica Timisoara

Implementation period

02.09.2013 - 12.12.2016

Main activities

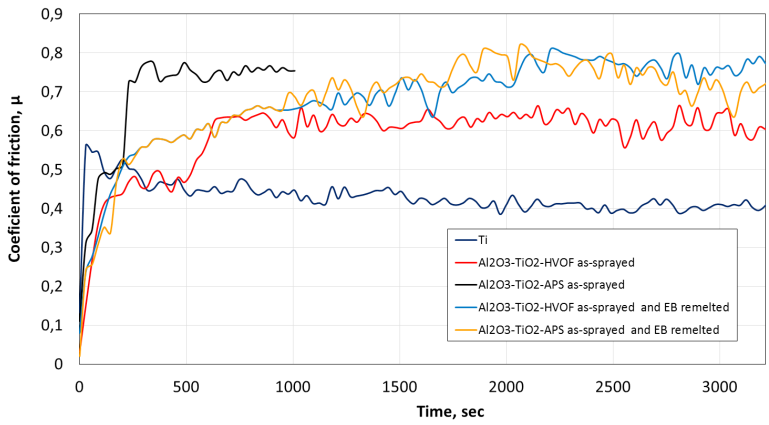
- State of the art and perspectives evaluation in surface coatings technique used as a method in order to improve the wear behavior of the titanium;
- Development of HVOF and APS sprayed Al_2O_3-TiO_2 coatings on the surface of titanium and their remelting using the electron beam (EB) method;
- Analysis and characterization of the obtained HVOF and APS sprayed Al_2O_3-TiO_2 coatings before and after the electron beam remelting treatment;
- Study of the wear and corrosion behavior of the coatings before and after the electron beam remelting;

Results

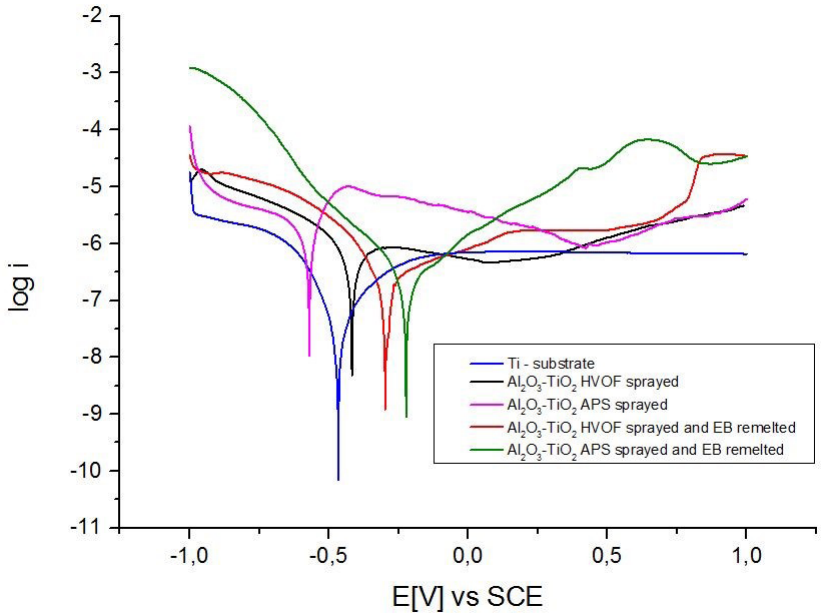
For the final stage of the project it has been obtained the following results:

- Study of the wear and corrosion behavior of the coatings before and after the electron beam remelting;

The results of this project demonstrated that the deposition and EB-remelting of Al_2O_3-TiO_2 coatings onto the titanium surface is a solution for the improvement of sliding wear resistance of this material without a major decrease in corrosion resistance. Moreover, the electron beam treatment can be used for fabrication of compact and homogenous coatings with higher adherence to the substrate.



Evolution of the friction coefficient in time for the tested materials



Potentiodynamic polarization curves of the samples tested in 3.5 % NaCl solution

Applicability and transferability of the results

The results which will be obtained in frame of the project will be transferred to companies in the field of automotive industry and not only. Also they will be presented to national and international conferences and published in scientific journals.

Financed through/by

EXECUTIVE UNIT FOR FINANCING EDUCATION HIGHER RESEARCH DEVELOPMENT AND INNOVATION (UEFISCDI)

Research Centre

Research Centre for Processing and Characterization of Advanced Materials

Research team

Project manager: Ion-Dragos UTU
Team members:
Viorel-Aurel SERBAN – senior researcher
Cosmin CODREAN – senior researcher
Carmen OPRIS – senior researcher
Iosif HULKA – postdoc researcher

Contact information

Assoc. Prof. Dr.Ing. Ion-Dragoş UŢU
Materials and Manufacturing Engineering Department, Faculty of Mechanical Engineering
Address: Bd. Mihai Viteazu, No. 1, RO300222, Timisoara
Phone: (+40) 256 403 656
E-mail: dragos.utu@upt.ro
Web: www.upt.ro/Informatii_UPT_504_ro.html

INNOVATIVE, ECOLOGIC AND EFFICIENT TECHNOLOGIES FOR JOINING METALLIC AND POLYMERIC MATERIALS USED IN AUTOMOTIVE INDUSTRY BY FRICTION STIR WELDING (INOVA-FSW)

Goal of the project

The project is focused on studying the possibilities of using Friction Stir Welding (FSW) for joining dissimilar material (metallic and polymeric) for automotive industry. Solid state welding process, like FSW, avoid the precipitation of secondary phases in the welded joint, resulting a high quality welded joint, even between materials impossible/difficult to weld with fusion welding processes. The main goal of the project is to obtain welding technologies for joining Al-Cu, Al-Steel, as well as different polymeric materials.

Short description of the project

The project studies the possibility to join, by FSW, Al-Cu, Al-steel and different types of polymeric materials.

Project implemented by

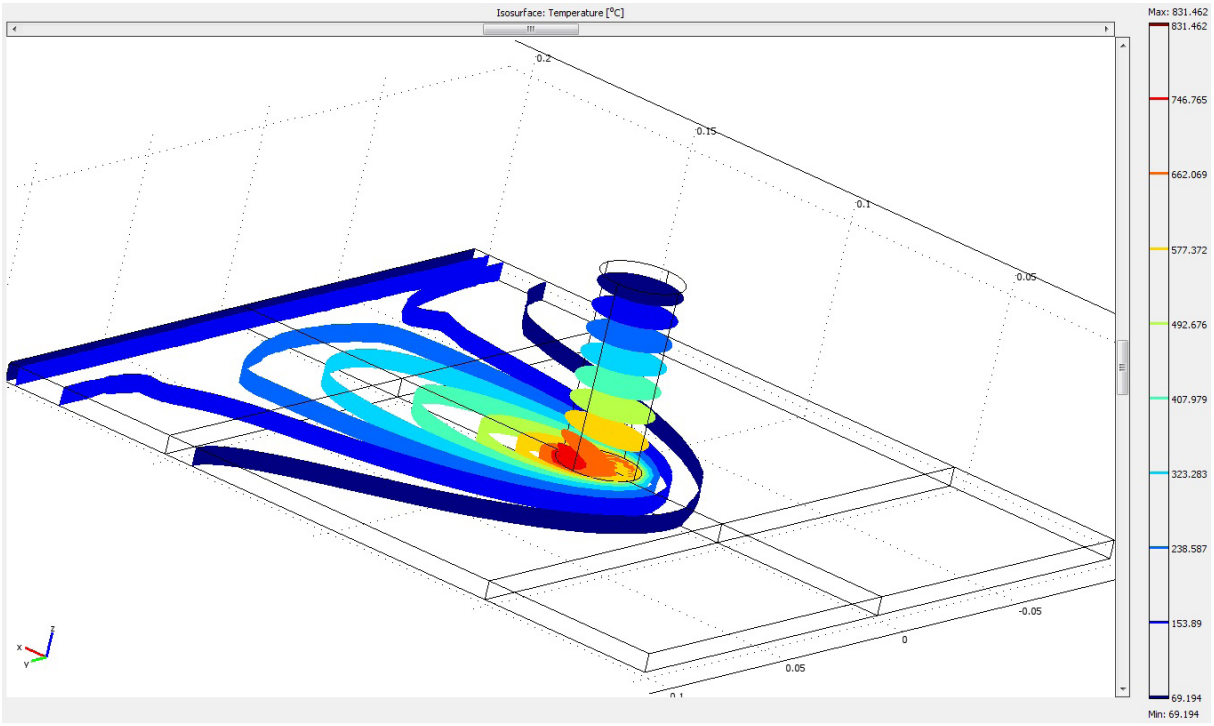
The partners in this project are: University Politehnica Timisoara (UPT), National R&D Institute for Welding and Material Testing – ISIM, Timisoara, University of Pitesti and Renault Technologie Roumanie (part of the Renault Group). The last partner will also implement the results of the project.

Implementation period

14.07.2014 – 30.09.2017

Main activities

The main activities of the project:
- defining the materials for the welding tools, technological parameters, testing procedures and quality specifications;
- experimental studies for joining Al (and aluminum alloys) with Cu (and copper alloys) and different polymeric materials;
- experimental studies for joining Al (and aluminum alloys) with steel;
- numerical modeling of FSW welding of dissimilar materials;
- testing of welded joints, optimization of the welding procedures (building a data base with results);
- dissemination of the results.



Results

The project results are materialized in more than 10 FSW technologies (tested and certified), for joining aluminum alloys with copper alloys, aluminum alloys with steel and also different polymeric materials. Also, there were 6 scientific papers that were published, based on the results of this project.

Applicability and transferability of the results

The re4sult of the project will be transferred and applied mainly at the partner Renault Technologie Roumanie (part of the Renault Group), but they are available to all industrial entities working mainly in automotive industry.

Financed through/by

UEFISCDI in grant PN-II-PT-PCCA-2013-4-1858 (Inova-FSW, contract 219/2014).

Research Centre

ICER – Institutul de Cercetari pentru Energii Regenerabile

Research team

University Politehnica Timisoara (UPT);
National R&D Institute for Welding and Material Testing – ISIM, Timisoara;
University of Pitesti
Renault Technologie Roumanie (part of the Renault Group).

Contact information

conf. Bogdan RADU, PhD
Department Materials Engineering and Fabrication,
b-dul Mihai Viteazul nr. 1, 300222, Timisoara
Phone: (+40) 256 403647
Mobile: +40746190268
E-mail: bogdan.radu@upt.ro
Web: http://www.inovafsw.upt.ro/

KNOWLEDGE MANAGEMENT-BASED RESEARCH CONCERNING INDUSTRY-UNIVERSITY COLLABORATION IN AN OPEN INNOVATION CONTEXT (UNIINOI)

Goal of the project

In the present competitive climate, knowledge and innovation are seen as the main distinguish factors of the organizations' success and as the basis of their competitive advantages. Following a long tradition of research in the field of innovation, open innovation is an approach in which the boundaries of innovation are shifting from a situation where organizations conduct research and development activities mainly internally, to a widespread collaboration and external knowledge source, in order to support achieving and sustaining continuous innovation of their product, services or processes. Furthermore, universities are seen among the most important partners with whom business organizations can cooperate for quantitative empirical evidence concerning the development, evolution and sustainability of Industry-University relations in Open Innovation. Despite the intensive efforts from both sides for the development of bilateral collaborations in the research and innovation field there are still space and resources for increasing the knowledge processed between these actors.

Short description of the project

The project activities are focuses on designing a feasible strategy (based on a model and an associated methodology) for the UNIinOI together with the definition of a set or a system of key performance criteria in order to characterize this process. The validation of the whole proposed approach for the increasing of the UNIinOI is developed in the case of Romanian universities and industrial organizations. All partners in the project will support the design and validation process of the model and methodology designed solutions..

