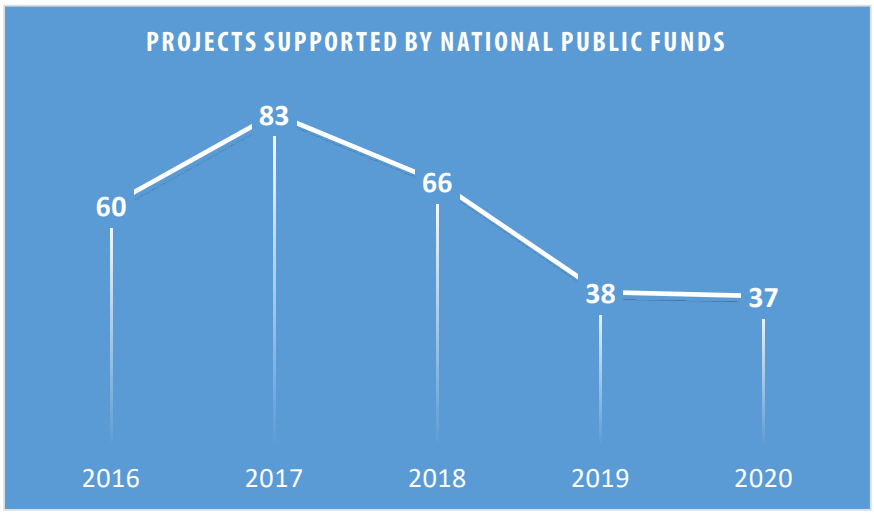
Universitatea Politehnica Timişoara
2020
PRIMUL VEAC DE ÎNVĂȚĂMÂNT UNIVERSITAR ÎN TIMIȘOARA

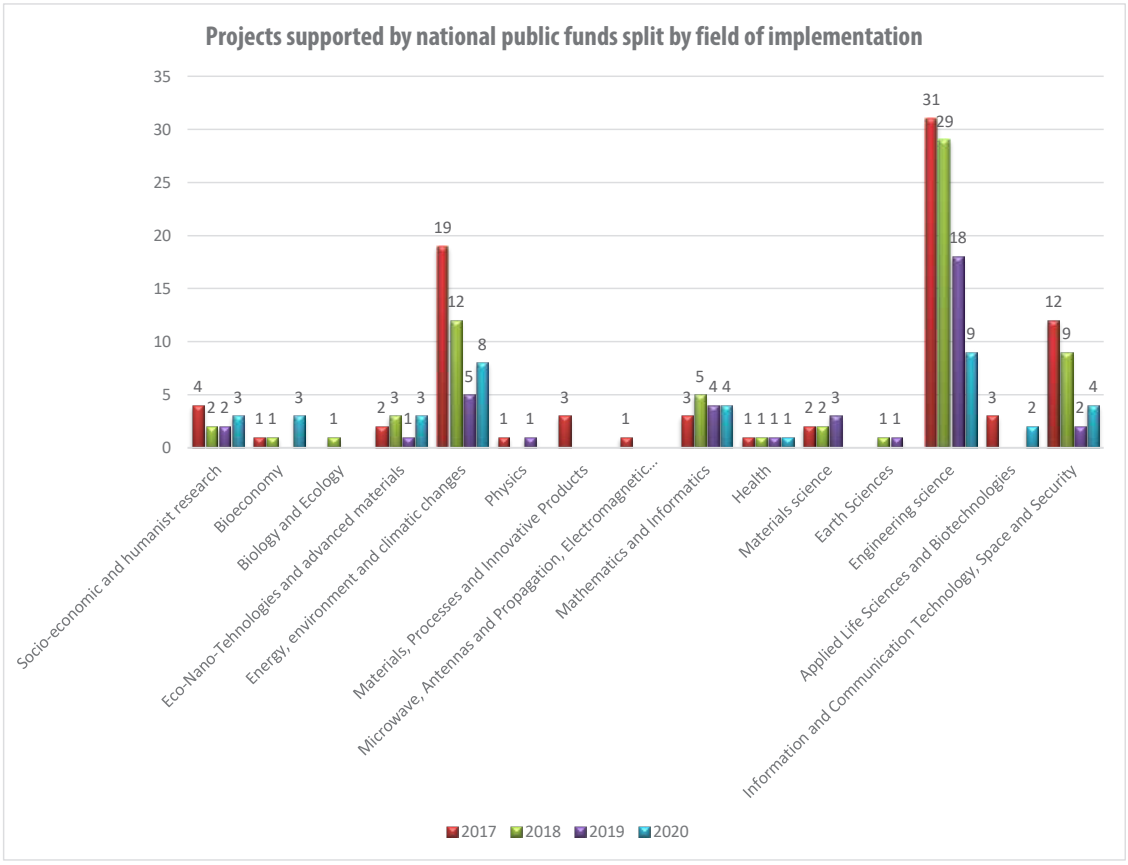
National Research Projects

PROJECTS SUPPORTED BY NATIONAL PUBLIC FUNDS IMPLEMENTED BY UPT 2020

Fields	Total number of projects	Number of projects presented
Social and Economic sciences	3	2
Eco-Nano-Tehnologies and advanced materials	3	3
Energy, environment and climatic changes	8	8
Mathematics and Informatics	4	4
Health	1	1
Bioeconomy	3	3
Applied Life Sciences and Biotechnologies	2	2
Engineering science	9	9
Information and Communication Technology, Space and Security	4	4
Total	37	36

EVOLUTION OF PROJECTS SUPPORTED BY NATIONAL PUBLIC FUNDS IMPLEMENTED BY UPT 2016 - 2020





PRESENCE - PRIVACY-ENABLED, SECURED INTERACTIONS BETWEEN VEHICLES AND SMART ELECTRONIC DEVICES

Goal of the project:

The main target of the project is the design, analysis and implementation of security and privacy mechanisms for mediating access to in-vehicle functionalities by using intelligent mobile devices instead of classical RF and/or mechanical vehicle keys that are rigid and are lacking in terms of configurability and functionalities. The design of such security solutions is challenged by limitations on computational capabilities of existing components, e.g., in-vehicle controllers, as well as by the potential insecurity of smartphones.

Short description of the project:

PRESENCE addresses the security of the newly emerged ecosystem of modern vehicles that interact with intelligent mobile devices, e.g., smart-phones.

Project implemented by

Politehnica University Timișoara

Implementation period:

2018-2020

Main activities:

Our project calls for the use of security enforcing technologies (e.g., NFC security cards) and modern device pairing techniques by harvesting environmental data (e.g., accelerometer data) to provide a secure and usable solution. Privacy enhancing technologies also need to be put in place in order to protect the users in front of corrupted cloud owners. As deployment platform we target Android, the mobile OS with the largest installed base. We also test the computational feasibility of the proposed solutions on a commonly employed controller for car BCMs.

Main project objectives:
1. Design, analysis and implementation of security protocols.
2. Security enforcing technologies (e.g., NFC cards).
3. Ecosystem-based device association (e.g., accelerometer data).
4. Cloud-based access control.
5. Connectivity to in-vehicle control units.

Results:

More than 15 research papers in relevant workshops and journals in the field addressing new concepts in vehicle access control supported by practical deployments on real-world components have been published. The list includes the following 6 Q1 journals:

[1] Bogdan Groza, Tudor Andreica, Adriana Berdich, Pal-Stefan Murvay, Horatiu Gurban, PRESTvO: PRivacy Enabled Smartphone-based access To vehicle On-board units, IEEE Access, 2020.

[2] Bogdan Groza, Adriana Berdich, Camil Jichici, Rene Mayrhofer, Secure Accelerometer-Based Pairing of Mobile Devices in Multi-Modal Transport, IEEE Access, vol. 8, 2020.

[3] Bogdan Groza, Lucian Popa, Pal-Stefan Murvay, CANTO - Covert AutheNtication with Timing channels over Optimized traffic flows for CAN, IEEE Transactions on Information Forensics and Security, accepted 2020.

[4] Bogdan Groza, Lucian Popa, Pal-Stefan Murvay, Highly Efficient Authentication for CAN by Identifier Reallocation with Ordered CMACs, IEEE Transactions on Vehicular Technology, 2020.

[5] Bogdan Groza, Lucian Popa, Pal-Stefan Murvay, TRICKS - time TRIggered Covert Key Sharing for Controller Area Networks, IEEE Access, vol. 7, 2019.

[6] Bogdan Groza, Pal-Stefan Murvay, Identity-Based Key Exchange on In-Vehicle Networks: CAN-FD & FlexRay, Sensors, 22, 2019.

Applicability and transferability of the results:

Replacing traditional keys with smartphones appears like a natural step for achieving increased usability and an improved user experience. Industry application of the designed protocols and implemented functionalities for car access control by modern smartphones is immediate.

Financed through/by

CNCS-UEFISCDI PN-III-P1-1.1-TE-2016-1317, 2018-2020

Research Centre

Department of Automation and Applied Informatics

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SECURITY ENHANCEMENTS AND VULNERABILITY ASSESSMENT FOR INDUSTRY-STANDARD NETWORKS (SEVEN)

Goal of the project

Most attacks on industry-standard networks rely on vulnerabilities. In this context, the SEVEN project aims to assess vulnerabilities in protocols not yet analyzed and to increase the security of industrial networks by proposing mechanisms to assure basic security objectives (e.g. authenticity, confidentiality or key management). The project also focuses on the design of intrusion detection systems. Finally, we also consider a performance impact evaluation of the introduction of the designed security solutions.

Short description of the project

Vulnerability evaluation and development of protection mechanisms for in industry-standard networks.

Project implemented by

Pal-Ştefan MURVAY (Project leader)
Bogdan GROZA (Mentor)

Implementation period

02/05/2018-30/04/2020

Main activities

The project is structured around three main activities.

1. The first main activity focuses on vulnerability assessment of industry-standard communication protocols. Our goal is to identify industry-standard communication-protocols that were not analyzed from a security perspective and identify potential vulnerabilities.Our first approach for enhancing the security of industry-standard communication protocols is the development of mechanisms for assuring basic security objectives such as: authenticity, confidentiality or key management.
2. A second approach focuses on designing intrusion detection mechanisms for the early identification of attack attempts.
3. Finally, we intend to provide an evaluation of the performance impact of the proposed mechanisms.

Results

The first phase of the SEVEN project focused on the identification of vulnerabilities in two industry-standard protocols, i.e., FlexRay and DeviceNet. The findings have been published as part of two conference papers:

[1] Pal-Stefan Murvay, Bogdan Groza, Practical security exploits of the FlexRay in-vehicle communication protocol, presented at The 13th International Conference on Risks and Security of Internet and Systems (CRISIS 2018), 2018.

[2] Pal-Stefan Murvay, Bogdan Groza, A brief look at the security of DeviceNet communication in industrial control systems, presented at The second Central European Cybersecurity Conference (CECC 2018), 2018.

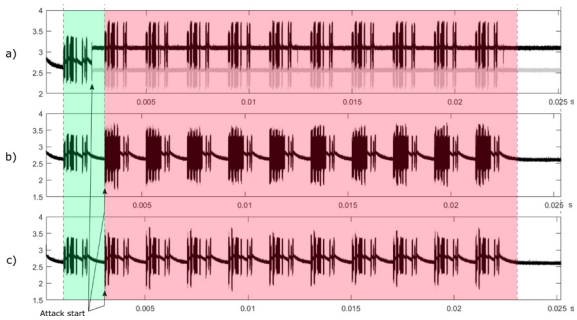

Figure 1. Three variants of the DoS attack for the entire communication.

We dedicated several lines of work to designing security mechanisms for enhancing the security of industry-standard protocols. The results obtained cover both secure communication mechanisms and intrusion detection systems for the Controller Area Network and FlexRay protocols. Papers presenting these results have been published in conference proceedings or journals:

[3] Pal-Stefan Murvay, Bogdan Groza, Accommodating Time-Triggered Authentication to FlexRay Demands, presented at The third Central European Cybersecurity Conference (CECC 2019), 2019.

[4] Camil Jichici, Bogdan Groza, Pal-Stefan Murvay, Integrating Adversary Models and Intrusion Detection Systems for In-Vehicle Networks in CANoe, presented at The 12th International Conference on Security for Information Technology and Communications (SECITC 2019), 2019.

[5] Pal-Stefan Murvay, Bogdan Groza, TIDAL-CAN: differential Timing based Intrusion Detection And Localization for Controller Area Network, accepted for publication in IEEE Access, 2020.

Applicability and transferability of the results

Our results add to the already known vulnerabilities of communication protocols used in industrial applications. Knowledge of the vulnerabilities is an important building block of designing proper security mechanisms for these communication protocols.

The proposed security mechanisms are efficient in preventing a series of spoofing and replay attacks as well as in the detection of attack attempts. These mechanisms focus on FlexRay, which was developed for the automotive industry and Controller Area Network, a communication protocol widely used both in the automotive domain and industrial control systems.

Financed through/by

This work was supported by a grant of the Romanian Ministry of Research and Innovation, CNCS - UEFISCDI, project number PN-III-P1-1.1-PD-2016-1198, within PNCDI III

Research Centre

Department of Automation and Applied Informatics

Research team

- Assist. Prof. Stefan MURVAY, PhD
- Prof. Bogdan GROZA, PhD

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NATURE-INSPIRED MODELING AND OPTIMIZATION TECHNIQUES OF FUZZY CONTROL SYSTEMS WITH MECHATRONICS APPLICATIONS

Goal of the project

The aim of this project is to demonstrate efficiency and prove the viability of an innovative tuning approach for fuzzy control systems using nature-inspired algorithms in control structures modeling and optimization stages. In this framework, combining nature-inspired optimization algorithms with fuzzy control structures, will have a significant impact on the performance of fuzzy control systems.

Short description of the project

The nature-inspired optimization algorithms will be employed in solving optimization problems that minimize discrete-time objective functions expressed as integral or sum-type quadratic performance indices.

Project implemented by

Politehnica University Timișoara

Implementation period

19.10.2018 - 18.10.2020

Main activities:

The main activities are:

1. Development of efficient control solutions for different processes by bypassing the higher derivative calculations;
2. Takagi-Sugeno fuzzy controllers' optimization through minimization of several objective functions;
3. Development of performant solutions with a reduced implementation cost;
4. Experimental validation of proposed control solutions;
5. Achievements dissemination in high visibility journals and conferences;
6. Successful project management administration.

Results

The main results are related to development of nature inspired algorithm-based solutions for solving optimization problems of fuzzy systems will be disseminated at national and international levels as: four papers published in Thomson Reuters Web of Science (formerly known as ISI Web of Knowledge) publications and four presentations at international conferences.

Applicability and transferability of the results

The results obtained during this contract belong exclusively to Politehnica University Timișoara.

Financed through/by

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

Research Centre

Faculty of Automation and Computers

Research team

- Eng. Radu-Codruț DAVID, PhD
- Prof. eng. Stefan PREITL, PhD

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DATA-DRIVEN CONTROLLERS FOR SHAPE MEMORY ALLOYS SYSTEMS (DDCSMASYST)

Goal of the project

Analysis, design and implementation of control solutions with nonlinear data-driven controllers (MFC, MFAC, ADRC, VRFT and IFT) in combination with other modern control algorithms in order to improve the CS performance and validate the new CSs with the proposed nonlinear controllers through experiments on laboratory equipments related to Shape Memory Alloys (SMA), and other various laboratory equipment with SMA as actuators.

Short description of the project

Nonlinear controllers whose parameters are tuned using experiments are developed and validated with experiments on laboratory equipments related to Shape Memory Alloys (SMA), and other various laboratory equipment with SMA as actuators.

Project implemented by

- As.Dr.Ing. Raul-Cristian ROMAN – responsible for outlining the research goals, modeling of experiments, simulation and data validation, writing scientific manuscripts, overall project
- Prof.Dr.Ing. Stefan PREITL – mentor for the project director, research goals
- Prof.Dr.Ing. Radu-Emil PRECUP – mentor for the project director, theoretical expert advisor regarding algorithm theory

Implementation period

17.08.2020 – 16.08.2022

Main activities

1. The analysis, the design and the implementation of nonlinear data-driven controllers (MFC, MFAC, ADRC, VRFT and IFT) in combination with other modern control algorithms in order to improve the CS performance.
2. Validation of the new CSs with the proposed nonlinear controllers through experiments performed on laboratory equipments related to Shape Memory Alloys (SMA), and other various laboratory equipment with SMA as actuators.
3. Applying the new CSs with data-driven controllers through external partners.
4. Publication of results in visible conference and journal papers.
5. Solving issues related to project management.

Results

The research team published two conference papers currently indexed in the international data bases IEEExplore (link and link). The proceedings of the previous editions of these conferences are indexed in WoS.

Applicability and transferability of the results

With the support of our partner from the University of Ottawa, the new CSs with nonlinear data-driven controllers presented in IJCCC journal and at 2020 IEEE International Conference on Systems, Man, and Cybernetics (SMC) and 2020 24th International Conference on System Theory, Control and Computing (ICSTCC) are in the validation process at Ontario Centers of Excellence.

Financed through/by

UEFISCDI

Research Centre

Automatic Systems Engineering Research Centre

Research team

-As.Dr.Ing. Raul-Cristian ROMAN – project leader
-Prof.Dr.Ing. Stefan PREITL – mentor

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AGENT-BASED INTERACTION MODELS WITH TEMPORAL ATTENUATION FOR OPINION POLL PREDICTION

Goal of the project

Improving the accuracy of opinion poll prediction by means of agent-based complex network modelling, with the integration of temporal attenuation to model the decaying strength of agent-agent interactions. To this end, we propose the following objectives:
1) Develop a novel temporal tolerance agent-based interaction model to improve the state of the art in terms of understanding how the temporal patterns of interaction between individuals influence the distribution of opinion at macro-scale.
2) Define cost-optimal temporal spreading strategies for improving diffusion coverage in social networks.
3) Enhance opinion poll prediction using temporal attenuation through votes injected in the social network by selected seeders, active for a predefined time frame.
4) Implement a mobile simulation application for opinion injection and poll estimation. We corroborate all expected research results, with direct applicative socio-economic impact, by developing a simulation application for further validation via crowdsourcing.

