TUIASI doctoral

CSD INTERNATIONAL CONFERENCE OF THE DOCTORAL SCHOOL

"GHEORGHE ASACHI"
TECHNICAL UNIVERSITY OF IASI, ROMANIA

7TH INTERNATIONAL CONFERENCE OF THE DOCTORAL SCHOOL

BOOK OF ABSTRACTS

MAY 15-17, 2024
IASI, ROMANIA

Excellence in Doctoral Studies through Innovation, Convergence and Interdisciplinarity

WWW.CONFERINTA-CSD.TUIASI.RO

Welcome to CSD2024, wishing you a successful conference!

7th International Conference of the Doctoral School

"Gheorghe Asachi" Technical University of Iasi

Excellence in Doctoral Studies through Innovation, Convergence and Interdisciplinarity

BOOK OF ABSTRACTS

May 15 – 17, 2024

IAŞI, ROMÂNIA

Organizers

- "Gheorghe Asachi" Technical University of Iasi, Romania
- Council for Doctoral University Studies, CSUD
- Council of Doctoral School, CSD

Partner:

- "Gheorghe Asachi" University Foundation, Iasi, Romania

Conference Sections

- **Section 1.** Interdisciplinary studies (**held onsite and includes papers from all doctoral fields**)
- **Section 2.** Computers and information technology; Systems engineering Electrical engineering; Energy engineering; Electronic engineering, telecommunications and information technology (**held online**)
- **Section 3.** Chemistry; Chemical engineering; Environmental engineering (**held online**)
- **Section 4.** Civil engineering and installations (**held online**)
- **Section 5.** Mechanical engineering; Industrial engineering; Materials engineering; Engineering and management (**held online**)
- **Workshop**: Applications of artificial intelligence in the industrial domains **(held onsite)**

Organizer's Message

Dear PhD Students,
Dear Colleagues and Guests,
Dear Participants,

The seventh edition of the International Conference of the Doctoral School at the "Gheorghe Asachi" Technical University of Iasi (TUIASI) aims to create a beneficial environment for PhD students from Technical Universities in Romania and abroad to share their research findings, exchange ideas, and establish new collaborations. It also seeks to refine their theoretical and methodological approaches, promote interdisciplinary research, and foster continuous development. Scheduled for three days from May 15th to May 17th, 2024, the conference will feature five panel sessions where PhD students can present and discuss their research papers. Additionally, the conference program will include plenary presentations by esteemed professors from universities closely linked with TUIASI.

The conference endeavors to bring together oral presentations covering various pertinent topics related to the university's thirteen doctoral fields: *Chemistry; Computers and Information Technology; Chemical Engineering; Civil Engineering and Installations; Electrical Engineering; Electronic Engineering, Telecommunications, and Information Technologies; Energy Engineering; Industrial Engineering; Materials Engineering; Mechanical Engineering; Environmental Engineering; Systems Engineering; and Engineering and Management.*

By bridging different scientific doctoral fields, promoting innovation through interdisciplinary collaboration, and focusing on internationalization, this event aims to create an intellectual crossroads where new ideas and scientific progress can emerge. This approach is intended to shape doctoral programs by emphasizing the training of PhD students in research and equipping them with core competencies for immediate application in societal institutions, contributing to the pursuit of a sustainable economy. For PhD students in the early stages of their doctoral studies, the conference provides an opportunity to prepare for the initial contributions to their chosen scientific field. Meanwhile, for those in the later stages, the conference serves as an essential step towards entering the job market.

Please visit **the conference website at: https://conferinta-csd.tuiasi.ro/**

Welcome to CSD2024, wishing you a successful conference!