Project implemented by

Project coordinator - University of Oradea www.uoradea.ro
Partener 1 - Politehnica University of Timisoara www.upt.ro
Partener 2 - Technical University of Cluj-Napoca www.utcluj.ro
Partener 3- S.C. EMSIL TECHTRANS S.R.L. Oradea, Romania

Implementation period

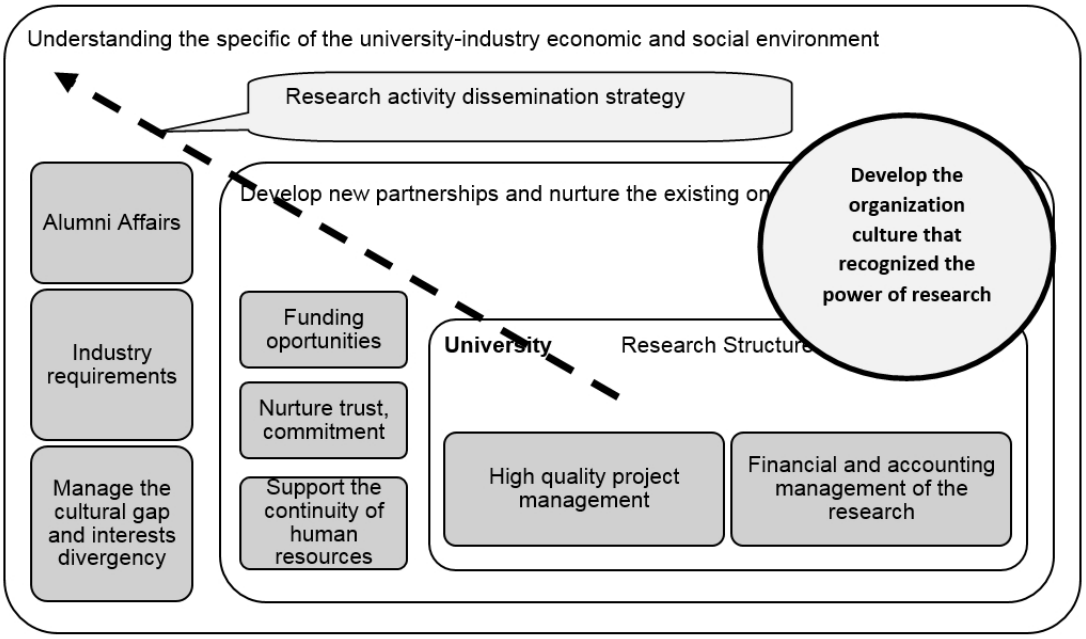
2014-2017

Main activities

Stage I - The development of the collaborative research environment (2014)
Stage II - The development of an Open Innovation environment between Industry-University (2015)
Stage III - The development of a model for the performance measurement of Industry-University collaboration in Open Innovation (2016)
Stage IV - The development of a methodology (associated with the previous designed model) for the performance measurement of Industry-University collaboration in Open Innovation (2017)

Results

During the project implementation there have been developed the ontology of UNIinOI (Fig. 1) using an appropriate software application for the knowledge map design and visualization. The ontology representation has a tree structure that include the description of each considered item as: motivation factors, barriers, channels for the knowledge transfer, benefits and disadvantages (dimensions of the proposed ontology considered as sub-ontologies). The ontology of UNIinOI allows the analysis and optimization of the different knowledge transfer processes, activities or interdependences by considering different items depicted in each sub-ontology. Therefore, each item has been detailed, for its complete characterization using relevant, actual references and existing regulations, norms for research and development activities in Romania.



The proposed model (or framework) for the UNIinOI

Applicability and transferability of the results

1. The projects' research results could be transferred in universities practices in order to define the strategy with its industrial partners in the local and regional areas (derived from a business model). In addition, the results could be useful for the internal procedures development and for the definition of a scientific framework in order to strength and intensify UNIinOI (including the development of future joint projects);
2. The research results could be easy transfer to industrial entities in order to foster UNIinOI;
3. Project's research results were transferred in the didactical process (master level) and enriched the knowledge bases of our didactical and PhD students' projects.

Financed through/by

The project is supported by the Ministry of National Education through The Executive Unit for Financing Higher Education, Research, Development and Innovation in the context of Partnerships in Priority Domains Programme.

Research Centre

Engineering and Management Research Center

Research team

Prof. Anca DRAGHICI (project responsible)
Prof. George DRAGHICI
As. PhD. Larisa-Victoria IVASCU

Contact information

Prof. Anca DRAGHICI, PhD
Faculty of Management in Production and Transportation
Department of Management
Address: Remus Str., No. 14, 300191, Timisoara
Phone: (+40) 256 403 610
E-mail: anca.draghici@upt.ro
Web: www.mpt.upt.ro

THE IMPACT OF THE ECONOMIC AND FINANCIAL STABILITY ON INVESTMENTS, INNOVATION PROCESS AND ENTREPRENEURIAL ACTIVITY IN THE EU

Goal of the project

The aim of the project is to analyze the relationship between economic and financial stability on the one hand, and investment, innovation and entrepreneurship on the other hand, with a focus on the EU countries.

Short description of the projects

The economic and financial stability plays an important role in promoting investment, in influencing the entrepreneurs' decisions and in enhancing the national innovativeness capacity. These aspects, extremely important for the European strategy for economic recovery and job creation are not sufficiently explored in the literature, while their empirical investigation is practically inexistent.

Project implemented by

Politehnica University of Timisoara, Management Department

Implementation period

01.10.2015 – 30.09.2017

Main activities

1. We develop the research on three directions:

- we analyze the link between stability and investments, considering the sectorial
particularities of the investments' determinants, using FDI and firm-level data.
- we investigate the role of the stability in enhancing the national innovativeness capacity.
- we explore the relationship between the economic stability and the entrepreneurial activity, to see which are the economic sectors where the entrepreneurial decision is sensitive to the evolution of the macroeconomic fundamentals.

2. Manipulation of AMADEUS statistics for firms' financial statements

3. Econometric analyses and generation of results

4. Dissemination of results

Results

Journal articles:

- Albulescu, C.T. and Ianc, N.B. (2016), Fiscal policy, FDI and macroeconomic stabilization, Review of Economic and Business Studies, 9(2), 131-146.
- Albulescu, C.T. and Draghici, A. (2016). Entrepreneurial activity and national innovative capacity in selected European countries, The International Journal of Entrepreneurship and Innovation, 17(3), 155-172.
- Albulescu, C.T., Tamasila, M. and Taucean, I.M. (2016). Shadow economy, tax policies, institutional weakness and financial stability in selected OECD countries. Economics Bulletin, 36(3), 1868-1875.

Conference papers:

- Albulescu, C.T., Miclea, S., Tamasila, M. and Taucean, I.M. (2016), The working capital and liquidity's role in explaining the Italians' firms profitability around the recent financial crisis. Proceedings of the 5th Review of Management and Economic Engineering International Management Conference, pp. 129-139.
- Draghici, A., Siakas, K., Albulescu, C.T. (2016), Comparison between entrepreneurship education in Romania and Greece - the case of two higher education institutions, ERiE 2016 conference, june 2016, Prague, Czech Republic, pp. 87-98.
- Albulescu, C.T. and Miclea, S. (2016), The interdependence between Italian firms' access to finance and their probability of default, Proceedings of the MakeLearn and TIIM Joint International Conference, 25–27 May 2016 Timisoara, Romania, pp. 697-703. (Best Paper Award)
- Albulescu, C.T., Breznik, K. and Dermol, V. (2016), What we understand by financial stability: text analysis with network approach, Proceedings of the MakeLearn and TIIM Joint International Conference, 25–27 May 2016 Timisoara, Romania, pp. 943-951.
- Albulescu, C.T., Tamasila, M. and Taucean, I.M. (2016). Entrepreneurship, tax evasion and corruption in Europe, Procedia - Social and Behavioral Sciences, 221, pp. 246-253.

Research stages:

- Claudiu Albulescu, University of Poitiers
- Bogdan Ianc, University of Orléans
- Adrian Ionescu, University of Orléans

Applicability and transferability of the results

The findings have practical implications for investment and financial managers of companies operating in different economic fields. The results have also practical implication for authorities, helping them to identify the elements which enhance the investment and the entrepreneurial activity, in order to sustain the economic growth and job creation. Further, relying on a sectorial analysis, the findings give a complete understanding about the determinants of investment and entrepreneurship, specific to each industry.

Financed through/by

Executive Unit for Financing Higher Education, Research, Development and Innovation - UEFISCDI

Research Centre

Engineering and Management Research Centre

Research Team

Assoc. Prof. Claudiu Albulescu, PhD
Assoc. Prof. Matei Tămășilă, PhD
Lect. Ilie Mihai Tăucean, PhD
Assist. Prof. Șerban Miclea, PhD
PhD student Bogdan Ianc
PhD student Adrian Ionescu
PhD student Simina Suciu

Contact information

Assoc.Prof. Claudiu ALBULESCU, PhD
Faculty of Managament in Production and Transportation,
Management Department, Remus Street, no. 14, 300191, Timişoara
Phone: (+40) 256 404 035
Mobile: (+40) 743 089 759
E-mail: claudiu.albulescu@upt.ro
Web: https://sites.google.com/site/isiiaue/

RANDOM MATRIX TEHNIQUES IN QUANTUM INFORMATION THEORY (RMTQIT)

Goal of the project

The field of Quantum Information Theory (QIT) attracted lately the interest of scientific community due to the its ambitious goals meant to create new technologic systems (quantum computers) and more secured methods to transmit the information. Nowadays, QIT is a multi-faceted field, with large connections in the subfields of Mathematics, such as Functional Analysis, Operator Theory, Linear Algebra, Probability Theory. The project RMTQIT purposes to give answers to open questions from QIT, using techniques from random matrix theory.

Short description of the project

The project RMTQIT focuses on a systematic exploration of theoretical questions in QIT about random quantum states and random quantum channels. These problems have attracted the attention lately in a very naturally connection to fundamental issues of QIT theory, such as entanglement theory and classical (or quantum) capacities for channels.

Project implemented by

- The Department of Mathematics, University Politehnica Timişoara, Romania
- Laboratoire de Physique Théorique de Toulouse, Université Paul Sabatier Toulouse III, France

Implementation period

1st March 2013-31st August 2016

Main activities

The activities developed within the project RMTQIT in 2016 mainly focused on completing the tasks proposed initially as well as to formulate new issues. It is relevant to mention that the team of the project submitted a joint paper with new results related to the decomposition of an arbitrary operator as a symmetric sum of positive semidefinite operators, focusing mostly on questions about the possible values of the symmetry parameters. The questions we asked are of interest from purely mathematical point of view as well as for its applications in the theory of SIC-POVMs or equiangular tight frames. Our results hold in the most general setting existing for decompositions of positive operators and prove to be useful also for classical set up; for example, for POVM case, we show that extremal decompositions for qubits exist iff the operator (the sum of the decomposition) is scalar. These results have been presented (by M.A. Jivulescu) with several occasions at international conferences and workshops, such as

1. Decomposition of positive operators with applications in Quantum Information Theory, School on Stochastic Methods in Quantum Mechanics, Autran, Franța, July 2016
2. On some decomposition of positive semidefinite operators by symmetric families of operators, Theodor Angheluta Seminar, The 15th International Conference on Applied Mathematics and Computer Science, Cluj-Napoca, July 5-7, 2016
3. Some decomposition of positive semidefinite operators, 26th Conference on Operator Theory, Timisoara, June 2016
4. Sisteme dinamice in teoria informatiei cuantice, Conferința Diaspora, Cercetarea Ştiințifică şi Invățământul Superior din Romania - Diaspora şi prietenii săi, Timisoara, 25-28 April 2016

Results

The main results of the project RMTQIT were resumed in the papers listed below

1. Maria Anastasia Jivulescu, Ion Nechita, Pasc Gavruta-On symmetric decompositions of positive operators-arXiv:1609.05060
2. Maria Anastasia Jivulescu, Nicolae Lupa, Ion Nechita - Thresholds for reduction-related entanglement criteria in quantum information theory- Quantum Information and Computation, vol 15, no 13&14 (2015), pp 1165–1184 (arXiv: 1503.08008)
3. Maria Anastasia Jivulescu, Nicolae Lupa, Ion Nechita, David Reeb - Positive reduction from spectra - Linear Algebra and its Applications 469 (2015) 276–304 (http://arxiv.org/abs/1406.1277arXiv:1406.1277)