Short description of the project

This project comes to push the boundaries of scientific understanding forward, on several levels, in terms of better predicting the spread of opinion over large social temporal networks, with applicability in opinion poll prediction.

Project implemented by

Associate Prof. Alexandru TOPÎRCEANU – project director. Roles of: outlining the research goals, modeling of experiments, simulation, and data validation, writing scientific manuscripts, overall project management.
Prof. Mihai UDRESCU – mentor for the project director, research goals, revising scientific manuscripts.
Mihai ARDELEAN, PhD student – mobile application development, under director's supervision.
Adrian MILITARU, MSc student – data acquisition and processing, under director's supervision.

Implementation period

August 2020 – July 2022 (24 months)

Main activities

In order to reach the final research objective – that of improving the accuracy of opinion poll prediction – a number of activities are planned. We start from developing a novel temporal tolerance agent-based interaction model to understand how the patterns of interaction between individuals influence the distribution of opinion at macro-scale.

We build upon our previously introduced tolerance model (Topirceanu et al., PeerJ Comp Sci, 2016), corroborated with state of the art, and augment it by adopting an original perspective on temporal dynamics
Next, we consider that opinion should not be considered fixed in time and space, but rather opinion should be injected at specific locations in the topology, for limited amounts of time, and that each spreader agent implies a cost of operation (Figure 1a,b).
Consequently, we enhance opinion dynamics prediction using temporal attenuation (TA) previously introduced in (Topirceanu et al., Social Netw. Analys. Mining, 2020) (see Figure 1c-e).

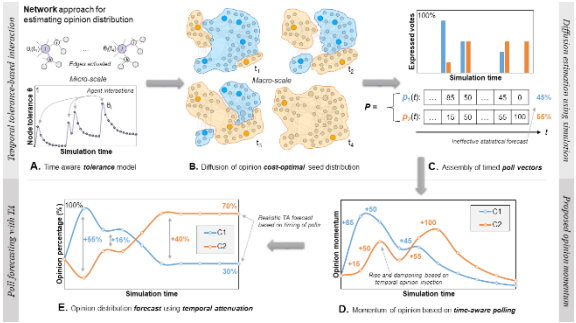
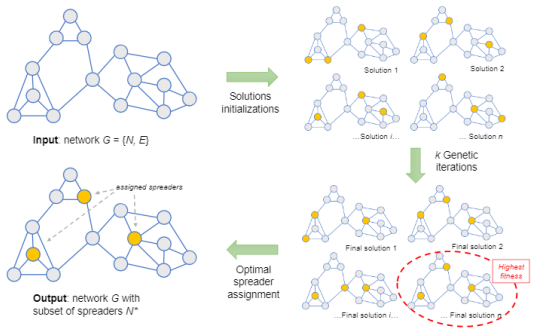


Figure 1 - Overview of the main objectives for creating a dynamic agent-based opinion injection simulation model which can better forecast opinion distribution in a large social network. Agents react to individual interactions in their vicinity by increasing their immediate tolerance threshold; poll vectors are further processed using temporal attenuation, and opinion momentum is computed based on the timing of polls in the network. The opinion distribution is computed based on its momentum, highlighting that forecasts using TA.

Results

We have currently introduced the GenOSOS computational intelligence framework. GenOSOS is able to determine a near optimal placement of opinion spreaders in a complex network, ensuring spatial heterogeneity. See Figure below.



Currently two proceedings papers (to appear in WoS):

- Topîrceanu, A. (2020, December). Analyzing the Impact of Geo-Spatial Organization of Real-World Communities on Epidemic Spreading Dynamics. In International Conference on Complex Networks and Their Applications (pp. 345-356). Springer, Cham.
- Topîrceanu, A. (October, 2020), "Genetically Driven Optimal Selection of Opinion Spreaders in Complex Networks", In 2nd International Conference on Machine Learning and Intelligent Systems (MLIS 2020), In Press, published by IOS Press in Frontiers in Artificial Intelligence and Applications, 2020. (to be indexed)

Also submitted:

- A manuscript under review in Expert Systems with Applications (Q1, IF=5.45)
- A manuscript under review in Scientific Reports (Q1, IF=3.99)

Applicability and transferability of the results

Current state of the art in forecasting employs multilevel regression and post-stratification (MRP). However, the MRP method is often cumbersome to apply, requiring economic indices and detailed demographics to be accurate. Alternatively, we propose to elaborate on the concept of temporal attenuation (TA), which models the timed oscillation of poll data as opinion momentum. For this, we propose a research methodology based on computer simulation of information diffusion, on large datasets, using novel agent-based models.

The expected results of this project are directly applicable in the industry context, like political and marketing research. For example, web marketing and recommender systems are increasingly popular for disseminating influence, as there is a need of scientific support for strategies to maximize revenue, applicable on social networking platform like Facebook or Twitter. Altogether, the project outputs can minimize marketing investment, and maximize the impact of a campaign.

Financed through/by

Romanian National Authority for Scientific Research and Innovation (UEFISCDI), project number PN-III-P1-1.1-PD-2019-0379

Research centre

- CCCTI: Research Centre for Computers and Information Technology (UPT)
- ACSA: Advanced computing systems and architectures research group

Research team

- Director – Associate Prof. Alexandru TOPÎRCEANU
- Mentor – Prof. Mihai UDRESCU

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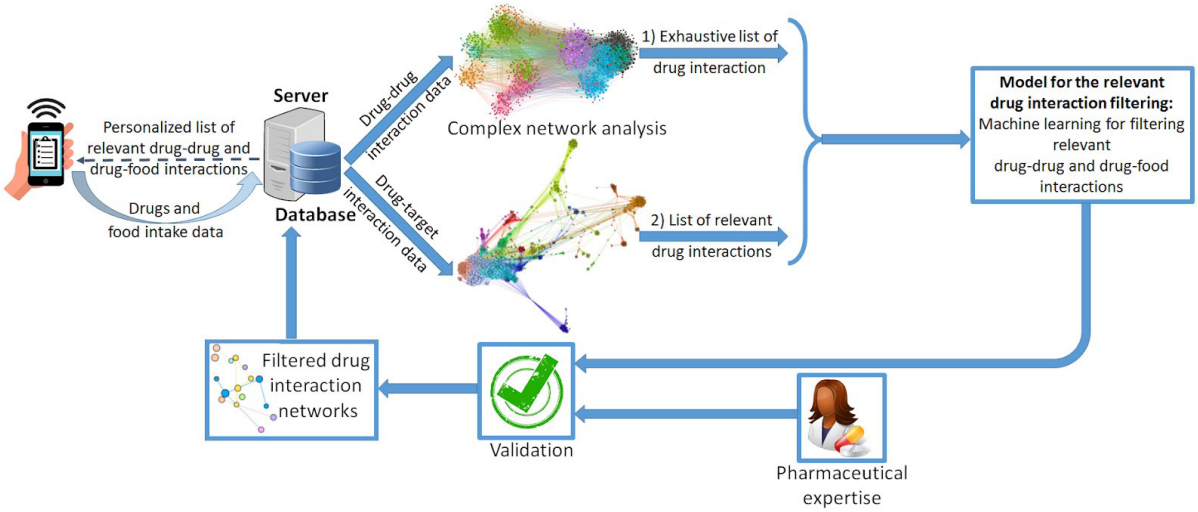
COMPLEXITY SCIENCE FOR PRECISION PHARMACY: PREDICTING RELEVANT DRUG INTERACTIONS USING COMPLEX NETWORK ANALYSIS (HYPERION)

Goal of the project

A drug-drug interactome (DDI) is a complex graph, where the node is a drug, and an edge represents a drug-drug interaction. DDIs are analyzed with algorithmic and statistical methods to predict previously unaccounted interactions. Our objective is to build a network-based model that selects only the individually-relevant drug interactions and then issues corresponding alerts. Our personalized drug interaction prediction model will mitigate alert fatigue. The end product will be a prototype of the smartphone-based personalized alert system, for relevant drug interactions.



Short description of the project

Drug-drug interactions (DDI) may cause therapeutic failure. Avoiding harmful DDI is crucial in medical practice.

Project implemented by

- "Victor Babes" University of Medicine and Pharmacy Timisoara (coordinator),
- Politehnica University Timisoara (partner)

Implementation period

02.11.2020-31.10.2022

Main activities

1. Building the initial drug-drug interaction network and the drug-drug similarity network
2. Performing the complex network analysis and processing on Politehnica University Timisoara and University of Medicine and Pharmacy Timisoara servers
3. Pharmacological validation of network modeling
4. Building a supervised machine learning model for selecting the relevant drug-drug and drug-food interactions
5. Adjusting the filtered drug interaction network according to the validated machine learning model
6. Mobile application development

Results

Our project's expected results are

(i) the validated drug-drug interaction and drug-drug similarity networks, in Gephi and Python/NetworkX, using data from the DrugBank database

(ii) the validated machine learning model for predicting the relevance (i.e., strength) of drug interactions at server-level, and (iii) the prototype smartphone software for personalized drug interaction alert.

Applicability and transferability of the results

The starting point of our project covers the TRL2-specific requests, as all project's objectives consists of theoretical models.

Both drug-drug interaction and drug-drug similarity networks with data from DrugBank, built in Gephi and NetworkX correspond to TRL3, as they represent analytical and experimental critical function.

The mobile application prototype for personalized drug interaction alert represents a laboratory-validated system (TRL4). We will experimentally demonstrate the integration of our system by testing it with data gathered from the medical prescriptions database. We will identify potential customers (patients with chronic diseases, pharmacists, and doctors).

Financed through/by

UEFISCDI, PNIII-P2-Subprogramul 2.1. Competitivitate prin cercetare, dezvoltare şi inovare–Proiect experimental-demonstrativ 2019

Research centre

Research Center in Computer and Information Technology (CCCTI)

Research team

- Prof. Mihai Udrescu, Ph.D.
- Assoc. Prof. Alexandru Topîrceanu, Ph.D.
- Assist. Prof. Alexandru Iovanovici, Ph.D.
- Eng. Sebastian-Mihai Ardelean, Ph.D. Student

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INTEGRATED AND SUSTAINABLE PROCESSES FOR ENVIRONMENTAL CLEAN-UP, WASTEWATER REUSE AND WASTE VALORIZATION – SUSTENVPRO

Goal of the project

The goal of complex project SUSTENVPRO is to increase the institutional performance in the ENVIRONMENT field of a consortium of 5 public research organizations with recognized research performances and one R&D National Institute under consolidation, through an integrative approach which supports/develop the existent research competencies of each partner and transfer capacities of results with applicative and innovative potential envisaging the elimination of priority pollutants from water using innovative advanced water/ wastewater treatment processes and waste recovery.

Short description of the project

The complex project **SUSTENVPRO** consisted of 5 research component projects (PC):
PC 1. Complex evaluations of priority pollutants present in various water matrixes and risk identification on the ecosystems and human health;
PC 2. Water treatment processes optimization and development of innovative materials for the priority pollutants removal;
PC 3. Valorization of biomass resources for the development of innovative processes for wastewater treatment and priority pollutants removal;
PC 4. Metallic waste valorization for innovative wastewater treatment process development and removal of priority pollutants;
PC 5. Sustainability assessments of water/ wastewater treatment and waste valorization processes based on life cycle assessment.

Project implemented by

The project is implemented by 4 universities and two national R&D institutes:
Coordinator: "Gheorghe Asachi"Tehnical University of Iasi;
Partners: Politehnica University of Bucharest; "Alexandru Iona Cuza" University of Iasi; Politehnica University Timişoara; "Petru Poni" Institute of Macromolecular Chemistry Iasi; National Research and Development Institute for Environmental Protection, Bucharest.

Implementation period

2018 - 2020

Main activities

-Developing and validating an innovative approach oriented to analysis, preventing and correcting the environmental risks associated with the presence of priority pollutants in various matrices of water use;
-Development of efficient innovative water treatment and advanced wastewater treatment processes in order to eliminate priority organic and inorganic pollutants in the anthropic water cycle;
-Development of new innovative materials (polymeric or composite materials) with properties designed according to the characteristics of the priority pollutants;
-Utilization of materials from organic (biomass) and inorganic waste (metallic waste) in innovative wastewater treatment processes for removing priority pollutants and recirculating / reusing water;
-Sustainability assessment of processes and products through Life Cycle Assessment tool.

Results

-Research workplaces;
-New/significantly improved technologies /procedures;
-New/significantly improved research services;
-New research and technology consultancy services (uploaded on the ERRIS platform);
-Research services by sharing the research infrastructure among project partners (A1 and A2 research vouchers);
-Knowledge transfer to water operator through C voucher;
-Research papers published in ISI-ranked journals;
-Communications at national and international scientific events (conferences, exhibitions);
-Dissemination and technology transfer workshops;
-(Initiation /Intermediary /Final) Project workshops;
-RDI common program (in agreement with the institutional development plan of every partner).

Applicability and transferability of the results

- Transferability of research results between consortium partners;
- Technological transfer of advanced water/wastewater treatment technologies/procedures to public and private economic environment (regional water operators, environmental companies, private companies in the water/waste field etc.); knowledge transfer to regional water operator through C voucher within the project framework tested at pilot scale as treatability study for concrete applications in drinking water treatment;
- Good practice guide for circular economy in water field for sustainability consulting company, non-profit organization, environmental agencies.

Financed through/by

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

Research centre

Research Centre in Environmental Science and Engineering

Research team

- UPT Project Responsible: Prof.dr.eng. MANEA Florica
- Scientific Researcher, level I : PODE Rodica
- Scientific Researcher, level III: COCHECI Laura
- Scientific Researcher, level III: POP Aniela
- Scientific Researcher, level III: VODA Raluca
- Scientific Researcher, level III: BACIU Anamaria
- Development engineer: IGHIAN Lacrima-Crysty
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3D POROUS DIMENSIONALLY STABLE ANODE - INTEGRATED PARTICULATE ELECTRODE - ELECTROCHEMICAL FILTERING SYSTEM FOR ADVANCED TREATMENT OF CYTOSTATICS-CONTAINING WATER

Goal of the project

The **goal** of the present project is to develop an innovative **three-dimensional (3D) Porous Dimensionally Stable Anode – integrated Particulate Electrode -Electrochemical Filtering System** for advanced water treatment, which will be validated at the lab-scale for advanced treatment of cytostatics-containing water. The system **will be flexible and enable for an advanced treatment of water/wastewater characterized by a wide range of contaminants (organics and inorganics)** by combination of advanced electrooxidation with adsorption/catalysis processes within one reactor.

Short description of the project

This project falls within the targeted area of **Environment and Climate Change and Depollution Technologies** according with the goals of Romanian National Plan for RDI 2015-2020.

Project implemented by

The project is implemented by one university, one research institute and one private company.

Coordinator: Politehnica University of Timisoara

Partners: National Institute for R&D in Electrochemistry and Condensed Matter Timisoara; S.C. BeeSpeed Automatizari SRL

Implementation period

2020-2022

Main activities

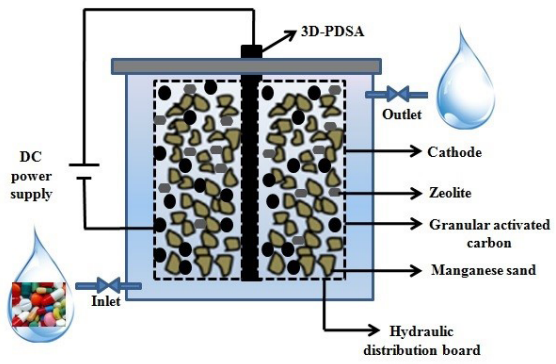
I. Synthesis and characterization of new porous dimensionally stable anodes. Design of an innovative three-dimensional (3D) porous dimensionally stable anode–integrated particulate electrode-electrochemical filtering system

II. Synthesis and characterization of new porous dimensionally stable anodes. Optimization of particulate electrode composition. Design and fabrication of an innovative three-dimensional (3D) porous dimensionally stable anode – integrated particulate electrode - electrochemical filtering system

III. Testing electrochemical filtering system in removal and degradation and mineralization of cytostatics from water.

Results

-Lots of porous DSA type electrode materials;
-Morpho-structural and electrochemical characteristics of the electrode materials;
-Various compositions of the particulate electrode;
-Design of innovative three-dimensional (3D) porous dimensionally stable anode–integrated particulate electrode-electrochemical filtering system;
-Innovative three-dimensional (3D) porous dimensionally stable anode–integrated particulate electrode-electrochemical filtering system;
-Functional and operational characteristics of innovative three-dimensional (3D) porous dimensionally stable anode–integrated particulate electrode-electrochemical filtering system;
-Scientific-technical report for each stage;
-1 patent request;
-4 ISI-ranked scientific articles;
-6 oral presentations and 8 poster presentations at national and international conferences.



Applicability and transferability of the results

- Transferability of research results between consortium partners;
- Technological transfer of advanced water/wastewater treatment technologies/procedures to public and private economic environment (regional water operators, environmental companies, private companies in the water/waste field etc.)