Honorary President,

Professor **Dan CAȘCAVAL**

Rector TUIASI

Conference committees

HONORARY PRESIDENT

Prof.dr. **Dan Cașcaval, RECTOR**, "Gheorghe Asachi" Technical University of Iasi, Romania

PRESIDENT

Prof.dr. **Maria Gavrilescu**, "Gheorghe Asachi" Technical University of Iasi, Romania

CO-PRESIDENT

Prof.dr. **Alexandru Sălceanu**, "Gheorghe Asachi" Technical University of Iasi, Romania

INTERNATIONAL SCIENTIFIC COMMITTEE

- Prof.dr. **Dominique Adolphe**, University Haute-Alsace, Mulhouse, France
- Prof.dr. **Giullia Loretta Batali**, Technical University of Civil Engineering of Bucharest, Romania
- Prof.dr. **Radu Gabriel Bozomitu**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Leandru-Gheorghe Bujoreanu**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Andrei Burlacu**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof. dr. **Simona Caraiman**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Gianfranco Chicco**, Polytechnic of Turin, Italy
- Prof. dr. **Iulian Aurelian Ciocoiu**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **António Cruz Serra**, Technical University of Lisbon, Portugal
- Prof.dr. **Antonela Curteza**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Pasquale Daponte**, University of Sannio, Italy
- Prof.dr. **Oana Dodun-Des-Perrieres**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Dan Eliezer**, Ben Gurion University of Negev, Beer-Sheva, Israel
- Prof.dr. **Lidia Gaiginschi**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Mihai Gavrilaș**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Liviu Goraș**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Nicolae Hurduc**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Horia Iovu**, University Politehnica Bucharest

- Prof.dr. **Dumitru Marcel Istrate**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Nicolas Kalogerakis**, Technical University of Crete, Chania, Greece
- Prof.dr. **Maria Carmen Loghin**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Irina Lungu**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Luis Lugo**, University of Vigo, Spain
- Prof.dr. **Antonio Marzocchella**, University Federico II, Naples, Italy
- Prof.dr. **Omid Mahian**, Xi'an Jiaotong University, China
- Conf.dr. **Petru Mihai**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Janus Mindykowski**, Gdynia Maritime University, Poland
- Prof.dr. **Alina-Adriana Minea**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Corneliu Munteanu**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Sohel Murshed**, University of Lisbon, Portugal
- Prof.dr. **Octavian Păstrăvanu**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Doina Pîslă**, Technical University of Cluj-Napoca, Romania
- Prof.dr. **Radu-Emil Precup**, Politehnica University of Timișoara, Romania
- Prof.dr. **Alexandru Sălceanu**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof. dr. **Neculai Eugen Seghedin**, Gheorghe Asachi Technical University of Iasi, Romania
- Prof.dr. **Irina Volf**, Gheorghe Asachi Technical University of Iasi, Romania

EXECUTIVE COMMITTEE

- Prof.dr. **Maria Gavrilescu**
- Prof.dr. **Maricel Adam**
- Prof.dr. **Ioan Doroftei**
- Prof.dr. **Florin Leon**

SECRETARIAT

- Eng. **Cristina Nagiț** (doctorat@tuiasi.ro)
- Dr. **Sabina-Nicoleta Rotenștein** (sabina-nicoleta.rotenstein@staff.tuiasi.ro)
- MSc **Sabina Bobu** (sabina.bobu@staff.tuiasi.ro)
- PhD Student **Nicoleta Cojocariu (Section 1)** (nicoleta.cojocariu@student.tuiasi.ro)
- PhD Student **Silvia-Nicoleta Plăcintă (Section 2)** (silvia-nicoleta.placinta@student.tuiasi.ro)
- PhD Student **Adriana-Mariana Asoltanei (Section 3)** (adriana-mariana.asoltanei@student.tuiasi.ro)
- PhD Student **Andrei Huțanu (Section 4)** (andrei.hutanu2@student.tuiasi.ro)
- Assist.prof.dr. **Elena Ionela Chereches (Section 5)** (elena-ionela.chereches@academic.tuiasi.ro)

General information

About our university

"Gheorghe Asachi" Technical University of Iasi is one of the most prestigious universities in Romania, being classified as an advanced research and education university (according to the Order of Ministry of Education and Research, MECTS nr. 5262/2011), whose mission is to carry out specific activities of creation, innovative capitalization of knowledge and its transfer to society in the fundamental fields of engineering sciences, architecture and urbanism, as well as in interdisciplinary and complementary fields, in the local community, at regional, national and international levels.