Financed through/by

- Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI)
- L'Agence Nationale de la Recherché (ANR), France

Research Team

Assist. Prof. Maria Anastasia Jivulescu
Dr. Ion Nechita
Prof. Găvruță Pașc
Assist. Dr. Nicolae Lupa

Contact information

Assist. Prof. Maria Anastasia JIVULESCU
Department of Mathematics
Address: Victoriei Square, no 2, RO300006, Timişoara
Phone: (+40) 256 403 098
Fax.: (+40) 256 403 109
Mobile: (+40) 740 517 340
E-mail: maria.jivulescu@upt.ro
Web:https://sites.google.com/site/rmtqit2013/

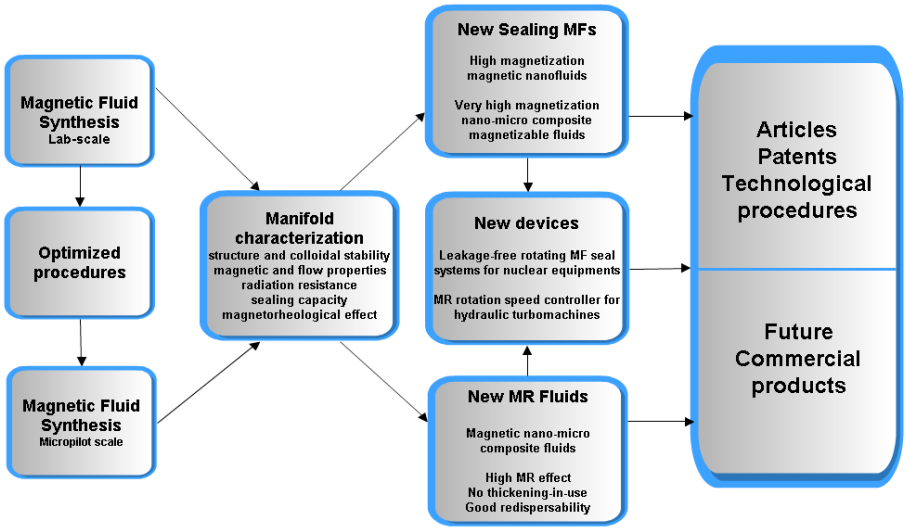
HIGH MAGNETIZATION MAGNETIC NANOFLUIDS AND NANO-MICRO COMPOSITE MAGNETIZABLE FLUIDS: APPLICATIONS IN HEAVY DUTY ROTATING SEALS AND MAGNETORHEOLOGICAL DEVICES

Goal of the project

The project is oriented to the extension of performances of rotating seals and adaptive motion control devices to meet the requirements of several well-defined new applications, by high and very high magnetization sealing fluids and new type of magnetorheological fluids to be synthesized.

Short description of the project

The project concept and objectives are illustrated schematically in figure bellow.



The workflow is organized along the following main directions: lab-scale and micro-pilot scale synthesis of high magnetization and radiation resistant magnetic nanofluids and nano-micro composite fluids for heavy duty (high pressure and /or rotation speed, contaminated medium) rotating seal and semi-active magnetorheological motion control applications; advanced structural, magnetic, rheological, magnetorheological characterization of the new magnetizable fluids; accelerated (irradiation) ageing and sealing capacity tests; design, manufacturing and experimental testing of leakage-free rotating seals for nuclear equipments and magnetorheological rotation speed controller devices for hydraulic turbomachines. The new rotating seal and motion control systems for nuclear and hydraulic equipments offer better quality than usual solutions have, will help to gain new market shares and open technological advantages over traditional manufacturing routes. The seal systems proposed for nuclear equipments offer much higher level of environmental protection over traditional sealing units due to the leakage- free property of magnetic fluid rotating seals, increasing the commercial value of the solutions proposed..

Project implemented by

- Romanian Academy – Timisoara Branch (Project coordinator),
- Politehnica University of Timisoara (Partner 1),
- S.C. ROSEAL S.A. Odorheiu Secuiesc (Partner 2)
- National Institute for R&D in Electrical Engineering ICPE-CA Bucuresti (Partner 3).

Implementation period

July 23, 2012 – December 31, 2016

Main activities

Main activities of the MagNanoMicroSeal project are: (O1) Synthesis and manifold characterization of magnetizable fluids for high pressure and heavy duty rotating seals and magnetorheological devices and, respectively, (O2) Design, fabrication and testing of leakage-free magnetofluidic rotating seal and magnetorheological(MR) control devices for well-defined applications/exploitation conditions.

Results

The main results of this project, to which Politehnica University of Timisoara contributed, refer to the elaboration of the following technological procedures:
– synthesis of high magnetization sealing fluids;
– synthesis of nano-micro structured magnetorheological fluids and qualification procedures:
– magnetic nanofluids for rotating seals for nuclear equipments.
The contributions of Politehnica University of Timisoara refer mainly to complex magnetic, rheological and magneto-rheological analyses of the magnetic sealing fluids and nano-micro structured magnetorheological fluids. The Politehnica University team oversaw the characterization of the magnetic nanofluids to be used for seals.

The results obtained in 2016 by the UPT team were disseminated in: Oana Marinica, Daniela Susan-Resiga, Florica Balanean, Daniel Vizman, Vlad Socoliuc, Ladislau Vekas, Nano-micro composite magnetic fluids: magnetic and magnetorheological evaluation for rotating seal and vibration damper applications, Journal of Magnetism and Magnetic Materials, 406, 134-143 (2016), FI=2.357 (2015/2016).

Applicability and transferability of the results

The technological progress is strongly evidenced by future commercial products planned for the industrial partner SC ROSEAL SA: 16 new type of magnetically controllable fluids, 1 prototype and 3 functional models of magnetofluidic devices for nuclear and hydraulic power engineering.

Financed through/by

the Ministry of Education, Research, Youth and Sports (MECTS) - Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI) through the PN II Program Partnerships in Priority Areas, Collaborative applied research projects, PCCA 2011.

Research centre

Research Centre for Engineering of Systems with Complex Fluids – Magnetometry Laboratory, Rheology Laboratory and Numerical Simulation and Parallel Computing Laboratory, from Politehnica University of Timisoara. URL: http://mh.mec.upt.ro/ccisfc/

Research team

The project research team consists of 42 researchers, engineers and technicians lead by
Dr. Ladislau VÉKÁS, the director of the MagNanoMicroSeal project (Romanian Academy Timisoara Branch).

The Politehnica University of Timisoara (Partner 1) research team in this project consist of 6 researchers and 2 research assistants, as follows:
Assoc. Prof. Dr.-Eng. Floriana D. STOIAN, project responsible for partner 1,
Phys. Oana Marinică,
Lect. Dr.-Eng. Mat. Sorin Holotescu,
Assoc. Prof. Dr.-Eng. Nicolae Crainic,
Lect. Dr.-Eng. Andreea Dobra,
Lect. Dr.-Eng. Adelina Han,
Res. Assist. Florica Bălănean,
Res. Assist. George Giula.

Contact information

Dr. Ladislau VÉKÁS, Corresponding Member of the Romanian Academy, Project coordinator
Romanian Academy Timisoara Branch
24 Mihai Viteazu Bv., 300223 Timisoara
Tel.: +40-256-403700; +40-256-403703;
E-mail: vekas@acad-tim.tm.edu.ro; vekas.ladislau@gmail.com

Assoc. Prof. Floriana D. STOIAN, PhD
Faculty of Mechanical Engineering/ Department of Mechanical Machines, Technology and Transportation,
UPT Partner responsible
1 Mihai Viteazu Bv., 300222 Timişoara
Tel.: +40-256-403671; +40-256-403700;
Mobile: +40-744-597308
E-mail: floriana.stoian@upt.ro; fdstoian@yahoo.com

ENVIRONMENTAL ENERGY HARVESTING HYBRID SYSTEM BY PHOTOVOLTAIC AND PIEZOELECTRIC CONVERSION, DC/DC TRANSFORMATION WITH MEMS INTEGRATION AND ADAPTIVE STORAGE

Goal of the project

The design, building and testing of the prototype of a hybrid system for energy harvesting from the ambient through photovoltaic conversion, DC/DC transformation with MEMS integration and adaptive storage, will be carried out. First key novel component of the device is the planar power micro-transformer for high frequency, with hybrid magnetic nanofluid/ferrite core and windings- a part of the DC/DC converter, fabricated in MEMS technology. A second key component is the photovoltaic cell, which relies on novel solutions.

Short description of the project

A prototype with wireless sensors powered by the harvesting system will be designed, built and tested. In this endeavor, there will be prepared a dedicated magnetic fluid to be used as core of a micro-transformer, which will be designed accordingly and tested. Further, an experimental model of the energy harvesting hybrid system will be elaborated, designed and tested. Finally, a prototype for the harvesting device will be designed and tested.

Project implemented by

- National Institute for R&D in Electrical Engineering ICPE-CA Bucharest (Coordinator)
- Politehnica University of Timisoara (Partner 1)
- Romanian Academy – Timisoara Branch (Partner 2)
- Politehnica University of Bucharest (Partner 3)
- SYSCOM PROCESS CONTROL LTD (Partner 4).

Implementation period

July 1st, 2014 – September 30, 2017

Main activities

The main activities are as follows:
(I) elaboration of the experimental model of the energy harvesting hybrid system by photovoltaic conversion and DC/DC transformation with MEMS integration;
(II) design and testing of the experimental model of the energy harvesting hybrid system by photovoltaic conversion and DC/DC transformation with MEMS integration;
(III) design and testing of the prototype of the energy harvesting hybrid system by photovoltaic conversion and DC/DC transformation with MEMS integration.

The 2016 year research aimed to complete the second activity listed above. Politehnica University team (P1), together with the Romanian Academy – Timisoara Branch team (P2), is responsible for the preparation and characterization (in terms of magnetic, rheological, electrical, thermal and structural properties) of the magnetic fluid used as magnetic fluid core of the power micro-transformer.

Results

The main result of the project will be the integration of an innovative photovoltaic conversion system and an original DC/DC converter, which utilizes a planar, spiral, MEMS, hybrid (magnetic nanofluid/ferrite) cored micro-transformer in an efficient device for energy harvesting. Regarding the use of a magnetic nanofluid core micro-transformer for the DC/DC converter, from the manufacturing point of view, it is expected that once the appropriate magnetic nanofluid characteristics are established, it will offer an easier way of obtaining the transformer core compared to a solid one. From the operating point of view, it is expected that by replacing the solid core with a liquid core will result in a better heat dissipation and reduction of the thermal stresses in the micro-transformer, leading to a longer life-cycle, maintaining or even improving the electric characteristics.
The results obtained in 2016 were disseminated through:

- one patent application: A/00713 /07.10.2016 (OSIM, RO), entitled "Planar transformer with magnetic nanofluid"; Authors: PISLARU – DANESCU L., POPA M., ILIE C.I., CHIHAIA R.A., BABUTANU C.A., NICOLAE S., BUNEA F., STOIAN F.D., HOLOTESCU S., MARINICA O.-M., MOREGA A.-M., MOREGA M., DUMITRU J.B., POPA N.C.; Owners: ICPE-CA Bucharest and UPT.
- a conference paper: Nicolae Calin POPA, Ladislau VEKAS, Nicolae CRAINIC, Floriana Daniela STOIAN, Sorin HOLOTESCU, Structural investigation of magnetic nano-fluids used in gravitational generator, presented at the International Conference on Nanotechnology, Nanomaterials & Thin Films for Energy Applications, Liverpool, UK, 27 – 29 July 2016.

Applicability and transferability of the results

The product can bring added value for further development as an end-product to the industrial partner. Possible applications are characterized by their placement in hard to reach places, isolated and without local and/or conventional sources. Among these are applications for industrial automation, monitoring of various parameters in industry (pressure transducers mounted in the gas distribution networks, device multiparameter probes mounted in drinking water distribution networks and others), in agriculture (humidity and soil temperature sensors), for surveillance and monitoring of perimeters.

Financed through/by

Ministry of National Education through the Executive Agency for Higher Education, Research, Development and Innovation Funding, Partnerships in priority S & T domains Program PN II, Joint Applied Research Projects PCCA 2013.