Financed through/by

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

Research centre

Research Centre in Environmental Science and Engineering

Research team

Politehnica University of Timisoara- Coordinator
- Prof. Dr. eng. Florica MANEA-project director
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- PhD stud. Sergiu VASILIE
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- Dr. Carmen LAZAU
- Dr. eng. Cornelia BANDAS
- PhD stud. Mina Ionela POPESCU
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SMART PHOSPHORESCENT PIGMENTS FOR PERSISTENT GLOW-IN-THE-DARK SAFETY MARKINGS

Goal of the project

The goal of the research project is to obtain smart phosphorescent pigments via an energy-efficient method and test them in making persistent glow-in-the-dark safety markings.
To achieve this goal, the project involves active research and development of efficient SrAl2O4: Eu^{2+}, Dy^{3+} phosphorescent pigments and adequate organic matrixes to incorporate the obtained pigments (TRL3). In a second phase, both components (pigment and organic matrix) will be integrated in the form of a glow-in-the-dark coating and tested for compatibility (TRL4).

Short description of the project

An energy-efficient method is used to make phosphorescent pigments designed for glow-in-the-dark safety markings.

Project implemented by

Polytehnica University Timișoara, Faculty of Industrial Chemistry and Environmental Engineering, department CAICAM

Implementation period

August 2020 – June 2022

Main activities

The following activities are involved to achieve the project goals:
- recipes design and combustion synthesis of SrAl2O4: Eu^{2+}, Dy^{3+} phosphor pigments;
- pigments characterization, results interpretation and recipes optimization;
- choosing a compatible organic matrix for pigments incorporation;
- preparation of organic matrix – pigment disperse systems with various pigment content, to establish the optimal proportions;
- coatings application and characterization. Results interpretation and parameters optimization;
- testing in laboratory conditions of the pigment-matrix system functionality;
- results dissemination and project management.

Results

The results will include, but are not limited to:
- sets of investigation reports, optimized pigments recipes and synthesis protocols;
- sets of investigation reports and selected organic matrix specimens.
- manuscript submitted for publication in an ISI-ranked journal, paper presentation within an international conference, diploma paper, project website, periodic research report for UEFISCDI;
- preparation recipes, working procedures, two components (pigment-matrix) specimens;
- coatings specimens, set of investigation reports, optimized coating application protocol;
- manuscript accepted for publication in an ISI-ranked journal, paper presentation within an international conference, "Inorganic Pigments Technology" special course topic, project website update, periodic research report for UEFISCDI, OSIM patent request.

Applicability and transferability of the results

The resulted pigment-matrix systems can be used as persistent glow-in-the-dark safety marking systems in the transportation (automotive and aircraft or railway industry), public spaces and buildings, road signage, etc. Different pigment-matrix systems may be used for different application supports.
The research results will also be disseminated as conference presentations and articles in ISI publications to increase project visibility. The know-how achieved within the project development will also be used to coordinate a diploma paper. The implementation team will apply for a patent request to protect the results obtained within the project for future transfer to the industry.

Financed through/by

The project is financed by the The Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI), P2 Program - Increasing the competitiveness of the Romanian economy through RDI/ Demonstration experimental project (PED)

Research centre

Research Center for Inorganic Materials and Alternative Energies

Research team

The research team is composed by

- the principal investigator
  - Radu LAZĂU,
- two experienced researchers
  - Cornelia PĂCURARIU and Robert IANOȘ
- and a technician
  - Aylin CĂPRARU.

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NEW "GREEN" TECHNOLOGY FOR ADVANCED WATER TREATMENT BASED ON FUNCTIONALIZED POLYSULFONES/IONIC LIQUIDS MEMBRANES (GREENTECHMEMBR)

Goal of the project

The goal of this project is to develop new supported liquid membranes (SLMs) and polymer inclusion membranes (PIMs), which will be used as medium separations in an innovative membrane treatment unit (MTU), which will be tested and validated for the advanced treatment of aqueous solutions, containing both organic and inorganic pollutants. Our approach involves the development of membranes based on quaternized polysulfones (PSFQs) and various ionic liquids (ILs), with improved features and performances, so that by integrating those into MTU, the functionality and expected performance of the entire assembly can be fulfilled.

Short description of the project

We aim to develop new functionalized polysulfones/ionic liquids membranes, for testing, and validation in a water treatment unit.

Project implemented by

- "Petru Poni" Institute of Macromolecular Chemistry Iasi (ICMPP) – project coordinator
- Politehnica University Timisoara, Faculty of Industrial Chemistry and Environmental Engineering (UPT) – project partner

Implementation period

03.08.2020-29.07.2022

Main activities

- Optimization of properties in solution in order to obtain ionic liquids-based polysulfone membranes;
- Formulation and design of ionic liquids-based polysulfone membranes (SLMs, PIMs);
- Optimization of properties in solid state in order to obtain ionic liquids-based polysulfone membranes applicable in microfiltration process;
- Design and development of the membrane treatment unit (MTU) by integrating the optimized experimental demonstrator (SLM, PIM) into a final product;
- Validation of the laboratory technology through specific tests;
- Dissemination of the results.

Results

The modeling of new membrane materials with increased efficiency in microfiltration processes was performed by the optimal combination of PSFQ functionalized with various ionic liquids. Thus, by the method of solution pouring, polysulfonic membranes with controlled thickness were obtained. By mixing/including polysulfonic solutions (PSFQ) with selected ionic liquids in different ratios the PIM membranes were obtained, and the SLM membranes were made by depositing/immersing the PSFQ membranes already obtained in the selected ionic liquids.

The membrane treatment unit (MTU) was designed / built for a variable flow of raw water, and the configuration of the unit by integrating the experimental demonstrator (SLM, PIM membranes) in the proposed technological installation was made to operate in optimal conditions for their application. in microfiltration processes, aiming to determine the efficiency of the membranes obtained in water treatment processes.

Applicability and transferability of the results

- A solid transfer of knowledge occurred during the collaboration between the partners involved in the research.
- Application of the developed membranes in the advanced treatment of waters and waste waters.
- Transfer of the membrane treatment unit from the lab-scale application to large-scale advanced treatment.

Financed through/by

This work was supported by a grant of the Romanian Ministry of Education and Research, CCCDI - UEFISCDI, project number PN-III-P2-2.1-PED-2019-3013, within PNCDI III.

Research centre

- Research Centre in Environmental Science and Engineering
- Research Institute for Renewable Energy

Research team

(ICMPP) – project coordinator:

- Dr. Anca FILIMON – project director
- Dr. Adina Maria DOBOS
- Dr. Alexandra BARGAN
- Dr. Mihaela Dorina ONOFREI
- PhD student Alexandru ANISIEI
- PhD student Oana Dumbrava

(UPT) – project partner:

- Assoc. Prof. Dr. Eng. Lavinia LUPA - UPT – project responsible
- Prof. Dr. Eng. Petru NEGREA
- Lecturer Dr. Eng. Laura COCHECI
- PhD student Samuel Nick ȚOLEA

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BIOCATALYTIC SYNTHESIS OF NEW POLYESTERAMIDES AS NANOCARRIERS FOR BIOACTIVE COMPOUNDS

Goal of the project

The goal of the project is to develop a demonstration model of a new biocatalytic approach to synthesize polyesteramides, based on renewable sources and suitable as nanosized carriers for bioactive compounds. Therefore, the project is focused on two main directions (i) biocatalytic polymerization and (ii) particle technology. The validation of the model will be accomplished through the effectiveness of the polymeric material in specific encapsulation of a bioactive product, together with the demonstration of its biodegradability.

Short description of the project

The main objective is to develop the biobased synthetic route for biocatalytic synthesis of new polyesteramides, starting from amino acids and ε-caprolactone, or hydroxy acids and ε-caprolactam, using green solvents. The stabilization of the employed enzymes will be performed by substrate-directed immobilization, including covalent binding onto magnetic particles and magnetic sol-gel entrapment. The selectivity of different lipases, proteases and esterases will be evaluated in terms of catalytic efficiency, to increase the productivity of the process. Several amino acids and hydroxy acids will be tested as co-monomers, and the optimal reactions conditions will be determined by experimental design. The reaction engineering will target the effect of different process parameters on the structure and properties of the synthesized polyesteramides. The structural analysis and assessment of the physico-chemical properties of the reaction products will be accomplished by advanced analytical techniques. The synthesized oligoesters will be used as starting materials for novel nanoparticles effective as bioactive compounds carriers.

Main activities

Stage 1 (2020) - Enzymatic synthesis of novel oligoesteramides/ polyesteramides of epsilon-caprolactone and epsilon-caprolactam.

Activity 1.1. Investigation of lipases and proteases from various microbial sources as biocatalysts for polyesteramide synthesis

Activity 1.2. The effect of process parameters on the composition of the reaction product

Activity 1.3. Characterization of reaction products by MALDI-TOF MS, NMR, FT-IR

Activity 1.4. Tailor-made immobilization of lipases, esterases and proteases to obtain active biocatalysts in polymerization reactions

Activity 1.5. Characterization of the immobilized lipases and reaction engineering

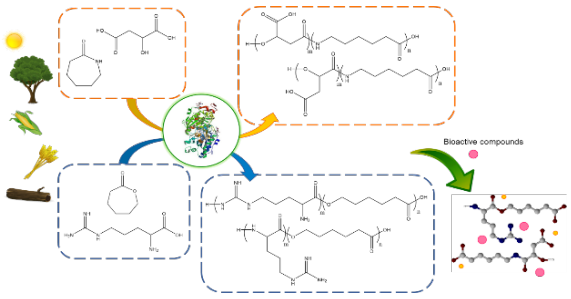

Figure 1. Green synthetic pathway for synthesis of novel polyesteramides from bio-based raw materials

Project implemented by

Politehnica University Timișoara

Implementation period

03.08.2020-29.07.2022

Results

The main results of the first stage were:
- the development of the experimental protocol for enzymatic synthesis of polyesteramides;
- the methodology for identifying the components of the polymerization product by MALDI-TOF MS and NMR;
- the development of a substrate-directed immobilization protocol for each type of the studied enzymes;
Visit also: http://chim.upt.ro/ro/cercetare/proiecte-de-cercetare/286-pn-iii-p2-2-1-ped-2019-2638 .

Financed through/by

Romanian Ministry of Education and Research, CCCDI - UEFISCDI, project code PN-III-P2-2.1-PED-2019-2638, project No. 272PED/2020, within PNCDI III

Research centre

Research Centre in Organic, Macromolecular and Natural Compounds Chemistry and Engineering

Research team

- Project leader: Prof. Dr. Eng. Francisc Peter
- Researchers:
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- Ș.l. dr. ing. Cristina Paul
- Ș.l. dr. ing. Iulia Maria Păușescu
- Ș.l. dr. ing. Valentin Badea
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- PhD Students:
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INTELLIGENT AND ACTIVE SYSTEMS IN FOOD PACKAGING BASED ON BIOPOLYMERS AND NOVEL FLAVYLIUM DYES

Goal of the project

The main scope of the project is developing a model for production of new materials used in food packaging systems which must include compounds that through their properties can emphasize different possible transformations of the packaged food. The packaging systems must fulfill mandatory conditions that should highlight possible food transformations in time under different conditions. This would be accomplished by inserting in the package material compounds with photochromic properties whose color is changing with pH value and temperature variation.

Short description of the project

The project will address the development of new packaging materials starting with computational methods and synthesis of new dyes and polymers.

Project implemented by

Politehnica University Timişoara

Implementation period

01.11.2020 – 31.10.2022

Main activities

Stage 1 – Design of flavylium dyes

Activity 1.1. – Design of novel flavylium dyes structures

Activity 1.2. – Geometry optimization and reactivity descriptors calculations for proposed structures

Activity 1.3. – Evaluation of photochromic properties of the proposed dyes

Activity 1.4. – Evaluation of antioxidant activity of proposed dyes

Activity 1.5. – Toxicity evaluation of the proposed compounds by theoretical methods

Activity 1.6. – Analysis of theoretical computations and selection of proposed dyes structures

Results

The results of the first stage:

- Geometry optimization of the designed dyes

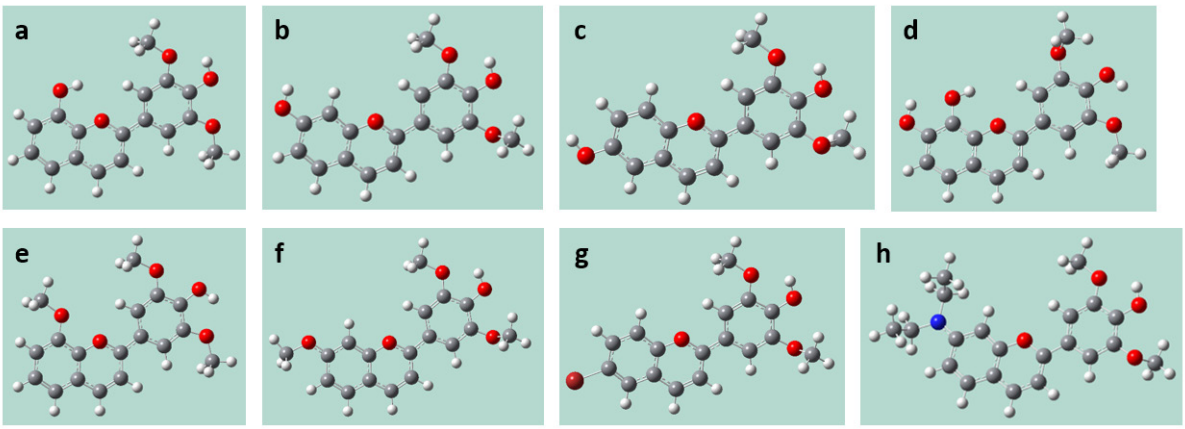

Fig. 1. The optimized structures of a set of flavylium salts at DFT/6-31G+(d,p) level of theory

- antioxidant and photochromic properties theoretical evaluation

Table 1. The calculated excitation energies, E (eV) of a set of flavylium dyes

Compound	Calculated absorption wavelength λ (nm)	Excitation energies E (eV)
1	482.1 (HOMO -> LUMO)	2.571
2	456.6 (HOMO -> LUMO)	2.715
3	465.1 (HOMO -> LUMO)	2.666
4	476.3 (HOMO -> LUMO)	2.603
5	474.7 (HOMO -> LUMO)	2.612
6	462.4 (HOMO -> LUMO)	2.681

- a list of proposed compounds for synthesis with all the computed properties, ordered by the two type of activities: antioxidant and photochromic.
- a scientific paper sent for publication

Financed through/by

Romanian Ministry of Education and Research, CCCDI – UEFISCDI, project number PN-III-P2-2.1-PED-2019-3037

Research centre

Research Center for Chemistry and Engineering of Organic, Macromolecular and Natural Compounds

Research team

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- Lecturer Valentin BADEA, PhD
- Lecturer Anamaria TODEA, PhD
- Eng. Ionuț TĂNASE, PhD student
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CONTINUOUS-FLOW SYSTEM BIOREACTOR FOR THE ENZYMATIC KINETIC RESOLUTION OF NOVEL CHIRAL SECONDARY HETEROCYCLIC ALCOHOLS- PN-III-P2-2.1-PED-2019-3414

Goal of the project

The goal of the project is to develop a demonstration model for quantitative resolution of racemic mixture of novel secondary alcohols with biologic potential activity. The validation of the experimental system will be accomplished through the effective obtaining of the enantiomers in quantities of the order of grams whose biological activity will be evaluated and compared with that of the racemic mixture..

Short description of the project

The aim of this project is to develop, at laboratory scale, a continuous-flow system bioreactor for quantitative kinetic enzymatic resolution of racemic mixtures of novel chiral secondary heterocyclic alcohols, with potential biological activity, which will be synthesized within this project.

After the synthesis of the new secondary heterocyclic alcohols (R,S)-1-(aryl/methyl)-2-[(4,5-diaryl-4H-1,2,4-triazol-3-yl)thio] ethan-1-ols as racemate, optimal conditions of enzymatic kinetic resolution will be established for each substrate, using selected microbial lipases and various reaction media.

The realization of the enzymatic kinetic resolution will be done using a continuous flow bioreactor followed by the isolation and purification of the products with high enantiomeric purity.

The realization of the enzymatic kinetic resolution will be done using a continuous flow bioreactor followed by the isolation and purification of the products with high enantiomeric purity.

The validation of the experimental system will be accomplished through the effective obtaining of the enantiomers, whose biological activity, after assigning their absolute configuration, will be evaluated and compared with that of the racemic mixture where they come from.

Project implemented by

Politehnica University Timișoara

Implementation period

03.08.2020-29.07.2022

Main activities

Stage 1- Synthesis, purification and spectroscopic characterization of intermediates used to obtain new chiral heterocyclic secondary alcohols.

Activity.1.1. Synthesis, purification and spectroscopic characterization of the corresponding N-(aryl) hydrazine carbothioamides - Part 1.

Activity.1.2. Synthesis, purification and spectroscopic characterization of the corresponding 2-benzoyl-N-arylhydrazine -1-carbothioamides - Part 1.

Activity 1.3– Synthesis, purification and spectroscopic characterization of the corresponding 4-aryl-5-phenyl-4H-1,2,4-triazole-3-thiols - Part 1.

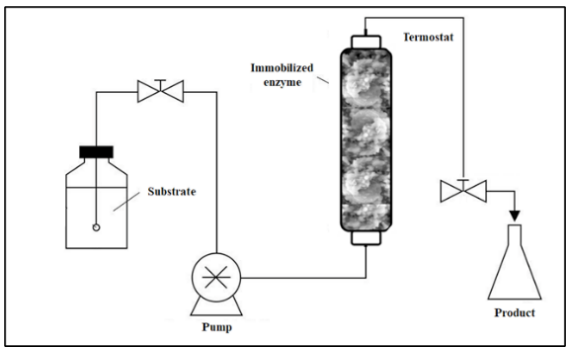

Figure 1. The proposed continuous flow system using packed-bed column bioreactor

Results

The results of the first stage were:

- development of an experimental synthesis protocol for N-(aryl) hydrazinecarbothioamide in gram amounts and spectroscopic characterization;

- development of an experimental synthesis protocol for benzoyl(acyl)-N-arylhydrazine-1-carbothioamide in gram amounts and spectroscopic characterization;

- development of an experimental synthesis protocol for 4-aryl-5-phenyl(alkyl)-4H-1,2,4-triazol-3-thiol in gram amounts and spectroscopic characterization;

- development of an experimental synthesis protocol for 1-(aryl)-2-[(4-aryl-5-aryl(alkyl)-4H-1,2,4-triazol-3-yl)thio]ethan-1-one in gram amounts and spectroscopic characterization.