"Gheorghe Asachi" Technical University of Iasi has the oldest tradition in engineering education in Romania, initiated by Gheorghe Asachi, a representative of the Romanian Enlightenment, and established within the Greek Academy in Iasi (Royal Academy) on November 15, 1813, by the decree signed by Scarlat Calimachi, the ruler of Moldova at that time. This school can be considered the nucleus of higher technical education in Moldova, continuing education between 1834-1847 at the Mihăilean Academy and later at the University of Iasi in the School of Industrial Electricity (since 1910), the Electrotechnical Institute (1912) and the Department of Technological Chemistry (since 1911).

On November 7, 1912, the Faculty of Sciences of the University of Iasi was transformed into an independent department of higher education for teaching electrical engineering, applied chemistry and agricultural sciences. This event represents the "birth certificate" of what later became the Polytechnic Institute of Iasi ("Gheorghe Asachi" Technical University of Iasi today), respectively of the Faculty of Electrical Engineering, Energy and Applied Informatics and the Faculty of Chemical Engineering and Environment Protection.

A crucial moment in the history of our university is the Decision no. 205.660/ 03.12.1937 of the Ministry of National Education, when, the technical higher education is taken out from the aegis of the University of Iasi by the establishment of the „Gheorghe Asachi” Polytechnic School of Iaşi, as a distinct institution of engineering higher education, the only higher education institution authorized to grant from that date the title of engineer. The University began its activity on October 1, 1938, within three faculties: Industrial Chemistry, Electrical Engineering and Agricultural Sciences, of which the first two were based in Iasi and the third in Chisinau. The first diplomas were issued in 1940.

Through the education reform of 1948, the "Gheorghe Asachi" Polytechnic Institute was established in Iaşi, with four faculties and ten specializations: Industrial Chemistry (mineral chemistry, leather), Civil Engineering, Electrical Engineering, Mechanics (thermodynamic engineering, hydrotechnics, machine building, aero-naval engineering) with a duration of studies of five years. The Polytechnic Institute of Iaşi functioned until 1990 with 6 faculties and many newly created specializations. In 1990, four new faculties were established, coming from the faculties of Electrical Engineering and Mechanics.

In 1993 the name of "Polytechnic Institute of Iasi" was replaced by "Gheorghe Asachi" Technical University of Iasi (TUIASI). In 2004 the Architecture department within the Faculty of Constructions and Installations became the "G.M. Cantacuzino" Faculty of Architecture and since then 11 faculties operate within TUIASI.

Today, TUIASI develops programs for undergraduate, master, doctoral, postdoctoral studies and scientific research in interdisciplinary research areas, out of which 10 areas were classified in category A, according to Law 1/2011 and HG 789/2011. The doctoral activity is organized within an interdisciplinary doctoral school including 13 doctoral fields established according to national and international research priority areas.

Plenary conferences

DIELECTRIC SPECTROSCOPY: A VIABLE TOOL FOR CABLE INSULATION DIAGNOSIS

Davide Fabiani

Alma Mater Studiorum – Università di Bologna, Italy

Correspondence address: davide.fabiani@unibo.it

Abstract:

Dielectric spectroscopy, a non-destructive diagnostic technique, has emerged as a pivotal tool in assessing the health and integrity of cable insulation systems. This method, grounded in the measurement of dielectric properties of materials as a function of frequency, offers a comprehensive insight into the condition of electrical insulation, critical for ensuring the reliability and safety of power distribution networks. The technique operates by applying a voltage signal across the material at different frequencies and measuring its response, which includes the permittivity and loss factor. These parameters reveal valuable information about the molecular dynamics within the insulation material, such as the presence of moisture, density of charge carriers, the integrity of the molecular structure and the presence of oxidized species which can be correlated with aging. Variations in these properties can indicate early stages of degradation, even before physical symptoms become apparent. Dielectric spectroscopy's frequency-dependent analysis offers a unique advantage. By spanning a broad range of frequencies, it can probe different relaxation processes, providing a multi-faceted view of the insulation's health. Low frequencies can uncover conductivity phenomena and space charge effects, while high frequencies can detect dipolar and molecular relaxations, each indicative of specific types of insulation issues. The implementation of dielectric spectroscopy in routine maintenance schedules enhances the reliability of electrical systems. By identifying potential problems early, utilities can avoid costly repairs, extend the lifespan of their assets, and ensure uninterrupted power supply. Moreover, this technique supports the evolution toward smart grids, where predictive maintenance and real-time monitoring are paramount.