Research centre

Research Center for Engineering of Systems with Complex Fluids, Politehnica University of Timisoara,
URL: http://mh.mec.upt.ro/ccisfc/

Research team

The research team of Politehnica University of Timisoara is consisting of three senior researchers, one PhD student and two research assistants:

Assoc. Prof. Dr. - Eng. Floriana D. STOIAN – Project responsible for Partner 1,
Lect. Dr.- Eng. Math. Sorin HOLOTESCU,
Phys. Oana MARINICA,
Assoc.Prof. Dr.- Eng. Nicolae CRAINIC,
Res. Assist. Florica BALANEAN,
Res. Assist. George GIULA.

Contact information

Assoc. Prof. Floriana D. STOIAN, PhD
Department of Mechanical Machines, Technology and Transportation / Research Center for Engineering of Systems with Complex Fluids,
1 Mihai Viteazu Bv., Timisoara 300222, Romania
Phone: (+40) 256 403671; Mobile:(+40) 744 597308
E-mail: floriana.stoian@upt.ro, fdstoian@yahoo.com
Project website:
http://www.icpe-ca.ro/lib/files/asemems-harvest.pdf

MITIGATION OF DECELERATED SWIRLING FLOW FROM CONICAL DIFFUSERS USING PULSATING WATER JET

Goal of the project:

The fundamental problem addressed in this project is studying a new control method of decelerated swirling flow. The main goal of this project is to evaluate numerically and experimentally the performance of a new flow control method with pulse water injection. The first goal of the project is to mitigate the low frequency plunging oscillations using axially-injected pulsation jets. The second goal is to minimize the injected discharge during this control. This project attempts to deliver answers to the following questions: Is the pulse water injection a valid control method from experimentally point of view? What is the pulse jet parameters which allow the mitigation/elimination of the VR and the maximum pressure recovery in the cone and what is the optimal jet's discharge value? Are there any technical and economical limits of this method? Which are the advantages (if any) of this method with respect to the previous ones (the jet and hydrodynamic feedback)? Which are the disadvantages (if any) of this method with respect to the previous ones (the jet and hydrodynamic feedback)? An existing test rig from Politehnica University of Timisoara is going to be used for experimental investigation of this method (Fig. 1).

Short description of the project:

The new control method consists in injecting a pulsating axial water jet in order to mitigate the low frequency plunging oscillations. The idea of using pulsating jets is yielded by the measured pressure's low-frequency oscillation in the conical diffusers of hydraulic turbines which are operated at part load. These regimes are imposed by the power network requirements. The fixed blade turbines e.g. Francis type, operating at part load present a high level of swirling flow at the inlet of draft tube. When swirling flow from draft tube is decelerating, it becomes unstable giving rise at helical vortex (or vortex rope). Vortex rope is the main cause for the occurrence of pressure fluctuations in draft tube of hydraulic turbines operating at part load. Mitigating the vortex rope phenomenon is an open problem for modern Francis hydraulic turbines. Numerous techniques have been examined for reducing these effects, with success varying widely. Two types of pressure fluctuations associated with the draft tube surge are identified in the literature. The first is an asynchronous pressure fluctuation due to the precession of the helical vortex around the axis of the draft tube. The second type is synchronous fluctuations who give rise to power fluctuations. Consequently, these low-frequency pressure oscillations will be mitigated using the pulsating axial jet control method.

Project implemented by

Politehnica University Timisoara, Research Center for Engineering of Systems with Complex Fluids

Implementation period:

01.10.2015-30.09.2017

Main activities:

1) Objective I: 3D numerical analysis of swirling flow using pulsating jet injection method,
2) Objective II: Manufacturing and implementing on the rig of Rotating Pulsating Jet Device,
3) Objective III: Experimental campaign for pulsating jet parameters optimization,
4) Objective IV: Validation of experimental vs. numerical data.

Results:

The results for 2016 are presented in the list of papers:
1. C. TANASA, T. CIOCAN, S. MUNTEAN and R. SUSAN-RESIGA, (2016), Numerical Assessment of Decelerated Swirling Flow with Vortex Rope from Conical Diffuser Using Pulsating Water Jet, 19th International Seminar on Hydropower Plants, Vienna, 09-11, November.
2. SUSAN-RESIGA Romeo-Florin, MUNTEAN Sebastian, TĂNASĂ Constantin, BOSIOC Ilie Alin, CIOCAN Tiberiu, POPESCU Constantin, (2016), ECHIPAMENT PENTRU CONTROLUL INSTABILITĂȚILOR CURGERILOR CU VÂRTEJ DIN DIFUZORUL CONIC AL TURBINELOR HIDRAULICE, patent application no. A0038/12.05.216 - in romanian.

Applicability and transferability of the results:

A new control method is promoted in this project which attempt to improve the flow control and mitigate the axial pressure pulsations revealed by previous investigations. The decelerated flow control using pulsating jets is a new idea. This new control method will mitigate the low frequency pressure pulsations. These plunging oscillations are dangerous due to the waves traveling along to hydraulic passage. This project will evaluate numerically and experimentally the performance of a new decelerated flow control method: using pulse water injection. Decelerated flow control is a problem experienced by hydraulic turbines when operating far from their best efficiency point as a request from energy market demands. Operating in such a regime (if even possible) causes severe vibrations, efficiency decrease, material fatigue, breaks blades etc. Implementation of a decelerated flow control system able to eliminate vibrations leads to maintenance and operation costs decrease. The method which will be tested on the experimental test rig will be proposed for using in real power plants from the national company SC Hidroelectrica SA Romania, which is partner in different contracts in the field of hydraulic machinery with our institution.

Financed through/by

Unitatea Executiva pentru Finantarea Invatamantului Superior, a Cercetarii Dezvoltarii si Inovarii UEFISCDI

Research Center

Research Center for Engineering of Systems with Complex Fluids

Research team

1. Tanasa Constantin, Director de Proiect
2. Ciocan Tiberiu, Cercetator Postdoctoral
3. Bosioc Ilie Alin, Cercetator Postdoctoral
4. Popescu Constantin, Student Doctorand
5. Predoiu Ionut-Costinel, Student Doctorand
6. Mos Daniel, Student Masterand
7. Muntean, Sebastian, Cercetator Senior
8. Todiruta Mariana, Cercetator Senior
9. Szakal Raul-Alexandru, Student Masterand

Contact information

Dr. Constantin TANASA, CSIII
Mechanical Engineering Faculty/Hydraulic Machinery Department,
Address: M. Viteazu, No. 1, Timisoara
Phone: (+40) 256403692
E-mail: constantin.tanasa@upt.ro
Web: http://mh.mec.upt.ro/RPJD-DJPR/#/login

IONOSPHERIC PROPAGATION PREDICTIONS AND WIDEBAND COMMUNICATIONS USING HF SDR SENSORS FOR INFORMATIONAL SUPPORT IN EMERGENCY SITUATIONS IN ROMANIA

Goal of the project

The project aims to implement software and hardware solutions that integrate ionospheric sounding algorithms in a network of SDR (Software Defined Radio) sensors in order to develop and validate a HF (High Frequency) ionospheric prediction model for the territory of Romania

Short description of the project

The project targets a systemic approach of the communication network through the
implementation, development and integration of recent technological solutions from the
perspective of providing information support for the management of interventions in disaster areas, where communication infrastructure does not exist or is damaged. Project results can be applied not only to the rapid resolution of remote communications in emergency situations, but also can be extended to other applications in the HF communications range, such as encrypted data communication links for the government or the military

Project implemented by:

- Land Forces Academy "Nicolae Bălcescu", Sibiu - coordinator
- Interactive Systems & Business Consulting, Bucharest - partner
- Politehnica University Timişoara - partner
- Technical University of Cluj-Napoca - partner

Implementation period

21.11.2014 - 30.06.2016

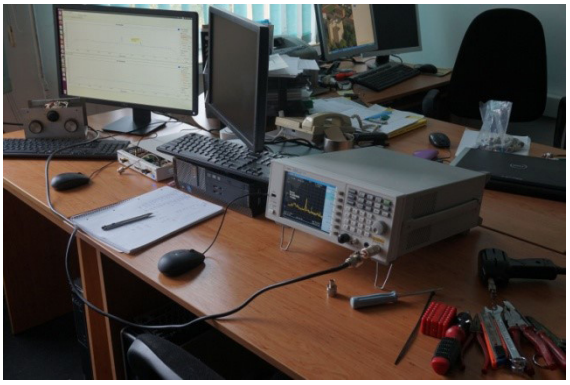
Main activities

- Building a SDR sensor network for ionospheric sounding
- Elaboration of an application for HF propagation predictions in Romania.
- Development of broadband HF communications by the implementation of adaptive systems

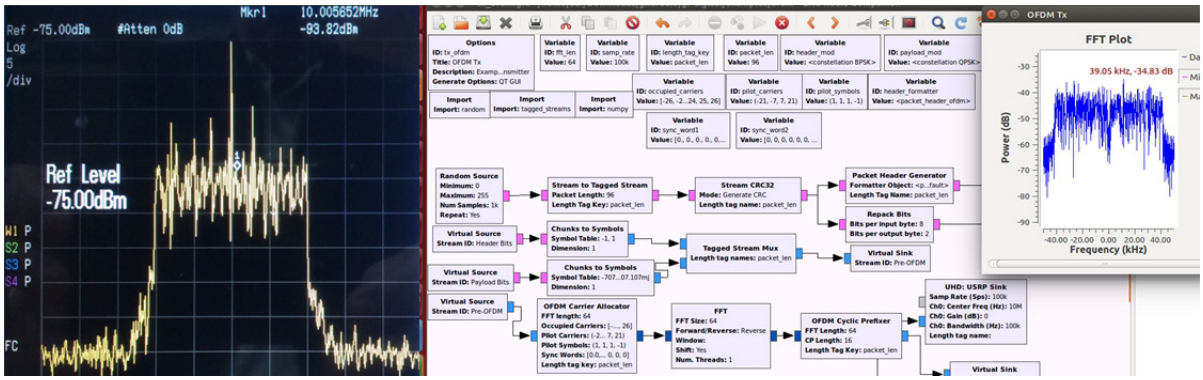
Results

The main deliverables of the project are:

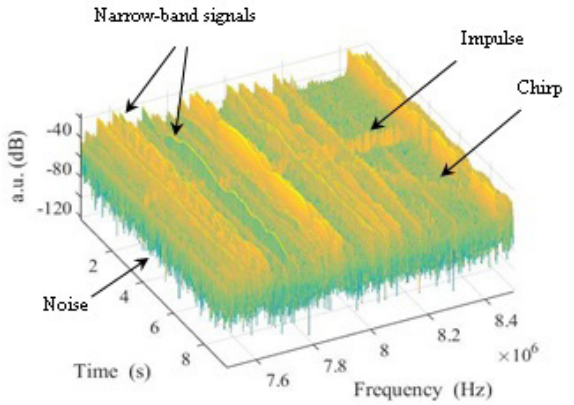
- an ionospheric model which is specific for Eastern Europe;
- algorithms for the automatic identification and classification of waveforms in order to increase the transfer rate and to implement techniques for dynamically accessing the HF resources;
- SDR solutions for local monitoring and collaborative spectrum sensing in the HF range;
- a HF radio network on the territory of Romania which allows high transfer rates in collaborative environments, by automatically adapting to specific conditions of ionospheric propagation at high angles of elevation.



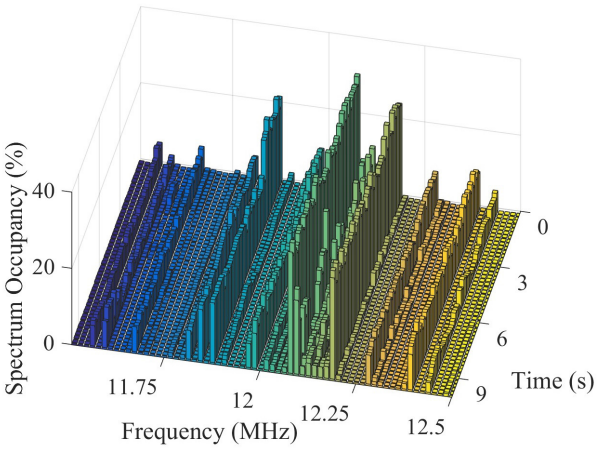
Equipment



Generation of an OFDM signal



Time-frequency representation of an acquisitioned signal



Spectrum occupancy.