Financed through/by

Research Centre in Organic, Macromolecular and Natural Compounds Chemistry and Engineering

Research centre

Research Centre in Organic, Macromolecular and Natural Compounds Chemistry and Engineering

Research team

- Project leader: Lecturer Dr. Eng. Valentin Badea
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- Lecturer Dr. Vasile Bercean
- Lecturer Dr. Eng. Anamaria Todea
- Lecturer Dr. Eng. Iulia Maria Păușescu
- Lecturer Dr. Eng. Valentin Laurențiu Ordodi
- Assis. Dr. Chem. Diana Maria Aparaschivei
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NEW SOL-GEL-MAGNETIC BIOCATALYSTS USED FOR THE ENZIMATIC HYDROLYSIS OF LIGNOCELLULOSIC BIOMASS

Goal of the project

The main goal of the project is the obtaining of new immobilized enzymatic biocatalysts, customized by new sol-gel entrapment techniques, used for the hydrolysis of certain types of lignocellulosic biomass.

Short description of the project

The major cause of environmental pollution is due to emissions generated by burning of fossil fuels. The known crude oil reserves are going to disappear in short time and the oil crisis in recent years, together with the rising of air pollution levels has shown the need for the replacement of fossil fuels with cleaner biofuels, obtained from a range of organic renewable raw materials.

The first step in conversion of lignocellulosic biomass is the pretreatment for the release of cellulose from the network formed with lignin and to increase the yield of fermentable sugars. There are many methods of pretreatment, but they are energy consumable and pollute the environment.

In this sense the project proposes an innovative approach on studies regarding biomass pretreatment and enzymatic hydrolysis of cellulose in an integrated system that can improve the exploitation of biomass components and the reuse of the biocatalyst. It is desired to provide novel biocatalysts, immobilized cellulases customized by new sol-gel entrapment techniques, used in the hydrolysis of certain types of lignocellulosic biomass.

By immobilization, stability and reusability of cellulases are significantly improved, a key issue for increasing the amount of fermentable sugars and to reduce process costs.

Figure 1. Types of lignocellulosic biomass (hard wood, soft wood, wheat straw, cardboard, mixture).

Project implemented by

Politehnica University Timişoara

Implementation period

15/09/2020-14/09/2022

Main activities

Stage 1 (2020) - Pretreatment of lignocellulosic biomass using unconventional methods.

Activity.1.1. Comparative evaluation of different pretreatment techniques.

Activity.1.2. Establishing the optimal conditions for the selected pretreatment techniques.

Results

The main results of the first stage were:

- the development of lignocellulosic biomass pretreatment protocols;
- the optimization of the enzymatic hydrolysis reaction parameters;
- the development of an optimized lignocellulosic biomass pretreatment protocol.

Also visit project website:
https://chim.upt.ro/ro/cercetare/proiecte-de-cercetare/248-pn-iii-p1-1-1-te-2019-1179

Financed through/by

Romanian Ministry of Education and Research, CNCS - UEFISCDI, project code PN-III-P1-1.1-TE-2019-1179, project number TE 94 / 2020 within PNCDI III

Research centre

Research Centre in Organic, Macromolecular and Natural Compounds Chemistry and Engineering

Research team

Project leader:

- Lecturer Ana Cristina PAUL, PhD

Researchers:

- Lecturer Gerlinde RUSU, PhD
- Lecturer DVM Simona MARC
- RA chem. Corina VASILESCU (PhD student)

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GREEN CHEMISTRY ROUTE FOR THE ENZYMATIC CASCADE SYNTHESIS OF BIODEGRADABLE OLIGOESTERS- PN-III-P1-1.1-TE-2019-1573

Goal of the project

The main goal of the project is to demonstrate a new concept for valorization of vegetable oils, mainly of castor oil by developing new oligo-esters containing -OH functions or aromatic rings, in a system of three cascade enzymatic reactions. The proposed reaction system involves an innovative three cascade reaction system catalyzed by two enzymes of different classes: (i) hydrolysis of triglycerides, (ii) glycerol oxidation and (iii) synthesis of oligoesters. The enzyme stabilization will be performed by covalent binding and the selectivity will be evaluated in terms of maximal catalytic efficiency, to increase the productivity of the process. The reaction products will be characterized in detail by several analytical techniques for structure confirmation and assessment of the physico-chemical properties and their biodegradability rate will be evaluated by two methods. The synthesized monomers and oligoesters will be used as starting materials for novel organogels preparation.

Short description of the project

The main objective of the project is to obtain new oligoesters in one-pot system starting from castor oil and bio-based furan monomers by a complete green route, using a combination of two enzymes. All the purposed reactions will be mediated by tailor-made immobilized enzymes that are non-toxic, recyclable and eco-friendly biocatalysts, by using green solvents or solventless systems. The resulted biodegradable oligoesters will present new functionalities and properties.

Project implemented by

Politehnica University Timişoara

Implementation period

15/09/2020-14/09/2022

Main activities

Stage 1 (2020) - Enzymatic synthesis and optimization of glycerol conversion in glyceric and tartronic acids.
Activity 1.1. Screening of laccases from different microbial sources in order to establish the types of products under different reaction conditions.
Activity 1.2. Screening of the initiator for the enzymatic oxidation reaction.
Activity 1.3. Characterization of reaction products by FT-IR and NMR methods
Activity 1.4. Tailor-made immobilization of laccases with high efficiency and stability for the synthesis of hydroxy acids derived from glycerol.
Activity 1.5. Characterization of the immobilized catalyst in terms of thermal stability, pH stability, reusability in several reaction cycles.

Figure 1. HPLC system for the analysis of reaction products (purchased using financial support from the project)

Results

The results of the first stage:
- Development of experimental methodology for enzymatic synthesis of glycerin acids using laccases.
- Development of the immobilization protocol for covalent binding of laccases.

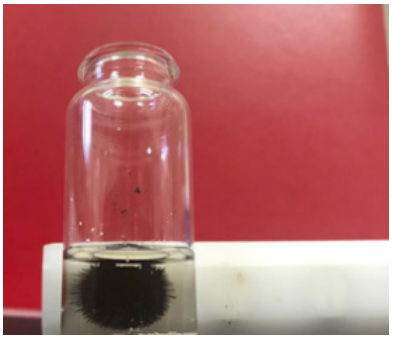

Figure 2. Laccase immobilized onto magnetic nanoparticles.

Visit also: http://chim.upt.ro/ro/cercetare/proiecte-de-cercetare/285-pn-iii-p1-1-1-te-2019-1573

Financed through/by

Romanian Ministry of Education and Research, CNCS - UEFISCDI, project code PN-III-P1-1.1-TE-2019-1573, project No. TE 101/2020, within PNCDI III

Research Centre

Research Centre in Organic, Macromolecular and Natural Compounds Chemistry and Engineering

Research team

Project leader:

- Ș.I. dr.ing. Anamaria Todea

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- Conf. dr. ing. Ionuț Valentin Ledeți
- Asist. dr. chim. Diana Maria Dreavă

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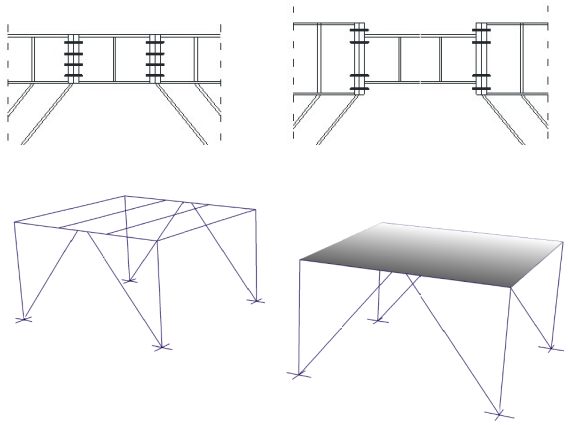
ADVANCING RE-CENTRING ECCENTRICALLY BRACED FRAMES: NEW LINK TYPOLOGIES AND INFLUENCE OF REINFORCED CONCRETE SLAB (ARNIS)

Goal of the project

To reduce the costs and downtime of a structure hit by an earthquake, removable links and re-centering capacity concepts may be implemented in a dual eccentrically braced structure. The project aims at extending the validation of re-centering capability and link replacement feasibility on extended end-plate typologies and also investigate more detailed the global and local influence of three-dimensional reinforced concrete slab panels, as well as reinforced concrete slab repair.

Short description of the project

It studies the re-centering capability using new link typologies and the concrete slab influence.



Project implemented by

Politehnica University Timișoara (UPT) – Civil Engineering Faculty – Steel Structures and Structural Mechanics Department

Implementation period

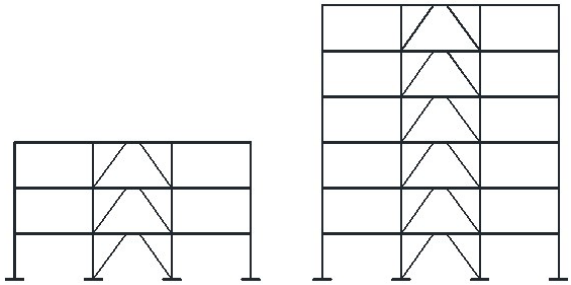
10.10.2018 – 09.10.2020

Main activities

- Designing prototype structures with two height levels: medium rise (P+2E) and higher rise (P+5E), with differently connected links (flush/extended end-plate), extending the bolted links removal procedure and re-centering capability – done in 2018;
- Experimentally testing isolated links assemblies in two solutions: flush end-plate bolted link and extended end-plate bolted link, at natural scale (1:1), both of them with and without concrete slab above the link (8 tests) – proposed for 2019;
- Experimentally testing a 3D portal frame, with/without concrete, with damaged/repaired slab (4 tests) – proposed for 2020;
- Calibrating numerical models post-test – proposed for 2019 and 2020;
- Seismic performance and behavior factors numerical assessment – proposed for 2020.

Results

In 2018 – prototype structures design, re-centering capability validation and link removal procedure description.



Proposed for 2019 and 2020:
- Design of experimental specimens;
- Material behavior curves;
- Links experimental results – describe local behavior;
- Frames experimental results – describe global behavior;
- Calibrated numerical models for links;
- Values of behavior factors for structures.

Obtained results will be presented in project deliverables and scientific papers at international conferences/journals.

Applicability and transferability of the results

Increase the application potential of the system both at national and international levels: by improved connections (larger behavior factor obtained), improved knowledge on the effect of reinforced concrete slab and repair of the slab.
Solutions providing self-centering of the structure are technically demanded and require specialized knowledge, careful maintenance and high initial cost. Alternatively, a conventional design can be employed, but with the dissipative members realized to be removable allowing their replacement when damaged and reducing the repair costs.

Financed through/by

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

Research centre

Research Centre for Mechanics of Materials and Structural Safety - CEMSIG

Research team

- Assist. Mirela Adriana CHESOAN, PhD (project manager)
- Assoc. prof. Aurel STRATAN, PhD

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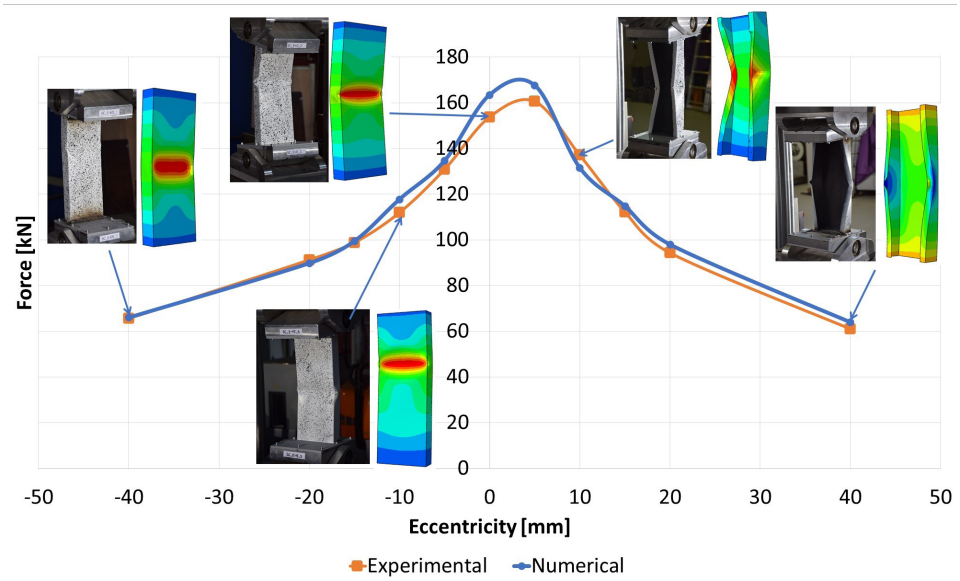
STRUCTURAL DESIGN TOOL FOR COLD-FORMED STEEL STRUCTURES (CFSEXPERT)

Goal of the project

The project will develop innovative design software tools for cold-formed steel members and structures. The calculation processes are prepared for practising engineers and integrated with easy-to-use modelling and analysis tools to provide complete design solutions.



Short description of the project

The project aims to develop a calculation core for the design of structures composed of cold-formed steel (CFS) members, which will be implemented in three different structural softwares: CFSExpert Structure, CFSExpert Member and CFSExpert Engine.

Project implemented by

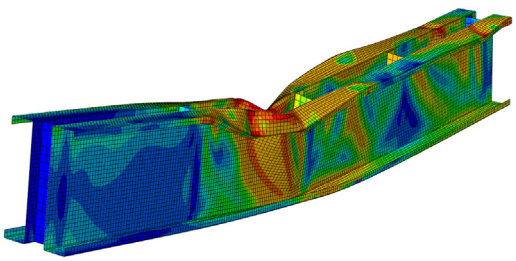
- ConSteel Solutions Ltd., Hungary
- GORDIAS Ltd., Romania
- Politehnica University of Timişoara, Romania

Implementation period

04.01.2020-31.12.2021

Main activities

- Review of existing analyses and standard design methods of CFS members and structures and identification of their limitations;
- Development of an advanced integrated analysis and of a design method for CFS members;
- Validation of the advanced CFS design methods via experimental and numerical tests;
- Experimental tests on:
  (1) minor and major eccentric compression of lipped channels;
  (2) back-to-back plain and lipped channels in bending;
  (3) Z-purlins with overlapping over intermediate supports and restrained by sheeting;
- Implementation of the advanced CFS design methods into a complete design package.



Results

The goal of the project is to develop straightforward software tools for engineers to use in their projects including cold-formed sections of general shape, according to a design based on Eurocode 3 – Part 1.3 concept.
The software is based on an innovative design process which integrates the specific modern mechanical analysis of CFS members (Constrained Finite Strip Method - cFSM) with existing and newly developed design procedures.
The software tools will be launched at three levels for different types of target users having the same calculation core including the developed new innovative design methodology.
The main R&D result of the project is in this special calculation core, but for the support of an efficient marketing and sales process it is also aimed to implement it into three different types of software realization.
The CFSExpert Structure is a design package implemented into the ConSteel 3D analysis and design software as an additional module for the design of cold-formed sections within a general 3D steel structural model.
The CFSExpert Member is a stand-alone software configuration to handle a single element, with simply supported or continuous statical system, with specific graphical input and output features limited to cold-formed profiles.
The CFSExpert Engine is a "black-box" calculation engine, without graphical user interface, but having standard easy-to-use input-output interface suitable for implementing into any existing or new-to-develop specific design software tools.

Applicability and transferability of the results

The CFSExpert software packages will fill a market gap of missing complete design tools supporting the complex design of CFS structures accordingly we expect great interest from structural engineering companies.
The companies already having CFS products can accelerate their design process and widen their product range using this software. The greater part of our possible market consists of those companies which realize new possibilities in using CFS in their structures by using this software.

Financed through/by

This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number EUROSTARS-2019-E!113493 – CFSExpert, within PNCDI III

Research centre

- Research Center for Mechanics of Materials and Structural Safety (CEMSIG),
- Politehnica University of Timişoara

Research team

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- Sen. lect. Ioan BOTH, PhD
- Sen. lect. Mircea BURCĂ, PhD
- Florin BODEA, PhD stud.
- Andrei GÎRBACEA, PhD stud.
- Antonio Andrei CRISTIAN, PhD stud.

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SAFETY OF BUILDING WALLS AND CLADDINGS AGAINST ACCIDENTAL EXPLOSIONS SAFE-WALL

Goal of the project:

Explosions produced in urban or industrial areas are low-probability but high-impact events. When they occur in the immediate vicinity of buildings or other constructions, the explosions can pose a high risk to the structural resistance and to the occupants (risk of injury or death).
The goal of this project is to provide more robust envelope solutions for the protection of occupants against the direct effects (pressure wave) and secondary hazards (local failures, fragmentation, flying debris) resulting from an explosion.

Short description of the project

The demonstration-building model includes several typologies of wall elements attached to a 3D steel frame structure. The building is tested against far-field and near-field explosions. The fixing/ anchoring systems of the walls to the building are also investigated to validate their performance under extreme loading.