Applicability and transferability of the results

- creating an integrated software application for HF propagation predictions adapted to the propagation particularities of our country
- developing localization algorithms used in OTH (Over-The-Horizon) radar systems
- establishing a tracking system in the HF range using SSL (Single Site Location) technology
- implementing the ionospheric measurement capability for HF radio stations with SDR architecture
- implementing algorithms for the adaptation of broadband waveforms to the ionospheric channel status
- developing a HF radio tranceiver with cognitive capabilities
- implementing an integrated system for monitoring the ionosphere

Financed through/by

PN-II-PT-PCCA-2013-4

Research team

Prof. dr. eng. Aldo De Sabata
Assoc. prof. dr. eng. Septimiu Mischie
Assist. lect. dr. eng. Cornel Balint
Assist. lect. dr. eng. Ciprian Dughir
Assist. lect. dr. eng. Cora Iftode

Contact information

Prof. Aldo DE SABATA, PhD
Faculty of Electronics and Telecommunications / Department of Measurement and Optical Electronics Address: Bd. V. Parvan nr. 2, 300223 Timisoara
Phone: (+40) 256 403 370
Mobile:
E-mail: aldo.de-sabata@upt.ro

MICRO-MECHANICAL MODELLING OF CELLULAR MATERIALS WITH REFINEMENTS ON FRACTURE AND DAMAGE

Goal of the project

Cellular materials are widely used as cores in sandwich composites, for packing and cushioning. The main characteristics of foams are light weight, high porosity, high crushability and good energy absorption capacity. Present project propose to develop micro-mechanical models in order to predict the mechanical properties of cellular materials with a focus on modeling the fracture and the influence of damage on the mechanical response.

Short description of the project

Project combines analytical, numerical and experimental methods for describing mechanical behavior of cellular materials.

Project implemented by:

Universitatea Politehnica Timisoara

Implementation period

05.10.2011 – 30.11. 2016

Main activities

- Better understanding of mechanical behavior of cellular materials.
- Develop micro-mechanical models to estimate mechanical properties of cellular materials.
- Implementation of constitutive material models in Finite Element Analysis.
- Investigating the size effect and notch effect on cellular materials Evaluating the behavior of cellular materials under dynamic (impact and fatigue) loading.
- Identification of damage mechanisms in cellular materials using Digital Image Correlation and Thermography.
- Investigating the effect of microstructural damage on the mechanical properties of cellular materials.
- Applixations of cellular structures in sandwich structures and sport industry.

Results

Dissemination of results in ISI journals

1. L. Marsavina, E. Linul, T. Voiconi, T. Sadowski, A comparison between dynamic and static fracture toughness of polyurethane foams, POLYMER TESTING, 32, 673-680, 2013 (IF 2.35)

2. L. Marsavina, D.M. Constantinescu, E. Linul, D.A. Apostol, T. Voiconi, T. Sadowski, Refinements on fracture toughness of PUR foams, ENGINEERING FRACTURE MECHANICS, 129, 54-66, 2014 (IF 2.024)

3. E. Linul, L. Marsavina, Assessment of sandwich beams with polymeric foam core using failure-mode maps, PROCEEDINGS OF ROMANIAN ACADEMY A, Vol. 16(4), p. 522-530, 2015 (IF 1.735)

4. Serban D., Linul E., Marsavina L., Modler N., Numerical evaluation of two-dimensional micromechanical structures of anisotropic cellular materials: case study for polyurethane rigid foams, IRANIAN POLYMER JOURNAL, Vol. 24 (6), p. 515-529, 2015 (IF 1.684)

5. Marsavina L., Constantinescu D. M., Linul E., Voiconi T., Apostol D., Shear and mode II fracture of PUR foams, ENGINEERING FAILURE ANALYSIS, Vol. 58 (Part 2), p. 465-476, 2015 (IF 1.358)

6. Negru R., Marsavina L., Voiconi T., Linul E., Filipescu H., Belgiu G., Application of TCD for brittle fracture of notched PUR materials, THEORETICAL AND APPLIED FRACTURE MECHANICS, Vol. 80 (Part A), p. 87-95, 2015 (IF 2.025)

7. Serban D., Marsavina L., Modler N., Low-cycle fatigue behaviour of polyamides, FATIGUE & FRACTURE OF ENGINEERING MATERIALS & STRUCTURES, Vol. 38 (11), p. 1383-1394, 2015 (IF 1.838)

8. Marsavina L., Kovacik J., Linul E., Experimental validation of micromechanical models for brittle aluminium alloy foam, THEORETICAL AND APPLIED FRACTURE MECHANICS, Vol. 83, p. 11-18, 2016 (IF 2.025)

9. Serban D., Voiconi T., Linul E., Marsavina L., Modler N., Viscoelastic Properties of PUR Foams Impact excitation and dynamic mechanical analysis, MATERIALE PLASTICE, 52 (4), p. 537-541, 2015. (IF 0.903)

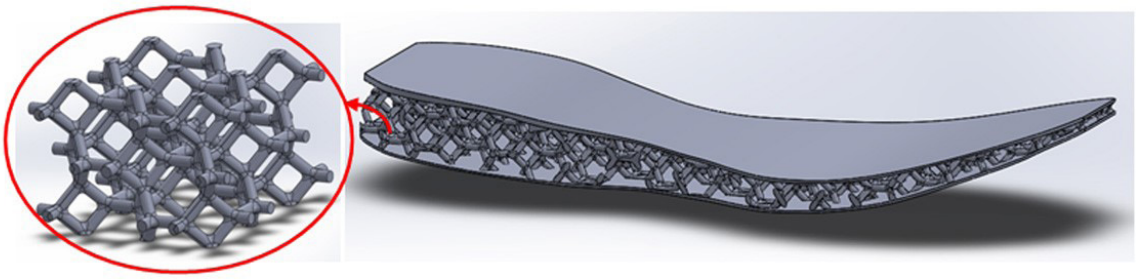
10. Serban D., Weissenborn O, Geller S., Marsavina L., Gude M., Evaluation of the mechanical and morphological properties of long fibre reinforced polyurethane rigid foams, POLYMER TESTING, 49, 121-127, 2016 (IF 2.35)

11. Marsavina L., Constantinescu D.M., Linul E., Apostol D.A., Voiconi T., Experimental and numerical crack paths in PUR foams, ENGINEERING FRACTURE MECHANICS, 167, p. 68-83, 2016, (IF 2.024)

12. Linul E., Marsavina L., Kovacik J., Sadowski T., Dynamic and Quasi-Static compression tests of closed-cell aluminium alloy foams, PROCEEDINGS OF ROMANIAN ACADEMY A, Accepted manuscript, 2016. (IF 1.735)

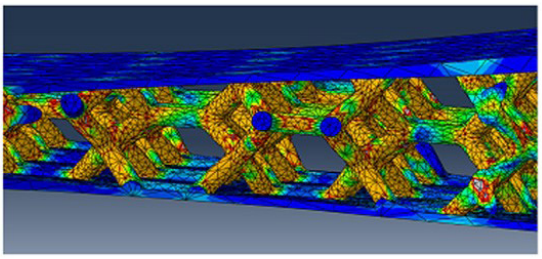
13. Apostol D., Stuparu F., Constantinescu D. M., Marsavina L., Linul E., Crack length influence on stress intensity factors for the asymmetric four-point bending testing of a polyurethane foam, MATERIALE PLASTICE, 53 (2), p. 280-282, 2016. (IF 0.903)

14. Linul E., Serban D., Marsavina L., Kovacik J., Low-cycle fatigue behaviour of ductile closed-cell aluminium alloy foams, FATIGUE & FRACTURE OF ENGINEERING MATERIALS & STRUCTURES, On Line accepted Manuscript, 2016, doi: 10.1111/ffe.12535 (IF 1.838).

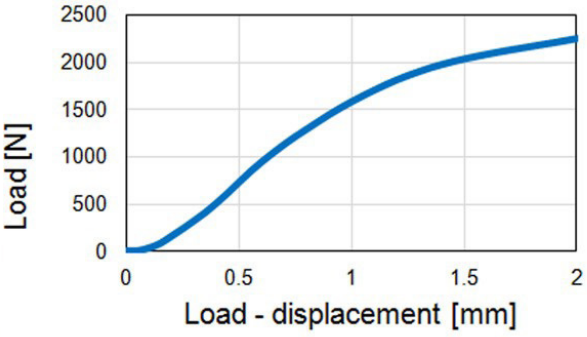


cellular structure

sole with cellular core



displacement results



load - displacement response of sole

Results on mechanical behavior of sole with cellular structure core

Applicability and transferability of the results

Results will be transfered to foams manufacturers to improve their manufacturing process. Also, companies using foam componets and cellular structures (shoes industry) will benefit by our developed micro-mechanical models to characterise their componens and in the product design.

Financed through/by

Grant PN-II-ID-PCE-2011-3-0456, Contract Nr. 172/2011, by Romanian Ministry of National Education, through UEFISCDI

Research Center

ICER

Research team

Prof. Dr. Eng. Liviu Marsavina – Project Manager
Prof. Dr. Eng. Dan M. Constantinescu – Senior Researcher
Dr. Eng. Emanoil Linul – Postdoctoral Researcher
Dr. Eng. Dragos A. Apostol – Postdoctoral Researcher
Dr. Eng. Dan A. Serban – Postdoctoral Researcher
Dr. Eng. Florin Stuparu – PhD student

Contact information

Prof. Liviu MARSAVINA, PhD
Faculty Mechanical Engineering
Department Mechanics and Strength of Materials
Address: Blvd. M. Viteazu, No. 1, 300222 Timisoara
Phone: (+40) 256 403 577
Mobile:(+40) 726 397 635
E-mail: liviu.marsavina@upt.ro
Web: http://www.marsavina.ro/index_MMMCM.html

HIGH PERFORMANCE LIGHTWEIGHT PANELS WITH A NEW OPTIMIZED DESIGN FOR ADVANCED AIRCRAFT STRUCTURES

Goal of the project

The goal of the project is the design, fabrication and testing of the new flat and curved aircraft panels having better characteristics, as follows:

- fabrication of the experimental models for both plane and curved sandwich panels;
- 3D modeling for linear and nonlinear analysis in order to characterize the new sandwich panels;
- static testing of the experimental new models.

Short description of the project

Design of aircraft panels, made of metal and composite material, flat and curved, with improved performances.

Project implemented by:

- University Politehnica Bucuresti - Coordinator
- Straero S.A - Partner 1
- University Politehnica Timisoara - Partner 2
- INAS S.A. - Partner 3
- SMART Mechanics S.R.L. - Partner 4

Implementation period

02.07.2012 - 30.10.2016

Main activities

1. Bending static tests on two type of specimens cut out from flat sandwich panels: PSP 1 (figure 1) with a compact core and PSP 2 (figure 2) with the core having circular holes;
2. Bending static tests on MEC 2 (figure 3) curved sandwich panels;
3. Stability tests on MEC 2 curved panels;
4. Numerical simulation of the mechanical behavior of tested sandwich structures;
5. Dissemination of the results.

All the specimens were made using polyurethane foam cores with density 300 kg/m^3, aluminum alloy 1050 H24 for faces, and adhesive AW 106/HV 953U.

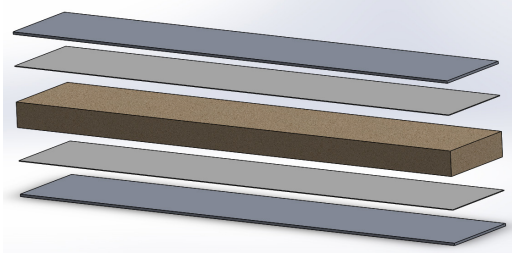


Fig. 1. PSP 1 panel

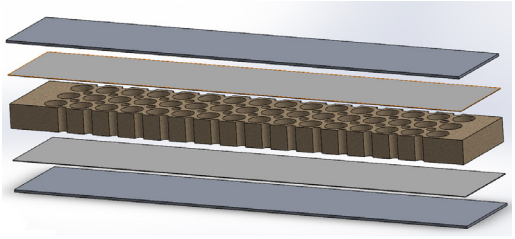


Fig. 2. PSP 2 panel

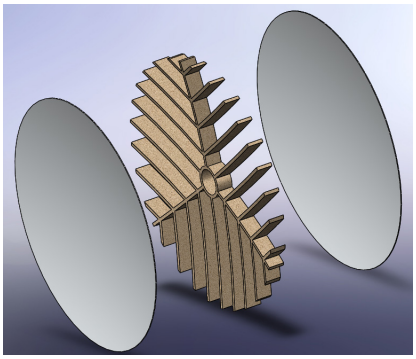


Fig. 3. MEC 2 panel

Results

1. Determination of strength and stiffness of the investigated sandwich structures;
2. Identification of the failure modes of the sandwich structures loaded in bending (figure 4);
3. Characterization of the mechanical behavior of the sandwich structures using the digital image correlation technique;
4. Numerical simulation of the mechanical response for tested sandwich structures.

The main publications are:

1. Negru R., Marsavina L., Hluscu M. (2016) Experimental and numerical investigations on adhesively bonded joints, IOP Conf. Series: Materials Science and Engineering, vol. 123 012012 (3rd International Conference on Competitive Materials and Technology Processes IC-CMTP3, Miskolc-Lillafüred, Hungary, October 6-10, 2014);

Fig. 4a. face indentation (PSP 1)

Fig. 4b. face yield (PSP 1)

Fig. 4c. core fracture (PSP 2)

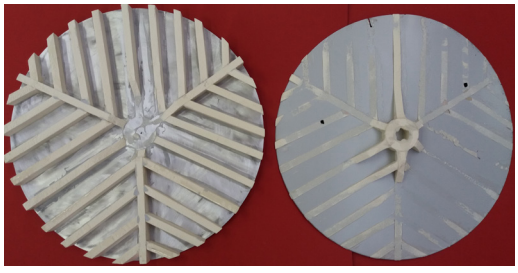


Fig. 4d. core shear (MEC 2)

2. Şerban D., Linul E., Sărăndan S., Marsavina L. (2016) Development of parametric Kelvin structures with closed cells, Solid State Phenomena, vol. 254 pp 49-54, Trans Tech Publications, Switzerland (AMS'15 Advanced Materials and Structures, Timişoara, România, October 16-17, 2015);
3. Negru R., Şerban D., Marsavina L., Magda A. (2016) Lifetime prediction in medium-cycle fatigue regime of notched specimens, Theoretical and Applied Fracture Mechanics 84, 140-148.

Applicability and transferability of the results

Results and design solutions will be transferred to sandwich structure manufacturers to improve their technologies. In addition, companies involved on design of aircraft will benefit by our developed sandwich structures and hybrid assembly solutions.

Financed through/by

PN-II-PT-PCCA-2011-3.2-0068 CONTRACT 206/2012, EXECUTIVE AGENCY FOR HIGHER EDUCATION, RESEARCH, DEVELOPMENT and INNOVATION FUNDING (UEFISCDI)

Research Center

"Şt. Nădăşan" Research Laboratory for Strength, Integrity and Durability of materials, structures and conductors,
http://erris.gov.ro/St-Nadasan-Research-Laborato

Research Team for Partner 2

Prof. Dr. Eng. Liviu Marsavina
Prof. Dr. Eng. Nicolae Faur
Dr. Eng. Radu Negru
Dr. Eng. Dan Andrei Şerban
Dr. Eng. Anghel Cernescu
Dr. Eng. Mihai Hluşcu

Contact information

Prof. Liviu MARSAVINA, PhD
Faculty Mechanical Engineering
Department of Mechanics and Strength of Materials
Address: Blvd. M. Viteazu, No. 1, 300222 Timişoara
Phone: (+40) 256 403 577
Mobile:(+40) 726 397 635
E-mail: liviu.marsavina@upt.ro
Web: http://www.marsavina.ro

CENTRALIZING AND OPTIMIZING SCADA IN THE WATER SECTOR (CASCADA)

Goal of the project

The knowledge transfer to Aquatim through software and hardware modules and strategies for centralizing and optimizing SCADA for the water sector.

Short description of the project

The general purpose of CASCADA is the knowledge transfer to the economic operator through software and hardware modules and strategies to solve stated problems in centralizing and optimizing SCADA for the water sector. The project proposes the ICOM module (Interface, Conversion, Optimization, Modularity) as instrument in solving both interfacing and protocol conversion problems and the development of non-invasive optimization modules of controlling groups of objectives already in function in the water sector. Also, in order to improve effectiveness, the project addresses the IGSS SCADA implementation strategy in Aquatim control center and the existing communication system. CASCADA wants to train Aquatim in SCADA/automation/communications new technologies and to practically apply the concepts in a SCADA analysis of three existing objectives of the operator.

Project implemented by

University Politehnica Timisoara

Implementation period

30.09.2016-30.09.2018

Main activities:

The activities are foreseen to implement the following three objectives:
1) Realizing and testing the ICOM module;
2) Optimizing the IGSS control center;
3) Direct knowledge transfer in new technologies.

Results

CASCADA, through the ICOM module will solve the SCADA integrability problems of the economic operator, respectively will provide an instrument, independent of local equipment and SCADA solutions, to answer integrability and functioning optimization issues for groups of interdependent objects as technological flow but independent regarding their implementations. Therefore, due to SCADA correlations of groups of objects (integrations on higher SCADA levels and creating control algorithms for group of objects), the economic operator's systems will be more stable and efficient, respectively the impact of the incidents will be reduced.
Optimizing the IGSS control center will provide the possibility to maximally use the resources available through licensing, an increased communication speed through systematizing the internal Aquatim network, respectively an adequate web based access conferred by the WebNavIGSS module.
CASCADA will impact also the quality of the future investments of the economic operator through opening perspectives to new technologies and optimal solutions, with increased efficiency and reduced costs.
The implemented activities will strengthen the entrepreneurial abilities of researchers and the connection between the academic environment and the industry requirements.

Applicability and transferability of the results

As a bridge grant, the project is strongly industry oriented, with significant practical value and focused on the knowledge transfer to an economic operator.

Financed through/by

UEFISCDI

Research Centre

ICER – Renewable energy research institute

Research team

Adrian Ștefan KORODI
Ioan SILEA
Octavian ȘTEFAN
Ruben Dan CRIȘAN
Teodor HUPLE
Alexandra-Ionela BASSO-ȚIDREA
Mihaiță-Alin RADU
Mihaela Marcella CRIȘAN-VIDA
Oana-Sorina CHIRILA

Contact information

S.L. Adrian Stefan KORODI, PhD
Faculty of Automation and Computers,
Department of Automation and Applied Informatics
Address: Str. V. Parvan, No. 2, 300223, Timisoara
E-mail: adrian.korodi@upt.ro

MESSAGE PASSING ITERATIVE DECODERS BASED ON IMPRECISE ARITHMETIC FOR MULTI-OBJECTIVE POWER-AREA-DELAY OPTIMIZATION

Goal of the project

The DIAMOND project proposes to exploit the robustness of modern decoders to arithmetic inaccuracies, for improving their latency and power consumption. The project focuses on Low-Density Parity-Check (LDPC) codes widely used in modern communication systems, and targets the design of message-passing iterative decoders using imprecise arithmetic units. We aim at harnessing the inaccuracies produced by imprecise computational units, while benefiting of their significant reductions in area, latency and power consumption.

Short description of the project

The project investigates the possibility of optimizing LDPC decoding architectures by employing imprecise and approximate techniques at different levels: message representation, processing unit and architecture.

Project implemented by

- Universitatea Politehnica Timisoara (UPT) – Romanian partner
- CEA-LETI, Grenoble – French coordinator partner
- ETIS Laboratory – French partner

Implementation period

March 2014 – March 2017

Main activities:

DIAMOND project have analyzed the impact of the introducing impreciseness and approximations in LDPC decoding architecture on the decoding performance, cost and throughput. The main activities involved:

1. Development of LDPC decoding techniques using imprecise message representation
2. Analysis and development of imprecise processing units
3. Development of imprecise stopping criteria for layered decoding
4. Development of proof-of-concept decoders using the imprecise techniques at different levels.

Results

The main results of the DIAMOND project include:

1. Imprecise message representation techniques – these include the development of the modified offset min-sum (MOMS) LDPC decoding, as well as the non-subjective finite alphabet iterative decoding of LDPC codes.
2. Imprecise processing units – the main developments have consisted in a novel check node unit using one-hot representation of messages, and a novel version of self-correcting min-sum (SCMS), that allows the implementation of this SCMS based LDPC decoder with a similar cost as the Min-Sum based ones.
3. Imprecise early termination criteria for layered LDPC decoders

In order to provide a wide range of proof-of-concept decoding architectures, for which a wide range of architecture and code parameters can be analyzed, an integrated environment for the architecture generation, verification and implementation – TEDI – has been developed.

Applicability and transferability of the results

The DIAMOND project aims at optimizing LDPC decoding architectures used for forward error correction in both wireless communications and data storage. Several steps for economic and industrial results dissemination have been undertaken. On one hand, a simplified version of the LDPC decoding architecture generator has been made publicly available on the webpage dbyaclick.cs.upt.ro . On the other hand, the proposed stopping criteria for layered LDPC decoding architectures has been considered for a joint patent application between the project partners.

Financed through/by

UEFISCDI – Romanian funding agency
ANR – French funding agency
Romanian project number: PN-II-ID-JRP-RO-FR-2012-0109

Research Centre

Research Centre in Computing and Information Technology – CCCTI

Research team

Dr. Oana Boncalo – Principal Investigator
Dr. Petru Mihancea
Ioana Mot
Gyorgy Kolumban Antal
Petra Csereoka

Contact information

Oana Boncalo, PhD
Department of Computer and Information Technology
Address: Vasile Parvan Blvd., Nr. 2, 300223, Timisoara
Phone: (+40) 256 403264
E-mail: oana.boncalo@cs.upt.ro
Web: http://staff.cs.upt.ro/~boncalo/diamond/contact.html

DIVIDEND - DISTRIBUTED HETEROGENEOUS VERTICALLY INTEGRATED ENERGY EFFICIENT DATA CENTRES

Goal of the project

DIVIDEND aims to optimize heterogeneous data centers, combining CPUs, GPUs, and task-specific accelerators, as a unified entity to the application developer and let the runtime optimize the utilization of the system resources during task execution. DIVIDEND embraces heterogeneity to dramatically lower the energy per task through extensive hardware specialization while maintaining the ease of programmability of a homogeneous architecture.

Short description of the project

DIVIDEND provides cross layer energy monitoring and management in data centers that use heteregenous CPU, GPU and FPGA based processing. We aim to provide energy optimization using a vertical based integration from different abstraction layers: hardware, operating system, compiler and application.

Project implemented by

- University of Edinburgh – Coordinator
- University of Lancaster
- Queens University of Belfast
- Ecole Polytechnique Federale de Lausanne
- Universitatea Politehnica Timisoara
- INRIA Paris,
- Advanced Micro Devices, Paris

Implementation period

May 2015 – May 2017

Main activities:

The main activities performed in UPT are related to the development and integration of energy monitoring of dedicated FPGA accelerators into the Distributed Heterogeneous System Architecture (DHSA) concept. The UPT research represents the first approach to use the FPGA accelerators in hybrid architecture with full access to the system shared memory, as well as complete queuing support for DHSA. We aim at providing efficient acceleration for irregular parallel application using the proposed approach.

Results

The DIVIDEND project has provided a complete integration of FPGA based application accelerators into the DHSA systems, by offering the required hardware, as well as driver and operation system level support. Furthermore, energy accounting for dedicated FPGA hardware accelerators for distributed applications is offered. Therefore, an energy aware FPGA acceleration in distributed HSA based heterogeneous CPU-GPU-FPGA systems has been developed.