Project implemented by

The project is implemented by a partnership between:

- Politehnica University Timisoara UPT, project coordinator Prof. dr.ing. Florea Dinu;
- National Institute for Research and Development in Mine Safety and Protection to Explosion INSEMEX Petrosani, responsible ing. Robert Laszlo;
- Technical University of Cluj-Napoca UTCN, responsible SL.dr.ing. Mihai Senila.

Implementation period

2020 – 2022

Main activities

WP1: Preliminary analyses, design and fabrication of experimental specimens

- Preliminary analysis of building envelope under external explosions
- Design of experimental full-scale wall specimens for explosion tests, substructure specimens for static test, and small-scale specimens from materials and components
- Fabrication of full-scale specimens, material coupons and connection components

WP2: Experimental program

- Experimental tests on materials and components
- Full-scale static tests on wall sub-structures
- Full-scale blast tests on wall-frame structure systems

P3: Validation of a full-scale building envelope under blast loading in laboratory environment

- Validation of full-scale blast test model in laboratory environment
- Numerical simulations on external wall systems with enhanced protection against explosive threats

WP4: Project management and dissemination

Results:

Preliminary analysis

Preliminary numerical simulations were performed on the full-scale building model to determine the explosion parameters (incident and reflected pressure/impulse) as a function of explosive charge size and position (see Fig. 1).

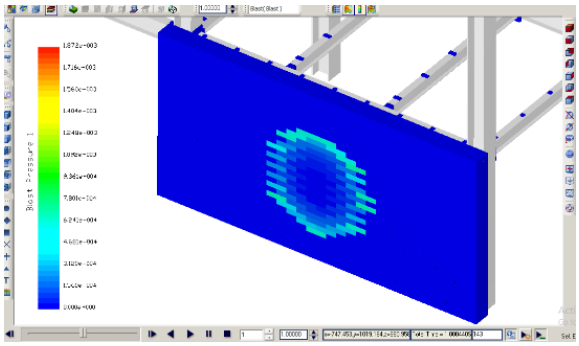
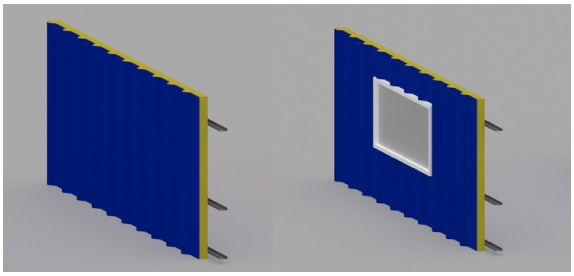


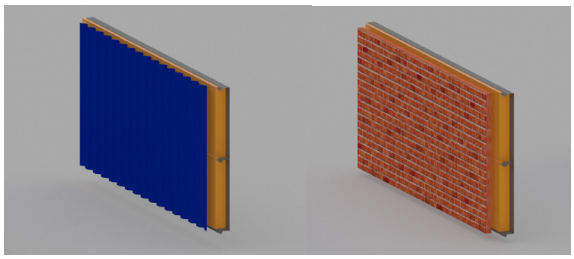
Fig. 1 Pressure distribution on the front wall from a charge located of 1.00 m

Design and fabrication of experimental specimens

The design of the wall specimens was done considering the non-accidental load requirements (dead load, wind load, others). The expected pressure/impulse from blast was used to evaluate the most probable damage level under the explosion. Four types of most common solutions were considered, see Fig. 2. The wall system will be mounted on an existing 3D steel frame structure, see Fig. 3 and Fig. 4. Static tests will be performed on similar wall elements to determine the capacity under normal loading conditions, see Fig. 5).



a)



b) c)

Fig. 2 Wall systems:

a) multi-skin sandwich panels with horizontal lipped rails (with and without windows);
b) multi-skin wall, with liner tray (cassette), insulation and outer steel cladding;
c) multi-skin wall, with liner tray (cassette), insulation and brick cladding

Fig. 3 Existing 3D steel frame structure

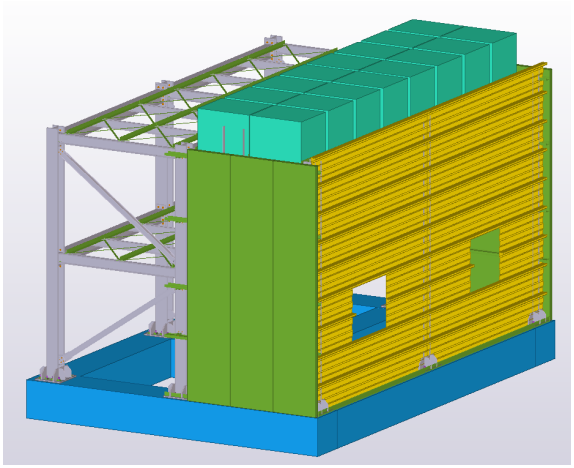


Fig. 4 The 3D frame model with the facade system for blast test

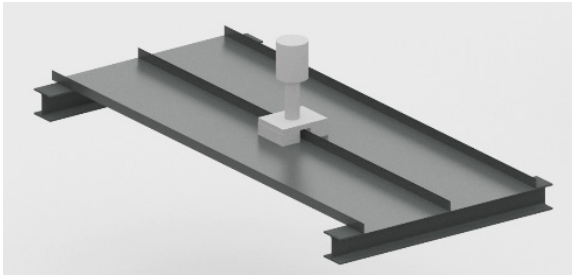


Fig. 5 Static test on wall elements

Applicability and transferability of the results

- Experimental validation of the response of an integrated building system in laboratory environment represents the bridge from the scientific research to the practical application (structural engineering).
- The qualification of acceptance criteria for wall components and connections under blast loading environment is an important step toward the codification and implementation of such systems in practice, guarantying improved performance and capacity to provide protection in case of extreme events.

Financed through/by

Romanian National Authority for Scientific Research and Innovation, project number PN III 279PED/2020 (PN-III-P2-2.1-PED-2019-1765), Safety of buildings walls and claddings against accidental explosions SAFE-WALL (2020-2022).

Research centre

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

Research team (from UPT)

- Prof.dr.ing. Florea DINU (Coordinator)
- Prof.dr.ing. Dan DUBINA, member of the Romanian Academy
- Prof.dr.ing. Viorel UNGUREANU
- Prof.dr.ing. Adrian CIUTINA
- Prof.dr.ing. Daniel GRECEA
- SL.dr.ing. Calin NEAGU
- SL.dr.ing. Ioan MARGINEAN
- Drd.ing. Jakab DOMINIQ
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INTELLIGENT CONTROL SYSTEMS WITH GENERALIZABLE BEHAVIOUR FROM LEARNED PRIMITIVES

Goal of the project

The project proposal aims at the continuous development of a hierarchical primitives-based learning concept for intelligent control systems (CSs). The idea is to induce feedback CSs with a generalization capability towards tracking tasks, inspired by intelligent living beings who can extrapolate learned optimal behavior to new unseen tasks without learning by repetitions. The framework operates on three levels. The project's main goals are: to improve existing issues and to experimentally validate the hierarchical learning framework on different ubiquitous tracking tasks.

Short description of the project

The framework operates on three levels:
L1) low level feedback CS design in model-free style to ensure reference tracking, disturbance rejection and indirect CS linearization;
L2) learning tracking tasks (in terms of CS reference input + controlled output pairs, called primitives) by repeated executions via data-driven Iterative Learning Control (ILC), over the feedback CS, in terms of a given optimal criterion;
L3) extrapolate the learned optimal tracking behavior to new tracking tasks, without needing repetitions.

Project implemented by

Assoc Prof. Mircea-Bogdan RĂDAC, PhD
Eng. Alexandra-Bianca BORLEA
Eng. Timotei LALA

Main activities

Main improvement activities are centered around making the above framework impactful, by:

a) ensure strong CS linearization at lower level, in an output reference model tracking problem setting, since the generalizability of the learned tracking behavior relies on the superposition principle of the linear CS;

b) ensure learning convergence at level L2 via ILC, while reducing the number of dedicated gradient experiments;

c) deal with tracking tasks of different time lengths (shorter/longer) than that of the learned primitives and with operational constraints.

Results

Development of a hierarchical learning framework that is able to generalize an optimally learned behavior to new unseen tasks.
The publication of papers in leading journals, participation and presentation of papers in international academic conferences, three scientific reports (two intermediate and a final one).

Applicability and transferability of the results

Validation of the proposed framework on a diversity of systems is expected to open new application areas to the next generation of autonomous, adaptive and intelligent planning and control systems (possible applications in UAVs and drones maneuvering, autonomous driving, robotic arms).

Financed through/by

UEFISCDI PN-III-P1-1.1-TE-2019-1089, 2020-2022

Implementation period

01.09.2020 – 31.08.2022

Research Centre

Department of Automation and Applied Informatics

Research team

- Assoc. Prof. Mircea-Bogdan RĂDAC, PhD
- Eng. Alexandra-Bianca BORLEA, MSc
- Eng. Timotei LALA

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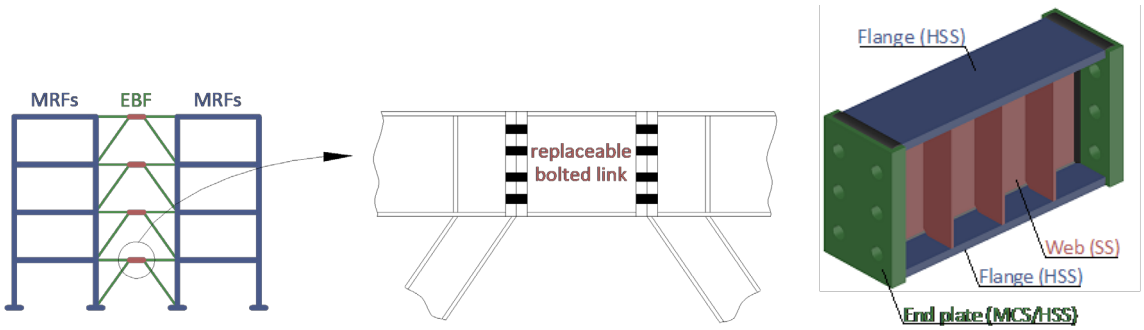
HYBRID REPLACEABLE LINKS FROM STAINLESS AND HIGH-STRENGTH STEEL (HYLINK)TREATMENT

Goal of the project:

The project aimed at development of a novel hybrid stainless steel replaceable link for re-centring eccentrically braced frames. Considering that the ductility of the replaceable link and the adequate resistance of the bolted connection are key requirements for the global seismic performance of the system, the goal of the project consists in numerical and experimental investigations of the hybrid link behaviour, in order to assess the benefits induced by the use of high-performance steels.

Short description of the project

The project aims at investigating numerically and experimentally a novel link, fabricated from high-performance steel.



Project implemented by

- Universitatea Politehnica Timișoara (UPT)
- National R&D Institute for Welding and Material Testing (ISIM)

Implementation period

2020 – 2022

Main activities

- Development of welding processes for joining dissimilar steels: stainless steel to high strength steel (SS/HSS), stainless steel to mild carbon steel (SS/MCS) and mild carbon steel to high strength steel (MCS/HSS).
- Characterisation of low-cycle fatigue (LCF) behaviour of stainless steel (SS), high strength steel (HSS) and mild carbon steel (MCS).
- Characterisation of low-cycle fatigue (LCF) behaviour of welded joints with dissimilar steel SS/MCS and SS/HSS.
- Experimental validation of inelastic cyclic performance of hybrid replaceable links.
- Development of a design recommendations for hybrid replaceable links.

These specific objectives will be accomplished through numerical and experimental investigations on low cycle fatigue response of materials, welded joint components and structural components (hybrid links).

Results

Result indicators which quantify the project achievements:

- Development of informative documents, research reports and design guidelines for hybrid replaceable links;
- Project outcomes will be disseminated through publication in conference proceedings and journal papers;
- Dissemination of project results through the website with free access to the users.

Applicability and transferability of the results

Considering that the potential for using austenitic stainless steel in applications requiring large ductility has been previously recognised, the present research project aims at promoting stainless steel for a wider adoption in structural applications.

Financed through/by

This work is supported by a grant of the Romanian Ministry of Education and Research, CCCDI - UEFISCDI, project number PN-III-P2-2.1-PED-2019-5427, within PNCDI III.

Research Centre

The Research Centre for Mechanics of Materials and Structural Safety – CEMSIG

Research team

- Prof. Aurel STRATAN
- PhD student Anna PRODAN
- Lect. Ioan BOTH
- Acad. Dan DUBINA

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NEW HYBRID DC-DC SWITCHING CONVERTER FAMILIES WITH APPLICATIONS IN BATTERY CHARGING SYSTEMS FOR ELECTRIC VEHICLES AND SOLAR ENERGY CONVERSION

Goal of the project

The project proposes three new dc-dc hybrid converter families suitable for solar energy processing and battery charging systems.

Short description of the project

Synthesis, analysis, simulation and practical validation of three new hybrid converter families with emphasis on two topologies from each family.
Therefore, in total 6 new converters will be investigated.
Two converters out of the six will be used for energy conversion in two applications: a battery charging system from the single phase mains as a solution in automotive industry and a solar energy conversion system comprising a PV panel and also including MPPT control.

Project implemented by

Politehnica University Timişoara
Department of Applied Electronics,
Project Director:
Ioana-Monica POP-CĂLIMANU

Implementation period

01.09.2020-28.02.2022

Main activities

A1. Ć-SC family. Theoretical development of the Ć-SC family. Topologies operation validation by simulation and experimental prototypes for 2 converters.

A2. S-SC family. Theoretical development of the S-SC family. Converters operation validation by simulation and hardware test for 2 converters.

A3. SN-SC family Theoretical development of the SN-SC family. Topologies validation by simulation and experimental prototypes for 2 converters.

A4. Comparative study of the 6 new developed topologies and final decision about the converter that is best suited in the battery charging system and in the solar energy system.

A5. Battery charger system based on the proposed converter topology. Design of the current mode control and charging profiles. Measurements and evaluation of the system performance.

A6. Design and practical implementation of the solar energy conversion system and its MPPT control; LabView programs for long term monitoring of system behavior in different environmental conditions.

Results

In the first year of the project 3 papers were published in the following journal and international conferences:

1. Pop-Calimanu I-M, Balint M, Lascu D. A New Hybrid Ćuk DC-DC Converter with Coupled Inductors. Electronics. 2020; 9(12):2188. https://doi.org/10.3390/electronics9122188

2. I. -M. Pop-Calimanu, C. Alexandru-Adrian and M. Pop-Calimanu, "A New Quadratic Step-Down Converter," 2020 International Symposium on Electronics and Telecommunications (ISETC), Timisoara, Romania, 2020, pp. 1-4, doi: 10.1109/ISETC50328.2020.9301118

3. G. -M. Jude, I. -M. Pop-Calimanu and F. Renken, "A New Step-Up Converter With Coupled Inductor," 2020 International Symposium on Electronics and Telecommunications (ISETC), Timisoara, Romania, 2020, pp. 1-4, doi: 10.1109/ISETC50328.2020.9301041.

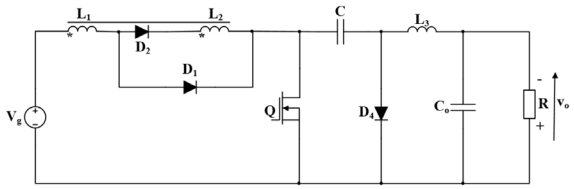

Fig. 1. The novel proposed hybrid Ćuk-type dc-dc converter with coupled inductors.

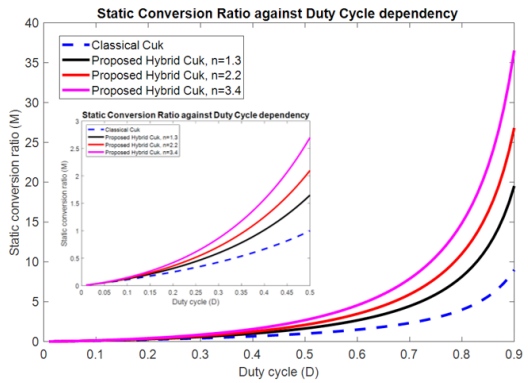

Fig. 2. Static conversion ratio against duty cycle

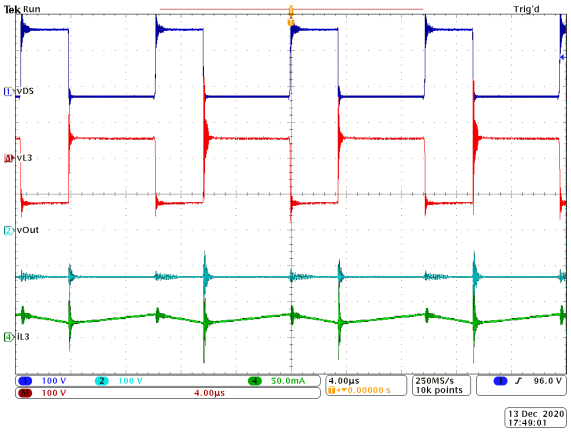

Fig. 3. Main waveforms

Applicability and transferability of the results

- Charging system for electric vehicles
- Solar energy processing and possible integration in Smart Grids and Smart Homes -
- Implementation in the automotive industry – Continental Automotive Timisoara or Vitesco Technology Engineering Romania

Financed through/by

Unitatea Executiva pentru Finantarea Invatamantului Superior, a Cercetarii, Dezvoltarii si Inovarii (UEFISCDI) Programul 1 - Dezvoltarea sistemului național de cercetare-dezvoltare
Subprogramul 1.1 - Resurse umane/Proiecte de Cercetare Postdoctorală, PN-III-P1-1.1-PD-2019, 184450 RON.

Research Centre

TIntelligent ElectronicSystems
https://erris.gov.ro/Centrul-de-Cercetari-SEI

Research team

Project Director:
- Ioana-Monica POP-CALIMANU
Mentor:
- Dan-Florentin LASCU

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GETICA-INTELLIGENT, INDEPENDENT AND AUTOMATED GREENHOUSE WITH SELECTIVE ABSORPTION OF SOLAR RADIATION USING DYE-SENSITIZED SOLAR CELLS (DSSCS)

Goal of the project

For the first time, GETICA project proposes to develop and validate an energy independent and combined fully automated greenhouse standalone prototype based on DSSCs.
Our team aims to implement a completely autonomous greenhouse in which plants can grow without human intervention. Moreover, it will be sought reducing production cost of the greenhouse using 3D printing of the modular roofs and a low-cost maintenance given by near zero energy input from conventional sources and decreasing the water consumption in irrigation.
In this context, GETICA project aims to demonstrate the economic sustainability of this smart greenhouse based on DSSC in the real agriculture.

Short description of the project

Our project involves the implementation of a prototype for an autonomous greenhouse that can provide all the necessary conditions for a proper growth of plants without the need for human intervention.
For this, the greenhouse has numerous sensors that record and analyze environmental conditions such as temperature, humidity, wind speed and direction, etc.
Depending on the data read from the sensors, the necessary measures will be taken in order to ensure the suitable environmental conditions for the plants (irrigation pumps or fans can be started, the roof can be closed or opened).

Project implemented by

- National Institute for Research and Development in Electrochemistry and Condensed Matter
-Faculty of Electronics, Telecommunications and Informational Technologies, Politehnica University Timișoara
- SYMPH ELECTRONICS

Implementation period

17.11.2020 – 31.10.2022

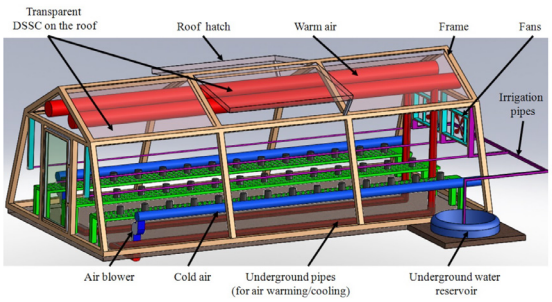
Main activities

The main activities in our project are:

- Define a block diagram for the greenhouse
- Establish the environmental conditions that must be monitored
- Establish the optimal dimensions for the greenhouse
- Design the resistance structure of the greenhouse
- Design the roof of the greenhouse
- Find methods to reduce manufacturing costs and maintenance costs
- Greenhouse implementation
- Control unit implementation
- Thermal simulation of photovoltaic cells

Results

The proposed greenhouse has transparent DSSC on the roof, fans, irrigation pipeline, underground pipelines, air blower, etc.



Applicability and transferability of the results

The implemented prototype offers an intelligent system for autonomous plant growth and for their monitoring using various sensors to record environmental conditions.
Moreover, our solution reduces the manufacturing costs and the maintenance costs.

Financed through/by

Ministery of Research and Innovation, CNCS - UEFISCDI,
Project number: PN-III-P2-2.1-PED-2019-2091

Research Centre

Politehnica University Timișoara (UPT)
Department of Applied Electronics

Research team

- Prof. univ. GONTEAN Aurel – Ștefan
- Eng. RICMAN Radu
- Eng. COVACI Corina
- Eng. ILIEȘ Elisei Ștefan
- Student MARINCA Magdalena Patricia

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RANGE OF PROTOTYPES OF AUTOMATIC CAPACITIVE COMPENSATORS DESIGNED TO IMPROVE THE POWER FACTOR AND LOAD BALANCING IN LOW VOLTAGE ELECTRICAL NETWORKS

Goal of the project

The project aims at two of the most important measures to increase the performance of electrical power distribution networks: reactive power compensation and load balancing. The aim of the project is to raise the level of technological maturity from TRL4 to TRL6 of an innovative load balancing solution in three-phase low voltage distribution networks, by using an automatically unbalanced capacitive compensator. It allows the two goals to be achieved simultaneously: improving the power factor and balancing the equivalent load.

Short description of the project

Currently the solution is materialized in the form of a demonstrative experimental model, successfully completed through a previous partnership between UPT (coordinator) and ICPE (partner).
https://www.sites.google.com/site/caeredjt/

Project implemented by

- ICPE S.A. of Bucharest – coordinator;
- Politehnica University of Timisoara – partner.

Implementation period

May 2020 – April 2022

Main activities

Starting from the identification of this innovative product as having a significant market potential, ICPE is this time the project coordinator and aims to develop it together with the same partner, UPT, to the prototype level. The new project mainly contains industrial research activities:

- transfer of intellectual property rights from UPT to ICPE;
- technical and economic analysis followed by the design, construction and commissioning of a range of prototypes (real-scale compensators) with rated reactive powers of 50, 150, 250 kvar;
- testing the range of prototypes in operating conditions similar to the real ones;
- optimization of algorithms to improve functional characteristics;
- validation of the components of the prototype range.

Results

The first stage (May 2020 - Dec. 2020) entitled "Studies on constructive solutions and trends for establishing new solutions for automatic capacitive compensator" has as main activities the choice of new solutions for automatic unbalanced capacitive compensator and testing of experimental models of assemblies and subassemblies in order to validate the proposed solutions. The results of this first stage are the following:

1.Study on constructive solutions and trends;

2.Design experimental models for assemblies and subassemblies;

3.Txperimental models for assemblies and subassemblies;

4.Test results of experimental models for assemblies and subassemblies; .

Applicability and transferability of the results

The market segment initially targeted by the new product is that of customers in the category of electrical power distribution operators. The large-scale installation of balancing capacitor banks in secondary distribution networks will make a massive contribution to reducing their own technological consumption and increasing the quality of electrical power supplied to consumers. As the benefits of the new product become known to more and more customers, as the quality of electrical power supplied in secondary distribution networks depreciates, more and more distribution operators and large consumers of electrical will be forced to adopt methods and means of limiting asymmetry disturbances and so the new product will impose itself on the market as the optimal solution.

Financed through/by

The Government of Romania, Ministry of Education and Research, through Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI) National Plan for Research - Development and Innovation for the period 2015-2020 (PNCDI III), project code: PN-III-P2-2.1-PTE-2019-0694 contract no. 41PTE/2020

Research Centre

Analysis and Optimization of Operating Regimes of Electrical Power Systems

Research team

UPT - partner

- Adrian PANĂ – in charge
- Florin MOLNAR-MATEI
- Alexandru BĂLOI
- Attila SIMO
- Ilona BUCATARIU
- Felicia BĂLOI
- Raul-Cristian ROMAN
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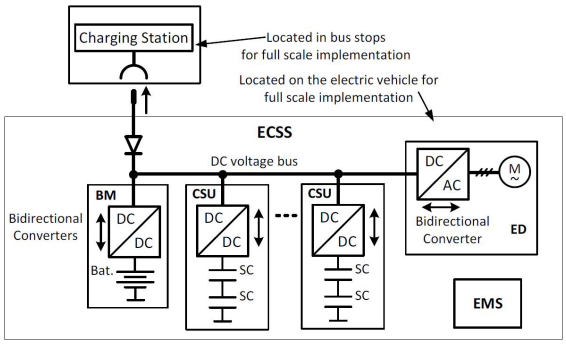
ENERGY CONVERSION SYSTEM FOR AN ELECTRIC CITY BUS/MICROBUS, WITH SUPERCAPACITOR ENERGY STORAGE AND SUPERHIGH POWER DENSITY DRIVE (ECON-BUS)

Goal of the project

The project main objective is to develop a small-scale laboratory demonstration model of an energy conversion and storage system for a public transport electric vehicle (bus / minibus), which is charged during stopping at stations. The system will be composed of a high torque density electric drive, powered by a high power density inverter associated with an energy storage unit based on supercapacitor cells, charged/discharged by DC-DC converters connected to a common voltage bus.

Short description of the project

The laboratory demonstration model of the energy conversion and storage system is designed and implemented based on preliminary research and digital simulation results. The model is validated in various operating modes, through extensive experimental tests. The dissemination of the obtained results is considered in order to find companies interested in potential industrial implementation.



Project implemented by

- Romanian Academy, Timisoara branch (Coordinator) &
- University Politehnica of Timisoara (Partner)

Implementation period

17/08/2020 – 15/04/2022

Main activities

- Development and test of the simulation models for the system components (2020)
- Extensive simulation testing of the entire conversion and storage system (2020)
- Design of the energy conversion and storage system (2021)
- Implementation of the demonstration model (2021)
- Design and implementation of the test bench for the demonstration model (2021)
- Extensive testing of the demonstration model (2021/2022)
- Patenting (2021/2022)
- Dissemination of the project results in scientific and academic environment (2021/2022)
- Industrial, scientific and in mass-media results dissemination (2021/2022)

Results

In the first stage of the project (2020) the individual simulation models of the electric drive system and of the DC-DC converter used for charging/discharging supercapacitors were developed and tested, as well as a model for determining the global power and energy data, for the energy conversion and storage system.
The electric drive simulations were carried out for both the 1: 1 scale (100kW) and the reduced 1:20 scale (5kW) that will be used to implement the laboratory demonstration model.
Two topologies were evaluated for the DC-DC converter. As with the electric drive, the design and simulation data were obtained for 1:1 scale (100kW) and for 1:20 scale (5kW).
All simulation results showed that the selected electric drive and both DC-DC converter are suitable for the application.

Applicability and transferability of the results

An important component of the project is the activity of disseminating the results, which will be done in the final stage. In addition to transferring essential information related to the obtained results to the scientific and academic community, detailed test reports will be submitted to the industry. If there will be no conditions for industrial implementation, the project research team will consider obtaining a new research grant to bring the TRL to a higher level.

Financed through/by

PNCDI III, Contract no. 307PED/2020; project code PN-III-P2-2.1-PED-2019-5230

Research Centre

Research Centre for Smart Energy Conversion and Storage

Research team

- Prof. Nicolae Muntean
- Acad. Ion Boldea
- Prof. Nicolae Tutelea
- Prof. Gheorghe-Daniel Andreescu
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- Assist. Prof. Ana Popa
- Assist. Dan-Cornel Hulea
- Assist. Liviu-Danut Vitan
- Assist. Adrian Martin
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SMART MICROACTUATORS WITH LAYER-OPTIMIZED ARCHITECTURE - SMAL

Goal of the project

The SMAL Project aims to use the models developed in our research group for bimorph and trimorph architectures with at least one layer that undergoes a temperature-dependent phase transformation, in order to manufacture cantilever-type microactuator demonstrators with enhanced displacement, for use in micro electromechanical systems.

Short description of the project

The project aims to generate sensing and actuation at micro and nano level by taking into account the change in the thermoelastic properties during a phase transformation in active layer(s). The materials considered as phase transformation active layers are shape memory alloys, that will be deposited by magnetron sputtering in various bi and multimorph layered architectures. The stress developed in such cantilever-type architectures is reflected in the actuation by bending (which depends on the thermoelastic properties of the shape memory alloy layer(s) and the one(s) of the passive (non-transforming) layer, usually used as a substrate. The demonstrators will be manufactured in bimorph and trimorph architectures and will be tested to determine the materials integrity as well as the functional output (e.g. actuation and curvature) with the results used for further optimization.

Implementation period

2020-2022

Main activities

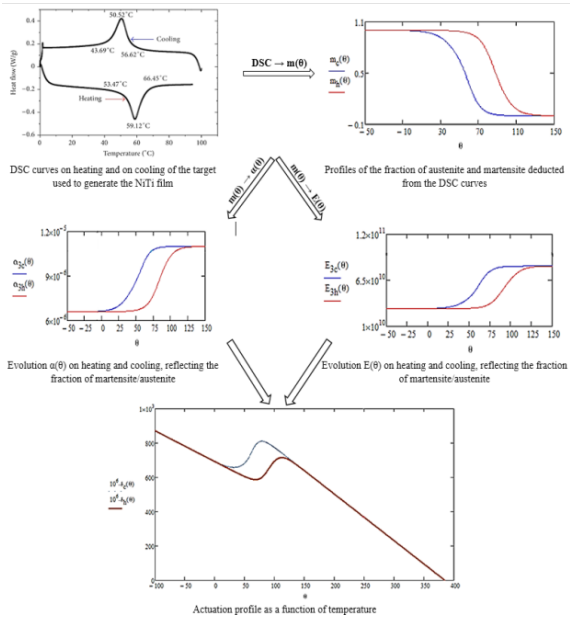
The demonstrators will be manufactured based on the analysis of the models developed by the members of the project team. The design of the bimorphs will be made in various architectures, with different deposition temperatures in order to verify the models over a larger temperature range. Magnetron sputtering will be used to generate the shape memory alloy films on several substrates, thus expanding the range of thermoelastic stresses that can be generated in the selected architectures (film/substrate). Multilayers will also be designed, taking into account the corresponding phase transformation features for each layer (e.g. transformation temperatures).

Project implemented by

Politehnica University Timisoara, Romania

Results

Models developed for analysis of different architectures based on shape memory alloy films.



Applicability and transferability of the results

The technical solutions developed in the project have the potential to be applied the micro-opto-electro-mechanical systems.

Financed through/by

PN-III-P2-2.1-PED-2019-0619-1

Research Centre

Smart Materials and Structures Laboratory
https://eeris.eu/ERIF-2000-000R-4315

Research team

Politehnica University Timisoara:

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THE RELATIONSHIP BETWEEN ENERGY INVESTMENTS, SHOCKS IN ENERGY PRICES AND THE MACROECONOMY IN THE EU COUNTRIES - EIP-MACRO

Goal of the project

Energy prices record high fluctuations increasing market uncertainty. The central role of oil prices in influencing consumption, investments and macroeconomic policies requires special attention. In this context, the main goals of the project are: (i) to analyse the investment behaviour and TFP of energy sector companies using firm-level data; (ii) to investigate the non-liner interactions between oil prices and the macroeconomy; (iii) to assess the environmental impact of energy policies, EU regulations and renewable energy consumption.

Short description of the project

The project aims to provide a deeper understanding of the energy and environmental economics issues, analyzing the interactions between energy prices and the macroeconomy.

Project implemented by

Politehnica University of Timisoara

Implementation period

02.05.2018 – 30.04.2020

Main activities

a) Development of research on three directions:
- determinants of investments and TFP of energy companies
- macroeconomic impact of oil price shocks
- environmental impact of energy policies.

b) Econometric analyses and generation of results

c) Dissemination of results in conferences and high-ranked journals.

Results

a) 3 Research stages for young researchers (University of Poitiers, University of Augsburg, International School for Social and Business Studies)

b) 11 Conference participations

c) 1 organized research workshop
https://sites.google.com/view/infer-timisoara-2019/home.

d) 11 ISI journal papers:

1. Grecu, E., Aceleanu, M.I. and Albulescu, C.T. (2018). The economic, social and environmental impact of shale gas exploitation in Romania: A cost-benefit analysis, Renewable and Sustainable Energy Reviews, 93, 691-700. (Q1)
2. Albulescu, C.T. and Pépin, D. (2018). Monetary integration, money demand stability and the role of monetary overhang in forecasting inflation in CEE countries, Journal of Economic Integration, 33(4), 841-879 (EMCI).
3. Albulescu, C.T., Kang, S.H., Tiwari, A.K. and Yoon, S-M. (2019). FDI, income, and environmental pollution in Latin America: Replication and extension using panel quantiles regression analysis, Energy Economics, 84, Article 104504. (Q1)
4. Kang, S.H., Tiwari, A.K., Albulescu, C.T. and Yoon, S-M. (2019). Exploring the time-frequency connectedness and network among crude oil and agriculture commodities V1, Energy Economics, 84, Article 104543. (Q1)
5. Albulescu, C.T., Riza, D., Raheem, I.D. and Tiwari, A.K. (2019). Does economic policy uncertainty connect financial markets? Evidence from oil and commodity currencies, Energy Economics, 83, 375-388. (Q1)
6. Tiwari, A.K., Adewuyi, A.O., Albulescu, C.T. and Wohar, M.E. (2020). Empirical evidence of extreme dependence and contagion risk between main cryptocurrencies, The North American Journal of Economics and Finance, 51, 101083. (Q3)
7. Grecu, E., Albulescu, C.T., Pârțachi, I.P., Stancu, S. and Trașcă, D.L. (2020). Output, uncertainty and fuel prices in the EU countries, Economic Computation and Economic Cybernetics Studies and Research, 1, 15-30. (Q3)
8. Albulescu, C.T., Artene, A.E., Luminosu, C.T. and Tamasila, M. (2019). CO2 emissions, renewable energy production and environmental regulation in the EU countries, Environmental Science and Pollution Research, 27, 33615-33635 (Q2)

9. Albulescu, C.T., Bouri, E., Roubaud, D. and Tiwari A.K. (2020). Quantile causality between banking, stock and real estate securities returns in the US, The Quarterly Review of Economics and Finance, 78, 251-260 (Q3)
10. Albulescu, C.T., Tiwari, A.K., Ji, Q. (2020). Copula-based local dependence between energy, agriculture and metal commodity markets, Energy, 202, 117762 (Q1)
11. Albulescu, C.T., Oros, C. (2020). Inflation, uncertainty and labor market conditions in the US, Applied Economics, 52, 5770-5782. (Q3)

e) 2 book chapters

1. Sirbu, R.M., Albulescu, C.T. (2020). Carbon emissions, energy consumption and managing investment in renewable energy, in: Innovation in Sustainable Management and Entrepreneurship, G. Prostean, J.J.L. Villahoz, L. Brancu, G. Bakacsi (eds.), Publisher: Springer, 14, ISBN 978-3-030-44710-6.
2. Albulescu, C.T., Miclea, S., Tamasila, M., Vartolomei, M. (2020). Financial Constrains and the Structure of the Firm's Investment: An Application to the Scientific R&D Industry from the Largest EU Countries, in: Innovation in Sustainable Management and Entrepreneurship, G. Prostean, J.J.L. Villahoz, L. Brancu, G. Bakacsi (eds.), Publisher: Springer, 18, ISBN 978-3-030-44710-6.