Applicability and transferability of the results

The DIVIDEND project developed the first approach that provides an energy cost for an application that has been executed in the distributed data center, composed of a heterogeneous computation platform consisting of CPUs, GPUs, or FPGAs. Therefore, for each user which runs applications on a data-center, a cost for the execution of each task can be offered. Therefore, the DIVIDEND project offers an energy aware application execution framework on distributed data-centers.

Financed through/by

CHIST-ERA NR 5/2015

Research Centre

Research Centre in Computing and Information Technology – CCCTI

Research team

Dr. Alexandru Amaricai – Principal Investigator
Prof. Marius Marcu
Dr. Sebastian Fuicu
Dr. Cosmin Cernazan
Dr. Sergiu Nimara
Gyorgy Kolumban Antal

Contact information

Alexandru Amaricai, PhD
Department of Computer and Information Technology
Address: Vasile Parvan Blvd., Nr. 2, 300223, Timisoara
Phone: (+40) 256 403272
E-mail: alexandru.amaricai@cs.upt.ro

NEW APPROACH OF USING IONIC LIQUIDS (ILS) AS GREEN EXTRACTANTS IN THE ADSORPTION PROCESS OF RADIONUCLIDES FROM WASTE AQUEOUS SOLUTIONS

Goal of the project:

The overall goal of the proposed project is to investigate a new approach of using the room temperature ionic liquid (RT IL) as extractants impregnated onto various solid supports in the adsorption process of radionuclides from waste aqueous solutions. The project has an interdisciplinary character presenting an integrated concept of waters depollution with radionuclides content

Short description of the project

Various ionic liquid impregnated materials are obtained and after a complex characterization they are used in the adsorption process of different radionuclides from synthetic and real aqueous solutions.

Project implemented by

Faculty of Industrial Chemistry and Environmental Engineering

Implementation period

01.05.2013 - 30.09.2016

Main activities

1. Impregnation of various ILs onto various solid supports using various methods of impregnation (2013);
2. Characterization of the obtained ionic liquid impregnated materials (2013);
3. Removal of various radionuclides from aqueous solutions through adsorption onto obtained ionic liquids impregnated materials: batch studies - equilibrium, kinetic and thermodynamic studies. (2013, 2014);
4. Removal of various radionuclides from aqueous solutions through adsorption onto obtained ionic liquids impregnated materials: Column studies (2015);
5. he influence of competitive cations (eg. Na, K and Be) and the concomitant extraction of various radionuclides (2015, 2016);
6. Desorption of the radionuclides and recycle of ionic liquid impregnated material. Use of various cycle adsorption- desorption (2015; 2016)

Applicability and transferability of the results

The project topic is answering a well-defined problem/question with practical relevance – in the waters depollution with radionuclides content, opening and establishing the new science based on both adsorption technology and ionic liquids. The results may also be transferred to the students as part of their training in the field of water and waste water treatment, adsorption process and obtaining of new functionalized materials field.

Results

The use of ionic liquid impregnated materials as adsorbents in the removal process of radionuclides from aqueous solutions presented very good performance in the removal process of radionuclides from waste aqueous solutions because the adsorbent properties of the solid supports and the advantageous properties of ILs were combined. All results were validated by publication in scientific journals and presentation at scientific conferences: 6 articles published in ISI indexed journals, 5 articles published in BDI indexed journals, and 19 articles presented at international conferences, one patent application.

Financed through/by

UEFISCDI/Human Resources - Research projects to stimulate the establishment of young independent research - TE

Research Centre

Research Institute for Renewable Energy

Research team

Lecturer Lavinia Lupa, PhD
Prof. Petru Negrea, PhD
Assoc. Prof. Adina Negrea, PhD
Scientific Researcher Mihaela Ciopec, PhD
Lecturer Raluca Vodă, PhD
Eng. Alexandra Bogin

Contact information

Lecturer Lavinia LUPA, PhD
Department of Applied Chemistry and Inorganic Compounds and Environmental Engineering
Address: Bd. Vasile Pârvan, No. 6, RO 300223, Timisoara
Phone: (+40) 256 404 192
Fax (+40) 256 403 060
E-mail: lavinia.lupa@upt.ro
Web:http://www.chim.upt.ro/Facultatea-de-Chimie-Industriala-si-Ingineria-Mediului_PN-II-RU-TE-2012-3-0198_2XW.html

ECO-EFFICIENT RECOVERY OF WASTES FROM HOT DIP GALVANIZING PROCESS AS ANIONIC CLAYS APPLICABLE FOR REMOVAL OF UNDESIRABLE COMPOUNDS FROM WATER

Goal of the project

The main objective of the project is the synthesis of anionic clays (layered double hydroxides) from wastes of hot dip galvanizing process (zinc ash and sludge from wastewater treatment) and the utilization of these materials in removal processes (adsorption or photocatalysis) of undesirable compounds from water (i.e. phenols, dyes, chromate). Another objective is to gain significant research experience for the project team.

Short description of the project

By treatment of industrial wastes some layered double hydroxides (LDH) will be prepared. The correlation between the chemical characteristics of precursors of LDH obtained from wastes and the performances of LDHs in removal processes of undesirable compounds from water will be clarified.

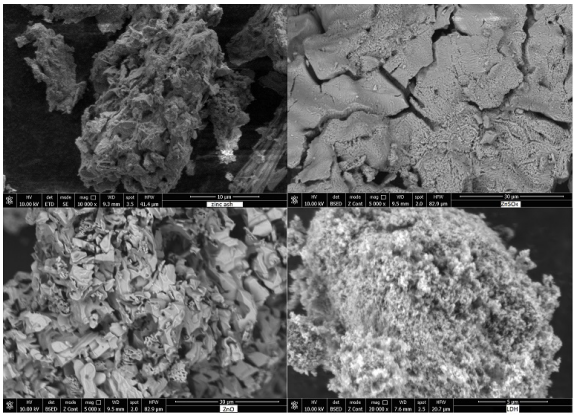


Figure 1. SEM images of zinc ash and product obtained after zinc ash treatment ($ZnSO_4$, ZnO and LDH)

Project implemented by

Faculty of Industrial Chemistry and Environmental Engineering

Implementation period

01.10.2015 – 30.09.2017

Main activities:

1. The influence of the working parameters of wastes treatment process on the chemical characteristic of the obtained metal solutions;
2. The influence of the chemical characteristics of solution precursors on the morphological and surface properties of the synthesized LDH;
3. The performances of the synthesized LDH in the sorption and photocatalytic processes for removal of undesirable compounds from water.

Results

1. Method for valuable metal recovery from wastes of hot dip galvanizing process.
2. New method for anionic clay synthesis from metal ions recovered from wastes of hot dip galvanizing process.
3. Method for removal of undesirable compounds from water by anionic clays synthesized from wastes of a "dirty industry".

Applicability and transferability of the results

By applying this approach, the wastes of a "dirty industry" (hot dip galvanizing process) are treated and a valuable product is added, keeping in mind that the anionic clays have multiple utilizations at industrial scale as plastic additives, as flame retardant and as anions scavengers. The project has an interdisciplinary character presenting an integrated concept of industrial wastes treatment and waters depollution.

Financed through/by

Romanian National Authority for Scientific Research and Innovation, CNCS - UEFISCDI

Research Centre

Research Institute for Renewable Energy

Research team

Assist.Prof. Laura Cocheci, PhD
Lecturer Lavinia Lupa, PhD
Lecturer Marius Gheju, PhD
Eng. Delia Andrada Duca, PhD student
Eng. Alin Golban, PhD student

Contact information

Assist.Prof. Laura COCHECI, PhD
Faculty of Industrial Chemistry and Environmental Engineering/ Department of Applied Chemistry and Engineering of Inorganic Compounds and Environment
Address: Vasile Parvan Bl., No. 6, 300223, Timişoara
Phone: (+40) 256 403069
E-mail: laura.cocheci@upt.ro
Web: https://sites.google.com/site/pniirute20140771/

SYNERGIC GREEN TECHNOLOGIES FOR TREATMENT OF HEXAVALENT CHROMIUM POLLUTED WATERS

Goal of the project

The first major objective of this project will be to study the influence of co-presence of sand, MnO_2 and sand coated with manganese oxides on Cr(VI) efficiency of removal with metallic iron. The second major objective of this project is to study the immobilization of exhausted reactive mixtures containing Fe, Cr, sand and MnO_2 in vitreous matrices. The Cr, Fe and Mn immobilization in the glass matrix will be analyzed in order to convert the resulting glasses into marketable glazes or bulk glass products.

Short description of the project

The proposed theme is integrated in the thematic area of water and wastewater treatment, with the aim of water reuse, waste recovery and protection of environment quality.

Project implemented by

University Politehnica Timisoara

Implementation period

01.10.2015-30.09.2017

Main activities:

1. Batch treatability experiments. Will be performed using a Berzelius flask containing Cr(VI) solution. Determined amounts of reactive materials are added to the solution and flask contents will be mixed continuously. Aliquots will be periodically extracted and analyzed.
2. Continuous long term column treatability experiments. Will be performed using an experimental setup comprising: columns with reactive material filling; peristaltic pump used to pass the Cr(VI) aqueous solution through the column; storage tank for the Cr(VI) solution. The Cr(VI) solution will be passed through the column packed with reactive material filling. Column effluent samples will be withdrawn at regular time intervals and analyzed.
3. Experiments regarding the synthesis of glasses from wastes. The exhausted reactive materials will be mixed with glass powders and borax and then melted in an electric furnace. In order to obtain bulk glass products the melt is press-quenched between two stainless steel blocks and annealed to remove stress. The granular frits are obtained after pouring the melts in cold water. The glaze slurry is prepared using the obtained frits (95%) and kaolin (5%) as suspension material. The terracotta plates glazed by immersion are dried and then fired at 980°C for 30 min. For the porous glass synthesis a foaming agent (SiC) was added together with the waste glass powder and the exhausted reactive mixtures. The raw materials are mixed together and then uniaxial pressed into cylindrical samples. The samples, dried at 80°C for 12 hours are treated at 900°C for 10 minutes.

Results

The assessment of sand co-presence on Cr(VI) removal with metallic iron.
The assessment of MnO_2 co-presence on Cr(VI) removal with metallic iron.
The assessment of MnO_2 and sand mixtures co-presence on Cr(VI) removal with metallic iron
The immobilization of exhausted reactive mixtures containing sand, Fe and Cr in vitreous matrices.

Applicability and transferability of the results

Treatment of waters polluted with Cr(VI).
Conversion of wastes into marketable glazes or bulk glass products

Financed through/by

Project PNII-RU-TE-2014-4-0508 No. 129/1/10/2015, Synergic green technologies for treatment of hexavalent chromium polluted waters. Total funding: 550000 RON

Research Centre

ICER

Research team

Gheju Marius Traian – Project manager
Balcu Ionel – Postdoctoral researcher
Moșoarcă Giannin Emanuel – Postdoctoral researcher
Vancea Cosmin Nicolae – Postdoctoral researcher
Bălăşoiu-Flueraş Adriana Maria – PhD student
Enache Andreea – PhD student

Contact information

Lecturer Marius GHEJU, PhD
Faculty of Industrial Chemistry and Environmental Engineering/ Department CAICAM
Address: Bd. Vasile Pârvan, nr. 6, 300223 Timişoara, România
Phone: (+40) 256 404185
E-mail: marius.gheju@upt.ro

EXPERIMENTAL MODEL FOR AN AUTOMATIC CAPACITIVE COMPENSATOR DESIGNED FOR IMPROVING THE POWER FACTOR AND FOR LOAD BALANCING IN LOW-VOLTAGE ELECTRICITY DISTRIBUTION NETWORKS - CAEREDJT

Goal of the project

The project is intended to finance industrial research activities, needed to put in practice under the form of an experimental model of research findings of a group of academics from UPT, concerning the network load balancing electric phase through cross unbalanced capacitive compensation. In electrical networks, inductive load variation implies variation of the capacitive compensation, thus the need for building an unbalanced capacitive automatic compensator, to track the load variation.