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 have both a micro- and a macro-level applicability. In the first case, the strategic management of companies activating in the energy field will benefit from a deeper understanding of elements influencing the level of investment in the industry. In the second case, national and international regulators and policy makers receive information about the impact of shocks in energy prices on inflation and exchange rate, but also about the effectiveness of environmental regulation and the role of renewable sources in reducing CO2 emissions at EU level.

Research Centre

Research Center in Engineering and Management

Research team

- Prof. Claudiu ALBULESCU, PhD (Principal Investigator)
- Lect. Alin ARTENE, PhD
- Lect. Caius LUMINOSU, PhD
- Lect. Şerban MICLEA, PhD
- Maria BOATCĂ-BARABAŞ, PhD student
- Roxana SÎRBU, PhD student

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ECONOMIC POLICY UNCERTAINTY, ENVIRONMENTAL AND ENERGY POLICIES AND THEIR MACRO-FINANCIAL IMPLICATIONS IN THE EU - EPUEER-MFI

Goal of the project

As a response to growing environmental concerns, the interest for identifying the economic elements that prevent the environmental degradation increased. At the same time, the economic and financial impact of environmental and energy policies gained the interest of researchers and policy makers. Against this background, the purpose of this project is to investigate how the policy-induced economic uncertainty impacts the producers, consumers and portfolio investment behavior, influencing thus the relationship between environment, energy use and macro-financial variables.

Short description of the project

The project aims to test the connection between policy uncertainty, energy and finance, considering their environmental impact

Project implemented by

Politehnica University of Timisoara

Implementation period

01.09.2020-31.08.2022

Main activities

a) Development of research on three directions:

(i) the impact of uncertainty and energy security on oil and financial assets prices connection,

(ii) the role of environmental regulations and renewables on carbon emissions,

(iii) the effect of policy-induced uncertainty and energy price shocks on bank stability.

b) Literature review and data collection

c) Econometric analyses and discussions on empirical results

d) Dissemination of results in conferences and high-ranked journals.

Results

a) 5 papers under review in ISI journals, out of which, 3 accepted papers:

1. Albulescu, C.T. (2020), COVID-19 and the United States financial markets' volatility, Finance Research Letters. (Q1)
2. Albulescu, C.T., Miclea, S. (2020), How does the national human capital index influence the total factor productivity of the Romanian R&D firms? Human Systems Management. (ESCI)
3. Albulescu, C.T., Mina, M., Oros, C. (2020), Oil-US Stock Market Nexus: Some insights about the New Coronavirus Crisis, Economics Bulletin. (ESCI)

b) 6 participations in international conferences:

1. 22th INFER Annual Conference, University Pris 13, Paris, France.
2. 11th Global Conference on Business and Social Sciences, Bangkok, Thailand.
3. 36th IBIMA Conference, Granada, Spain.
4. The 14th International Management Conference "Managing Sustainable Organizations", Bucharest, Romania.
5. 12th International Conference "Globalisation and Higher Education in Economics and Business Administration", "A.I. Cuza" University, Iasi, Romania.
6. 33rd EBES Conference, Madrid, Spain.

c) project website:
https://sites.google.com/view/epueer-mfi-te2019/home

Applicability and transferability of the results

The results of the project have noteworthy implications for international investors and policymakers. In the first case, the investors will learn how the commodity and financial markets are connected and how the economic policy uncertainty will affect their risk management and portfolio optimization strategy. In the second case, national and international regulators and policymakers receive information about the impact of shocks in energy prices on macroeconomic variables, but also about the effectiveness of environmental regulation and the role of renewable sources in reducing carbon emissions at EU level.

Financed through/by

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

Research Centre

Research Center in Engineering and Management

Research team

Prof. Claudiu ALBULESCU, PhD (Principal Investigator)
Lect. Caius LUMINOSU, PhD
Lect. Şerban MICLEA, PhD
Assist. Prof. Lavinia MIHALI, PhD
Assist. Prof. Andra DIACONESCU, PhD
Roxana SÎRBU, PhD student

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INCREASING THE INSTITUTIONAL PERFORMANCE OF THE POLITEHNICA UNIVERSITY TIMIȘOARA BY STRENGTHENING THE R & D AND TECHNOLOGICAL TRANSFER CAPACITY IN THE FIELD OF "ENERGY, ENVIRONMENT AND CLIMATE CHANGE"

Goal of the project

The overall objective of the PERFORM-TECH-UPT project is to increase the institutional performance of the Polytechnic University of Timisoara (UPT), by developing the R & D capacity of the Research Institute for Renewable Energy, a structure of UPT, by expanding and consolidating its activities in the field of intelligent specialization Energy, Environment and Climate Change, to serve the innovation requirements of economic operators from Romania West Development Region, respectively by intensifying the collaboration and visibility at national and international level.

Short description of the project

The PERFORM-TECH-UTP project is dedicated to the institutional development of UPT through targeted activities on human resources, research and development infrastructure and international visibility.

Project implemented by

Politehnica University Timișoara

Implementation period

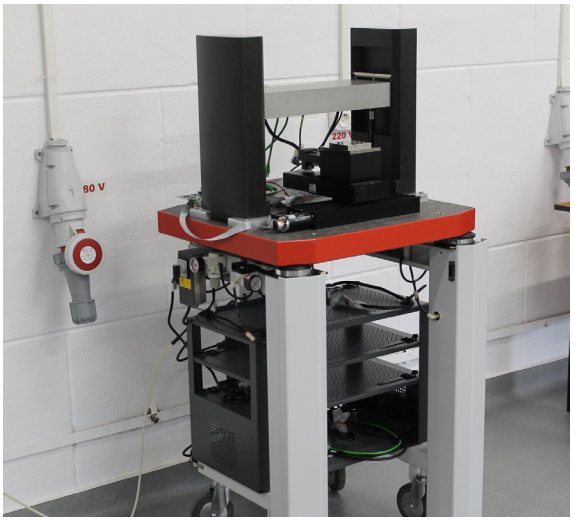
October 16th, 2018 - December 10th, 2020 (26 months)

Main activities

- Project management and coordination
- Acquisition of significant R&D equipment and services
- Financial support for attending prestigious international conferences
- Stimulate the publication of articles in WOS indexed journal, located in the Q1
- Stimulation of the doctoral research activity of the last year of internship for the successful completion of the experimental part of the thesis
- Identifying funding opportunities for research and the development of successful applications
- Development of a portfolio of new products / technologies / methods / systems / services or significantly improved
- Selection of postdoctoral researchers in the field of the project
- Integration and testing of purchased equipment within research centers / laboratories
- Creating the site www.research.upt.ro

Results

- Creation of a multidisciplinary research platform capable of meeting the needs and requirements of economic operators including in priority economic sectors, such as "energy and environmental management", part of the Industrial Policy Direction named "Innovation, technological development and added value" (according to the National Competitiveness Strategy 2014-2020).
- The development of a highest level research infrastructure in the field of "Energy, environment and climate change", which will enable the participation of UPT's RDI staff in projects of national and international scale to be dynamic.
- The increase in the number of publications in high impact journals, that is in the first two quartiles, but also in the international recognition, by winning awards at large-scale scientific events and inventics exhibitions.
- Financing of minimum 20 support grants for the participation of researchers at prestigious international conferences.
- Project based employment of 3 researchers.
- Funding of 4 doctoral internships, to successfully complete the experimental part of the doctoral thesis.
- Creation of the site www.research.at.upt.ro containing information about the university research infrastructure, and about the services that the UPT can offer in the area of RDI.
- Financing of 20 grants in order to stimulate the publication of scientific articles in first quartile WOS journals.
- Organization of 2 workshops.



Financed through/by

Ministry of Education, "Program 1 - Development of the National Research and Development System, Subprogram 1.2 - Institutional Performance", National Plan for Research, Development and Innovation for the period 2015-2020 (PNCDI III), Institutional Development Project - CD Excellence Funding Project.

Research centre

1. Research Institute for Renewable Energy
2. Research Centre for Smart Energy Conversion and Storage
3. Research Centre for Mechanics of Materials and Structural Safety
4. Research Centre for Processing and Characterization of Advanced Materials
5. "Ştefan Nădăsan" Research Laboratory for Strength, Integrity and Durability of materials, structures and conductors.

Research team

- Assoc. Prof. Liviu CĂDARIU-BRĂILOIU, PhD
- Prof. Eng. Viorel-Aurel ȘERBAN, PhD
- Prof. Eng. Viorel UNGUREANU, PhD
- Prof. Eng. Nicolae MUNTEAN, PhD
- Prof. Eng. Liviu MARȘAVINA, PhD
- Prof. Eng. Petru NEGREA, PhD
- Assoc. Prof. Eng Bogdan RADU, PhD

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INOVATIVE METHOD FOR LANDFILLING OF MUNICIPAL SOLID WASTE INCINERATION RESIDUES BY STABILIZATION/SOLIDIFICATION INTO COAL FLY ASH ROCK MATRIX RESULTED FROM DENSE SLURRY TECHNOLOGY

Goal of the project

The project goal is treatment of MSWI residues by stabilization/solidification by means of using a binder matrix. The aim of this process is to create new compounds in a stabilized form that encompassing the harmful elements, which are non-hazardous or less hazardous than the raw (initial) material.
Project includes a series of experiments for embedding the MSWI residues into the coal fly ash rock matrix with the support of the preview research results. There will be done a small scale landfill disposal, in order to investigate the leaching behavior on environmental conditions for tracking the pollutants concentrations migration into environment.

Short description of the project

The project concept is based on using fly ash and desulphurization products related to coal incineration as a binder material to stabilize through solidification process the pollutants (heavy metals mostly) contained in MSWI residues.

Main activities

The main activity of the project is to assess the discharge behavior of the experimental landfill disposal exposed into environmental conditions.

In this demand the following activity were foreseen:

- Construction of the experimental demonstrator.
- Evaluate the waste characteristics.
- Construction of the experimental landfill disposal according to the proposed technology.
- Leaching and percolation sampling.
- Lab analyses of experimental samples. Data recording.
- Processing and analyses of the experimental data.
- Interpretation of experimental data.
- Model the environmental behavior of the waste.
- Validate the model by calibration with the results from laboratory tests and field experiments and by comparing it to natural analogues.

Implementation period

01.05.2018 - 30.04.2020

Project implemented by

Politehnica University Timişoara

Results

Stage I (2018) – Up-grading the existing lab demonstrator. Technical design. Purchasing of equipment.

1.1 Preparation of design documents.
1.2 Designing installations for upgrading the experimental demonstrator in accordance with the proposed technology.
1.3 Elaboration of technical datasheets for equipment purchasing.
1.4 Launch of the public procurement procedure in accordance with the legislation in force.
1.5 Reception of purchased equipment. Equipment payment.

Stage II (2019) – Construction of experimental demonstrator (upgrade). First run. Testing. Lab analyses

2.1 Integration on technological assembly

Applicability and transferability of the results

The solidification/stabilization method of different types of toxic residues consists of using a binder matrix, which is non-pollutant for the environment with the aim to encapsulate the harmful chemical compounds.

In this regard most of the applied technologies are using cement based binder matrix material which is an expensive material in comparison with coal fly ash and associated flue gas desulphurization (FGD) by-products related to coal power plants.

In fact the coal fly ash and FGD by-products are residues that end into open landfill disposal, which means that are costs free.

More than that is well known that cement factory worldwide are using coal fly ash as material basis for different types of cements, for their cementitious properties given by the pozzolanic compounds like silica (SiO_2), alumina (Al_2O_3), and iron oxide (Fe_2O_3) that exceeds over 80% of the fly ash composition.

The new proposed technology based on using fly ash and desulphurization by-products related to coal incineration as a binder material according to solidification/stabilization method, will eliminate the costs with the cement, which could bring considerable economical savings.

From environmental point of view the incineration residues (fly ash and FGD by-products) related to coal incineration can be used as binder material according to the proposed concept of solidification/stabilization method, with the aim to prevent ground water pollution by leaching phenomenon developed on open landfill disposals by dense slurry technology.

Financed through/by

Executive Agency for Higher Education, Research, Development and Innovation Funding – UEFISCDI /
PN-III-P1-1.1-PD-2016-1093

Research centre

Research Institute for Renewable Energies – ICER

Research team

Research contract director /Coordinator:

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Mentor:

- Prof. Daniel DAN, PhD

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FREE RUNNER FOR SWIRLING FLOW CONTROL AT THE OUTLET OF HYDRAULIC TURBINES

Goal of the project

The main objective of the project is to design and investigate a new concept by using a free runner downstream on the main hydraulic runner turbine. The free runner concept supposes that rotates at the runaway speed with vanishing mechanical torque. The main purpose is to redistribute between the shaft and the periphery the total pressure and the moment of momentum such that the flux of total pressure and the moment of momentum are not altered. Moreover the free runner does not modify the operating point.

Short description of the project

The research topic deals with the fundamental aspects of the decelerated swirling flows in conical diffusers, applied to the flow in the draft tube cone of hydraulic turbines. The variable demand on the energy market, as well as the limited energy storage capabilities, requires a great flexibility in operating hydraulic turbines. When the hydraulic turbine operates far from the best efficiency point, the flow downstream the runner becomes unstable (with formation of a precessing spiral vortex in the draft tube cone). The decelerated swirling flow and the precessing spiral vortex are responsible for severe pressure fluctuations which reduce the operating regime and diminish performances. The project propose a new concept in order to control the flow by adding a free runner downstream the hydraulic runner turbine. The free runner will be designed taking into account the flow from the exit of the main turbine runner, such that at the inlet of the conical diffuser a uniform flow should enter. Numerical and experimental investigations will evaluate the new concept in order to minimize the effects of hydraulic instabilities.

Project implemented by

Politehnica University Timişoara

Implementation period

02.11.2020 – 03.10.2022

Main activities

The main activities are programed as follows:

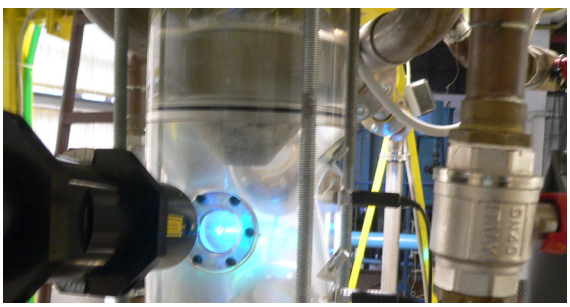
Activity 1. Flow field analysis in the draft tube cone of the swirl apparatus using Laser Doppler Velocimetry – first year 2020.

Activity 2. 3D hydrodynamic design of the free runner blades and mechanical design for the free runner rotating system; Numerical simulation of the swirl apparatus with the new concept of free runner – second year 2021.

Activity 3. Implementation and first tests of the free runner system. Experimental investigations of the free runner performances – third year 2022.

Results

The project will develop a free runner which can be mounted downstream of the turbine runner in order to diminish the hydraulic instabilities.



First results concentrated on the experimental investigations of the velocity profiles in the divergent part of the swirl apparatus. Therefore the LDA velocity profiles measured at the exit of the runner will be used as design inlet conditions for the free runner blades new concept..

Applicability and transferability of the results

The results obtained from this project can be implemented in the hydraulic turbines in order to operate in safety conditions far from the best efficiency point.

Financed through/by

UEFISCDI, P1 Human Resources Program, Research Projects to Stimulate Young Independent Teams (TE)

Research centre

Research Centre for Engineering of Systems with Complex Fluids

Research team

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- Eng. Timotei ARDELEAN, PhD Student
- Eng. Raul SZAKAL, PhD Student
- Eng. Constantin TANASA, CS II
- Associate Prof. Adrian STUPARU, PhD
- Prof. Romeo SUSAN-RESIGA, PhD

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RESEARCH CONCERNING CHARACTERIZATION AND IMPROVEMENT OF THE ELECTROMAGNETIC ENVIRONMENT IN MODERN CARS

Goal of the project

- Assessment of the electromagnetic environment in modern vehicles: technical and legal aspects;
- Assessment and analysis of measuring and testing methods and of equipment involved in Automotive EMC;
- Implementation of novel test and measurement methods in Automotive EMC and improvement of the testing repeatability
- Applications of metamaterials to Automotive EMC.

Short description of the project

This project is component of the complex project *Hybrid Platform for Communication in Visible Light and Augmented Reality for the Development of Intelligent Systems for Assistance and Active Security of Vehicles*, 21PCCDI / 2018.

Project implemented by

Politehnica University Timişoara,
Faculty of Electronics, Communications and Information Technology,
Department of Measurements and Optical Electronics

Implementation period

18.05.2018 - 16.11.2020

Main activities

1. Characterization of the electromagnetic environment in vehicles:
   - Near field and far field measurement;
   - Spectral occupancy measurement.
2. Improvement of repeatability of Automotive MC tests
   - Assessment of devices and equipment involved;
   - Interlaboratory testing and comparisons
   - Far-field prediction from near-field measurements data;
   - Prediction of far-field radiation from current measurement.
3. Methods of reduction of conducted and radiated emissions;
   - Resonance analysis of systems that fail EMC tests;
   - Applications of metamaterials: filtering, suppressing of cavity oscillations, screening with frequency selective surfaces.

Results

2018-2020

- Documentations and reports concerning assessment of electromagnetic field in modern cars;
- Documentations and reports concerning EMC Automotivex inter-laboratory comparisons, chamber validation and equipment assessment;
- Documentation and reports concerning applications of periodic structures in the Automotive EMC field;
- 35 published papers on:
  - Application of Frequency Selective Surfaces ;
  - Conduction and radiated immunity (Fig. 1);
  - ALSE chamber validation;
  - Stripline measurements in Automotive EMC;
  - Near field measurements and applications to emission reduction;
  - Frequency selective surfaces;
  - Antenna simulation and measurement (Fig. 2)
  - Spectrum occupancy measurement in the different frequency ranges (Fig. 3);

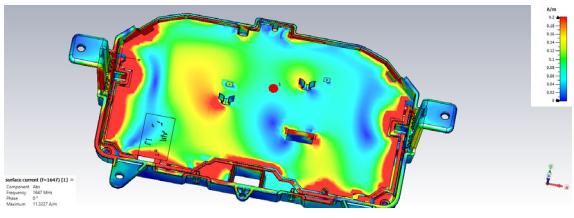

Fig. 1. Radiated immunity tests: DUT simulation

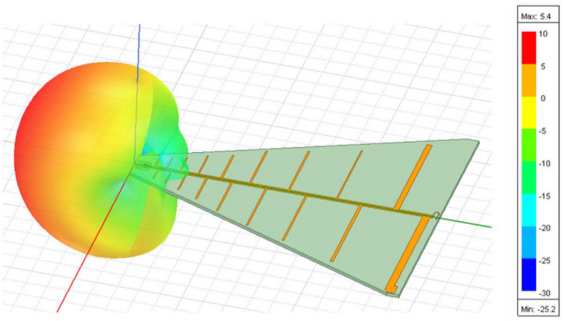

Fig. 2. Antenna simulation

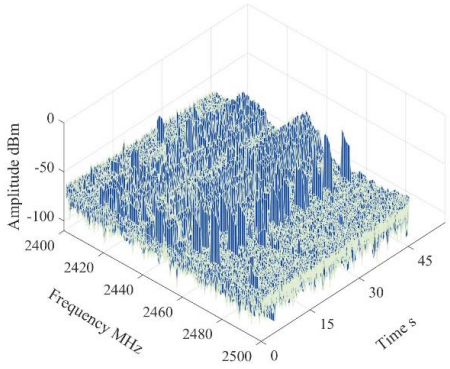

Fig. 3. Spectrum occupancy

Applicability and transferability of the results

Results obtained in this research might be useful to:

- EMC laboratories, mainly related to Automotive industry;
- EMC professionals;
- EMC research community;
- EMC standards elaboration;
- Legal authorities that regulate spectrum occupancy;
- Professionals working in Automotive design.

Financed through/by

UEFISCDI

Research centre

ICER - Research Institute for Renewable Energy

Research team

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- Cornel BALINT
- Septimiu MISCHIE
- Cora IFTODE
- Andrei SILAGHI

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FUZZY CONTROLLERS FOR SHAPE MEMORY ALLOYS SYSTEMS (FUZZYSMA)

Goal of the project

Analysis, design and implementation of adaptive fuzzy control solutions which include combination of fuzzy control, adaptive control, gain-scheduling control and sliding mode control in order to improve the Control System (CS) performance and validate the new CSs with the proposed adaptive fuzzy controllers through experiments on laboratory equipments related to Shape Memory Alloys (SMA), and other various laboratory equipment with SMA as actuators.

Short description of the project

Adaptive fuzzy control algorithms are developed and validated with experiments on laboratory equipments related to Shape Memory Alloys (SMA), and other various laboratory equipment with SMA as actuators..

Project implemented by

Lect. Claudia-Adina Bojan-Dragoş - carries out all management activities and all activities that involve theoretical approaches.
Prof. Stefan Preitl - assists the PI in the management of the activities.
Lect. Alexandra-Iulia Szedlak-Stînean - is in maternity leave in the first year of the project and she will carry out activities that involve simulation and experimental approaches on processes that include SMA actuators in the second year.
Assist. Raul-Cristian Roman - carries out activities that involve hardware and software implementations and solve numerical problems.
M.Sc. Elena-Lorena Hedrea - carries out activities that involve theoretical research and experimental approaches on processes that include SMA actuators.

Implementation period

15.09.2020 – 14.09.2022

Main activities

1. The analysis of the theoretical framework with regard to the controlling of processes that include SMA actuators.
2. The development and implementation of new three new adaptive fuzzy control algorithms for nonlinear SMA processes.
3. The validation of the proposed control algorithms as controllers for real-world processes that include SMA, with the support of the external partners (Continental Automotive Timişoara, Airbus Helicopters Romania – through direct connections timely consolidated, Ontario Centres of Excellence – through our Ottawa team partner). 4. The dissemination of results focused on high visibility journals and important conferences.
5. Solving the project management issues.

Results

The research team works on the publishing journal papers indexed in Clarivate Analytics Web of Science (WoS, with one of the previous names ISI Web of Knowledge) (link) and on the publishing of conference papers currently indexed in the international data bases IEEExplore (link and link). The proceedings of the previous editions of these conferences are indexed in WoS..

Applicability and transferability of the results

With the support of our partner from the University of Ottawa, the new CSs with adaptive fuzzy controllers will be in the validation process at Ontario Centers of Excellence..

Financed through/by

UEFISCDI

Research Centre

Automatic Systems Engineering Research Centre

Research team

- S.I.dr.ing. Claudia-Adrina BOJAN-DRAGOŞ - Project Leader
- Prof.dr.ing. Stefan PREITL - Member
- S.I.dr.ing. Alexandra-Iulia SZEDLAK-STINEAN - Member
- As.dr.ing. Raul-Cristian ROMAN - Member
- As.drd.ing. Elena-Lorena HEDREA - Member

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INSPECTION OF HIGHLY SCATTERED AND ARTIFICIALLY ILLUMINATED UNDERWATER SCENES USING OPENROV TRIDENT

Goal of the project

Optical systems of the existing ROV's (including OpenROV Trident) are quite limited when dealing with deep and turbid underwater scenes that require artificial illumination. Despite of the recent efforts, existing single-image underwater techniques exhibit significant limitations in the presence of highly scattered water and/or artificial ambient illumination. As a result real time pre-processing (to enhance visibility of such scenes) of the captured video stream is a must. This project proposes a radically novel paradigm that provides the basis for more direct, interactive and efficient underwater studies, while reducing the associated costs.

Short description of the project

This project aims to develop an effective underwater image enhancement techniques that can be employed in real time by the affordable ROV Trident..

Implementation period

1.11.2020-30.10.2022

Financed through/by

UEFISCDI

Research team

- Cosmin Ancuti
- Horia Balta
- Kis Arpad
- Codruta O. Ancuti

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INTELLIGENT CONTROL SYSTEM FOR CONTINUOUS CASTING BASED ON WATER FLOW CONTROL IN THE SECONDARY COOLING

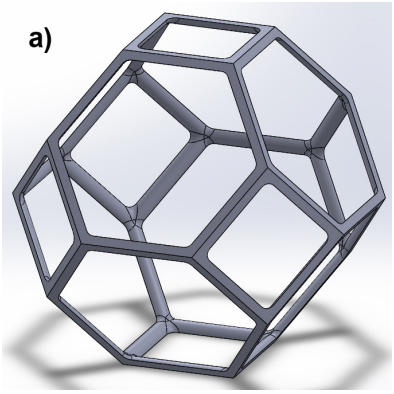
Goal of the project:

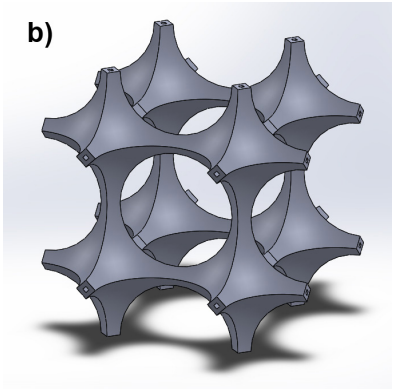
This project deals with the development of metamaterial structures composed tessellations of mainly two types of open cells: truncated hexahedron tessellation (the Kelvin structure,

a) and hollow sphere tessellation

b). The structures will be modelled using computer aided design software and their mechanical properties will be evaluated using finite element analysis software.

When the desired geometries will be developed, the CAD file will be exported to a rapid prototyping machine for manufacturing.





Short description of the project:

This project addresses a subject in the field of innovative materials and it deals with the design and manufacturing of structures composed of engineered materials whose properties are not found in nature (metamaterials). The metamaterials proposed for this project will consist of cellular polymeric lattices, whose properties will be controlled through geometric parameter manipulation (strut thickness, cell size and shape). The main applications of these structures will be as cushioning and protective layers meant to absorb the deformations and impact energy of personal protective equipment. The project has two main stages. The first stage consists of the design and simulation of the structures in order to determine the optimal parameters in terms of mechanical properties. The second stage of the project will deal with the manufacturing of the structures through rapid prototyping and the experimental determination of their mechanical characteristics. The comparison between the estimated and experimentally determined properties will validate the designs of the structures, allowing for complex geometry modelling for actual safety equipment applications.

Project implemented by

Politehnica University Timişoara

Implementation period:

1.5.2018 – 30.4.2020

Main activities:

O1. Literature survey concerning metamaterial structures and additive rapid prototyping techniques.

A1.1. Literature study concerning mechanical metamaterial structures

A1.2. Literature study concerning rapid prototyping techniques for polymers

O2. Development of parametrical metamaterial structures

A2.1. Design of metamaterial structures based on Kelvin cells

A2.2. Design of metamaterial structures with hollow sphere cells

O3. Numerical evaluation of the mechanical properties of the developed metamaterial structures

A3.1. Determination of the mechanical properties of the polymers used in rapid prototyping

A3.2. Evaluation of the static mechanical properties of the developed structures

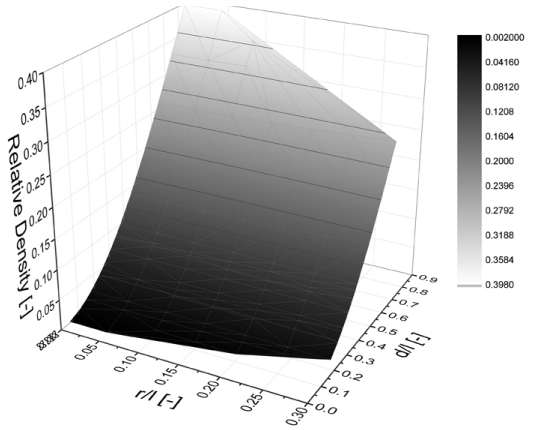
A3.3. Evaluation of the impact and energy absorption properties of the developed structures

A3.4. Optimization of metamaterial structures

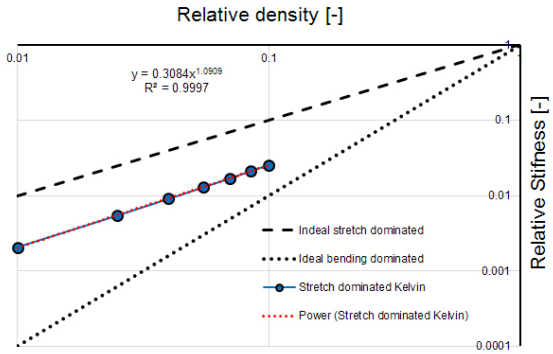
04. Manufacturing of metamaterial structures
    A4.1. Parameter adjustment for structure manufacturing through rapid prototyping
    A4.2. Manufacturing of designed structures through additive rapid prototyping
05. Experimental determination of the mechanical characteristics of the manufactured structures
    A5.1. Elaboration of static tests in compression on the manufactured structures
    A5.2. Elaboration of static tests in bending on the manufactured structures
    A5.3. Elaboration of fatigue tests in compression on the manufactured structures
    A5.4. Elaboration of impact tests on the manufactured structures
06. Structure validation and product component design
    A6.1. Comparison of results and simulation optimization
    A6.2. Design of safety equipment components based on metamaterial structures
    A6.3. Numerical analysis of the designed components' behavior in impact applications

Results:

After the first year of implementation, several structures were generated, and the variation of relative stiffness with the structure parameters was investigated.



The geometries were imported into a finite element analysis software and the relative stiffness and relative strength variation with relative density was determined.
Partial results were published in an article entitled " A parametric study of the mechanical properties of open-cell Kelvin structures" and presented at the international conference AMS18



Applicability and transferability of the results:

The results obtained from this project can be implemented in safety equipment, for various types of industries, such as civil engineering (helmets), sports (protective equipment such as helmets, shin guards, padding), automotive (motorcycle suits) and defense (body and vehicle armor)

Financed through/by

UEFISCDI
Programul 1 - Dezvoltarea sistemului național de cercetare-dezvoltare

Research Center

1. Laboratorul Ștefan Nădășan, Politehnica University Timișoara
2. Medical Engineering Research Center, Politehnica University Timișoara
3. ICER - Research Institute for Renewable Energy, Politehnica University Timișoara

Research team

- Eng. Dan-Andrei ȘERBAN, PhD
- Prof. Eng. Nicolae FAUR, PhD

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SMART BUILDINGS ADAPTABLE TO THE CLIMATE CHANGE EFFECTS (CIA_CLIM)

Goal of the project

The specific objective of the project is centred on the increase of energy efficiency of buildings, by using smart facades with low-thermal transfer and smart energy efficiency through building automatization and solar energy collectors, through a modular laboratory demonstrative application. The resulted system, the smart house, is conceived thus to minimize the input energy for maintenance.

Short description of the project

The four component projects are focusing on two principal research directions:

(i) use of smart facades with the low-thermal transfer, actively integrated for the enhancement of internal comfort and possessing a passive control of energy and

(ii) smart energy efficiency through building automatization and solar energy collectors.

CIA.CLIM
clădiri inteligente adaptabile la efectele schimbărilor climatice

Project implemented by

Politehnica University of Timișoara as coordinator (CO), in collaboration with

-Technical University of Civil Engineering of Bucharest (UTCB, P1),

-Technical University of Cluj-Napoca (UTCN, P2),

-National Institute for R & D in Electrical Engineering Bucharest (ICPE – CA, P3) and

-National Institute of R & D for Electrochemistry and Condensed Matter Timișoara (INCEMC, P4)

Implementation period

01.03.2018 - 30.06.2021

Main activities

Project 1 investigates the mechanical properties of cellular materials used as thermal insulations in smart façade systems, through mechanical compre-ssion, bending and toughness fracture testing.

Project 2 is focused on obtaining, characterizing and testing of high-property materials used for smart facades as thermal insulation materials and as support for special property layers: photo-catalytic layers and with reduced absorption/reflexion of UV-VIS-IR radiation.

Project 3 investigates the implementation of the electric power distribution in direct current for individual households or in small communities (smart-grid), with renewable energy sources integration.

Project 4 implements the knowledge and data resulted from projects no. 1-3 through a modular laboratory demonstrative application. The project will perform an integrated study on the influence of the facades and the energetic contribution to the internal comfort of the building.

Results

- Determination of mechanical properties of cellular materials used as thermal insulations in smart façade systems;
- Production, characterization and testing of high-property materials used for smart facades as thermal insulation materials and as support for special property layers;
- Implementation of the electric power distribution in direct current for individual households or in small communities (smart-grid), with renewable energy sources integration, finalizing with an experimental platform;
- Modular laboratory demonstrative application for the implementation of project results, performing a global study regarding the influence of the facades and the energetic contribution to the internal comfort of the building.

Applicability and transferability of the results

In the construction domain, the energy represents the key-point in achieving efficient buildings. All the results obtained in the frame of the project are expected to be of interest for the economic environment, from manufacturers to contractors. Design guidelines and recommendations will be provided.

Financed through/by

The project is supported by a grant of the Executive Unit for Financing Higher Education, Research, Development and Innovation (UEFISCDI), project number PN-III-P1-1.2-PCCDI-2017-0391 / grant agreement 30PCCDI/2018.

Research Centre

- ICER - The Research Institute for Renewable Energy, UPT (CO);
- "St. Nadasan" Research Laboratory for Strength, Integrity and Durability of materials, structures and conductors, UPT (CO);
- Research Center of Environmental Science and Engineering, UPT (CO);
- Intelligent Control of Energy Conversion and Storage Research Center, UPT (CO);
- ACTEX - Integrated Platform of Research and Development for the Behaviour of Structures under Extreme Actions, UPT (CO);
- CAMBI - Advanced Research Center for Ambiental Quality and Building Physics, UTCB (P1);
- EEC - Energy Efficiency in Buildings, UTCB (P1);
- RLSDEPE - Research Laboratory and Sustainable Development in Electronics and Power Electronics, UTCN (P2);
- Department for Efficiency in Conversion and Consumption of Energy, ICPE - CA (P3);
- Renewable Energies – Photovoltaics – Laboratory, INCEMC (P4);
- Chemical and Electrochemical Synthesis Department, INCEMC (P4).

Research team

The research team is composed by 90 researchers of the five institutions.

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DATASET AND IMAGE DEHAZING TECHNIQUES FOR HIGHLY DISTORTED HAZY SCENES

Goal of the project

The main objective of this project is to design effective image dehazing techniques but also an image interpretation framework that are robust to haze, including the challenging cases where the sources of light and impairment are non-uniformly distributed over the scene. As a federating objective, our project aims at implementing dehazing methods that are suited to dense and non-homogeneous hazy scenes.

Short description of the project

This project aims to build up an image dataset including pairs of hazy and haze-free scenes, for which hazy scenes include real, dense, and non-homogeneous haze and to develop develop several image dehazing techniques.

Implementation period

1.11.2020- 30.10.2022

Financed through/by

UEFISCDI

Research team

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- Kis Arpad
- Cosmin Ancuti

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