Short description of the project

The automatically unbalanced capacitive compensator proposed by this project is an innovative product, so achieving a functional experimental model involves overcoming a number of scientific and technical challenges, the most important being: control and single-phase switching of the capacitor batteries steps, the construction algorithm and implementation of a programming language for PLC process control, process optimization for automatic compensation.

Project implemented by

- Politehnica University of Timisoara– Lead partner
- S.C. ICPE S.A. Bucharest – Project partner

Implementation period

01.07.2014 - 30.09.2017

Main activities

1. Conducting studies and analysis on the alternative constructive solutions and developing the technical documentation for the construction of the experimental model.
2. Manufacturing of the experimental model and the analysis, control and monitoring systems.
3. Testing the model and proving its functionality and its utility
4. Dissemination of results and protect the intellectual property rights.

Financed through/by

Executive Unit for Financing Higher Education, Research, Development and Innovation - UEFISCDI

Applicability and transferability of the results

The results of the project are useful for unbalanced electrical loads supplied at low voltage level, and also for the Distribution system operator (DSO).

Results

- The main outcome of the project will be a functional experimental model and its documentation of implementation for a capacitive compensator designed to improve power factor and load balancing in networks of low voltage power distribution.
- It will underpin the design and construction in a later stage, of a prototype of a capacitive automatically balance high power compensator (tens of kVA) for increasing network performance of low-voltage power distribution and utilization facilities connected to it, by reducing reactive power flow and load balancing.
- The results of the research will be disseminated in scientific papers in professional journals or communication conferences.
- New technical solutions brought by this automatic capacitive compensator, as regard to the structure, order, sizing, automatic control algorithm, will be the subject of intellectual property protection activities.

Research Centre

Analysis and Optimization of the Electrical Power Systems Regimes

Research team

Assoc.Prof. Adrian Pană, PhD
Prof. Radu - Emil Precup, PhD
Prof. Ștefan Preitl, PhD
As. Florin Molnar-Matei, PhD
As. Alexandru Băloi, PhD
Lecturer Ilie Mihai Tăcucean, PhD
Lecturer Mircea-Bogdan Rădac, PhD
As.Claudia-Adina Bojan-Dragoș, PhD
Alexandra Iulia Stînean, PhD
Eng. Andrei Plettinger

Contact information

Assoc. Prof. Adrian PANĂ, PhD
Department of Power Engineering
Address: Bv. Vasile Pârvan, No. 2, RO300223, Timisoara
Phone: (+40) 256 403420
E-mail: adrian.pana@upt.ro
Web: https://sites.google.com/site/caeredjt/

NOVEL TECHNIQUE TO ENHANCE THE SECURING LEVEL OF SECURITY PAPER USING THE SUPERPARAMAGNETIC FINGERPRINT OF MAGNETIC NANOPARTICLE DISPERSIONS - NANOMAGSECURITYPAPER

Goal of the project

The continuous diversification of the paper securing techniques is one of the most important ways to erect fences against forgery attempts. The project aims to expand the diversity of high tech means for paper securing. The general objective of the project is to elaborate a new paper securing technique based on the superparamagnetic fingerprint of magnetic nanoparticles made of oxide compounds

Short description of the project

The objective is to elaborate a new paper securing technique based on the superparamagnetic fingerprint of the magnetic nanoparticles.

Project implemented by

- Romanian Academy – Timisoara Branch (Project Coordinator)
- SC CEPROHART SA (Partner 1)
- SC ROSEAL SA Odorheiu Secuiesc (Partner 2
- SC Datronic – NCIP SRL (Partner 3)
- National Institute of R&D for Izotopic and Molecular Technologies Cluj-Napoca (Partner 4)
- Politehnica University of Timisoara (Partner 5).

Implementation period

July 1, 2014 – September 30, 2017

Main activities

- elaboration of superparamagnetic paper assortments with
  - low security level, using poly-disperse magnetic nanoparticles
  - high security level, using bi-disperse magnetic nanoparticles
  - white color, using core-shell (core/magnetic, shell/polymer) particles
- elaboration and testing the authentication method by static and dynamic magnetometry

Results

- methods for synthesis and characterization of oxide magnetic nanocomposites
- methods for elaboration and validation of magnetic loaded papers
- first instance validation of magnetic loaded papers

Financed through/by

Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI

Applicability and transferability of the results

The new method of securing paper using the superparamagnetic nanoparticles can be transferred to SC Ceprohart SA Braila. The transfer will contribute to:

- diversification of the product made in the national paper industry with simple brown paper secure and secure complex white paper,
- orientation of national industry to obtain a special paper grade with high complexity,
- increase the security level of specialty papers, difficult to fake on the internal market
- reduce the imports of security paper
- increase output and thus sales of security paper from Ceprohart.

Research centre

Research Centre for Engineering of Systems with Complex Fluids – Laboratory of Rheology and Magnetometry, from Politehnica University of Timisoara.
URL: http://mh.mec.upt.ro/ccisfc/

Research team

Dr. Oana MARINICA
Dr. Aurel ERCUTA
Dr. Catalin MARIN
Techn. Florica BĂLĂNEAN
Techn. George GIULA

Contact information

Dr. Vlad SOCOLIUC – Project Director
Romanian Academy – Timisoara Branch, Center for Fundamental and Advanced Technical Research, Laboratory of Magnetic Fluids
Bd. Mihai Viteazu No. 24, 300223, Timisoara, Jud. Timis
Tel./Fax: (+40) 256 403700
E-mail: vsocoliuc@gmail.com

Dr. Oana MARINICA – Project Responsible from Partner 5
Politehnica University of Timisoara, Research Center for Engineering of Systems with Complex Fluids, Laboratory of Rheology and Magnetometry,
Bd. Mihai Viteazu No. 1, 300223, Timisoara, Jud. Timis
Tel./Fax: (+40) 256 403700
E-mail: oana.marinica@upt.ro; marinica.oana@gmail.com
Web: http://vsocoliuc.wordpress.com/projects/nanomagsecurity-paper/

MAGNETIC NANOFLUID ROTATING SEAL SYSTEMS FOR HIGH PERIPHERAL SPEEDS - HISPEED NANO MAG SEAL

Goal of the project

The project technical objective is to achieve at experimental model scale new leakage-free MNF sealing systems for high peripheral speeds (up to 30 – 70 $m \cdot s^{-1}$) in the sealing area, designed to equip gas turbo-compressors.

Short description of the project

The project proposes the development of seals with magnetic nanofluid (MNF), which has significant advantages compared to conventional mechanical seals: hermetic sealing, exceptionally long lasting operation without intervention (5 years), minimal wear (only viscous friction), virtually zero contamination, optimal torque transmission, wide operating range (10^{-8} mbar - 10 bar), relatively simple and cost efficient execution.

Project implemented by

- SC ROSEAL SA Odorheiu Secuiesc (Project coordinator)
- Romanian Academy – Timisoara Branch (Partner 1)
- National Institute of R&D for Izotopic and Molecular Technologies Cluj-Napoca, Politehnica University of Timisoara (Partner 2)
- Politehnica University of Timisoara (Partner 3)
- Romanina Research and Development Institue for Gas Turbines – COMOTI Bucharest (Partner 4)

Implementation period

July 1, 2014 – September 30, 2017

Main activities:

- laboratory and micropilot scale synthesis of magnetic nanofluids with carboxylic stabilizers and magnetizations between 400-1000 G
- conception, design and implementation of new experimental models of sealing systems with magnetic nanofluid for high peripheral speeds
- testing and performance evaluation of new experimental models sealing systems with magnetic nanofluid, designed for high peripheral speeds

Results

- methods for synthesis and characterization of high magnetization nanofluids with carboxylic stabilizers
- experimental models for new sealing systems
- experimental models for sealing systems – innovative version with magnetic nanofluids with carboxylic stabilization

Applicability and transferability of the results

The expected results will facilitate design and low cost industrial scale production of an original sealing system with stable MNF at high temperatures (160 – 180 °C), for high peripheral speeds (up to 30 – 70 $m \cdot s^{-1}$) in the sealing gap. They have some important advantages compared to conventional mechanical seals: hermetic sealing, high reliability, relatively simple construction, low execution cost. These performances indicate the market towards ROSEAL Co. is heading, namely the gas turbo-compressors in fertilizer and petroleum refining industry.

Financed through/by

Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI) .

Research centre

Research Centre for Engineering of Systems with Complex Fluids – Laboratory of Rheology and Magnetometry, from Politehnica University of Timisoara.
URL: http://mh.mec.upt.ro/ccisfc/

Research team from Politehnica University of Timisoara

Dr. Oana MARINICA
Dr. Floriana D. STOIAN
Dr. Nicolae CRAINIC
Dr. Sorin HOLOTESCU
Techn. Florica BALANEAN
Techn. George GIULA

Contact information

Dr. Tunde BORBATH - Project Director
SC ROSEAL SA
Str. Nicolae Balcescu No. 5/A, 535600, Odorheiu Secuiesc, Jud. Harghita
Tel.: (+40) 266 215998; 266 218122; 266 215912; 747 116610
Fax: (+40) 266 215912
E-mail: office@roseal.topnet.ro
Web: www.roseal.eu; roseal.topnet.ro

Dr. Oana MARINICA – Project Responsible from Partner 3
Politehnica University of Timisoara, Research Center for Engineering of Systems with Complex Fluids, Laboratory of Rheology and Magnetometry
Bd. Mihai Viteazu No. 1, 300223, Timisoara, Jud. Timis
Tel./Fax: (+40) 256 403700
E-mail: oana.marinica@upt.ro; marinica.oana@gmail.com
Web: http://www.roseal.eu/HiSpeedNanoMagSeal/

VALORIZATION OF ENERGETIC POTENTIAL FOR AGRO-INDUSTRIAL RESIDUES THROUGH BIODEGRADATION PROCESSES AND CATALYTIC COMBUSTION OF OBTAINED BIOGAS

Goal of the project

The main purpose of the project involves a novel contribution in a direction which is currently under development at national level by providing relevant information impacting the quality of life by increasing regional and local autonomy in the context of valorization the renewable energy resources. The degree of novelty for the project also involves developing an experimental pilot for testing liquid substrates in anaerobic fermentation processes, which can have further industrial applications.

Short description of the project

The proposed project highlights the way different biodegradable materials can be used for biogas production

Project implemented by

Pilot installation and small scale test rigs, used for testing different materials in terms of their potential relative to obtaining biogas, measuring equipment and IT equipment for mathematical / modelling approach.

Implementation period

01.10.2015 – 30.09.2017

Main activities:

Determining the preliminary materials which will be used inside the anaerobic fermentation processes, Laboratory analysis for determining the characteristics of the chosen materials, Using third party infrastructure for comparative and complementary laboratory determinations, Identifying the mathematical models which are to be used inside determinations, Creation and computation of different scenarios for obtaining preliminary data for chosen mathematical models, Preparing and testing inside the reactors of 1l, 2l, 6l, Optimization of pilot installation and tests, Laboratory determinations on resulting materials, Catalysts obtaining and laboratory testing, Comparison of experimental and modeling data, Results dissemination.

Results

Publication of at least 2 papers in ISI journals, publication of at least 2 papers in BDI indexed journals, attendance to a minimum of 2 national or international conferences, publication of a book chapter or book with the obtained results.

Applicability and transferability of the results

The results obtained in the project can be further tested at larger scale in terms of material recipe / biogas quality and quantity and also the development of the pilot installation can be used as an example of combining fossil and renewable sources of energy in order to produce biofuels with impact at local level relative to obtaining of a certain degree of energetic autonomy.

Financed through/by

This project was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS – UEFISCDI

Research Centre

ICER

Research team

Adrian Eugen Cioablă,
Gavrilă Trif-Tordai,
Dorin Lelea,
Alina Gabriela Dumitrel,
Francisc Popescu,
Vodă Raluca,
Lucia Ana Varga,
Roxana Milotin,
Adrian Ţenchea.

Contact information

As. Adrian Eugen Cioablă, PhD
Mechanical Engineering Faculty/Department MMUT,
Address: Mihai Viteazu Blv.., No 1, Postal Code 300222, Timişoara
Phone: (+40) 256 403746
Mobile: (+40) 728123289
E-mail: adrian.cioahbla@upt.ro
Web: www.biogaztm.weebly.com