Keywords: cable insulation, dielectric spectroscopy, frequency-dependent analysis, molecular dynamics, predictive maintenance

TRENDS IN POLYMER-BASED NANOCOMPOSITES

Horia Iovu

National University of Science and Technology, Politehnica, Bucharest, Romania

Correspondence address: author: horia.iovu@upb.ro

Abstract:

Hybrid materials based on polymers and inorganic materials (e.g. clays (montmorillonite, halloysite) and porous materials (e.g. mesoporous silica, porous clay heterostructures)) are recommended as smart drug release platforms due to their high drug loading/encapsulation efficiency, enhanced drug release profile and low burst release of active pharmaceutical ingredients. The morphology and textural parameters of inorganic host, the presence of modifier agents within the clay surface or in the gallery, drug encapsulation conditions (pH values, soaking time) and polymer type are important parameters that play a significant role on the performance of organic-inorganic drug delivery systems. The research topic of our group includes the development of various types of hybrid drug delivery systems like dendrimers (PAMAM)/clays, crosslinked films of Poly(vinyl alcohol)/Halloysite/diphenhydramine hydrochloride, hydrogels of Poly(vinyl alcohol)/Halloysite/ acetylsalicylic acid and methacrylate modified halloysite. The influence of various parameters (initial drug concentration, contact time, pH reaction and temperature) onto the adsorption/intercalation of thiamine hydrochloride (VB1) within different aluminosilicate hosts (montmorillonite, halloysite) was studied. Porous clay heterostructures are new hosts for drug encapsulation that exhibit higher drug encapsulation efficiency than classical inorganic materials like montmorillonite.

Keywords: hybrid materials, smart drug release, inorganic hosts, drug encapsulation, polymer-modified clays

CURRENT CHALLENGES IN PLANNING FOR TEAMS OF ROBOTS WITH HIGH-LEVEL MISSIONS

Cristian Mahulea

Universidad de Zaragoza, Spain

Correspondence address: cmahulea@unizar.es

Abstract:

In this presentation, we explore the current strategies for developing path planning methods for teams of robots through the lens of discrete event systems. We highlight the limitations of traditional transition system models, notably their susceptibility to state explosion problems, and advocate for the adoption of Petri net models. By employing Petri net models, we address these challenges effectively. The talk will present a novel solution utilizing these models, supported by simulations and experimental results to demonstrate their efficacy in complex robotic team missions.

Keywords: discrete event systems, path planning, Petri net models, robotic team missions, transition system models

LOW-COST FERRITE PERMANENT MAGNET-ASSISTED SYNCHRONOUS RELUCTANCE ROTOR: AN ALTERNATIVE SOLUTION FOR RARE EARTH PERMANENT MAGNET SYNCHRONOUS MOTORS

Sorin Mușuroi

University Politehnica Timișoara, Romania

Correspondence address: sorin.musuroi@upt.ro

Abstract:

The reasons for electric drive systems with variable Synchronous reluctance motors (SynRM) are apparent pole synchronous machines with a large saliency ratio. They are referred in the literature also as reactive synchronous machines and variable reluctance synchronous machines with passive rotor. A large saliency ratio can be achieved by both axially and transversally laminated rotor structures. The process of the electromagnetic torque production in a SynRM is based on the shape anisotropy which characterizes the machine. In the last time transversally laminated rotor structure is preferred, because the axially laminated rotor structure has from the mechanical point of view some drawbacks. The advantages of these motors are given by the technological simplicity, low cost price, quiet and robustness. The disadvantages are related to the low value of developed electromagnetic torque, low value of power factor and low efficiency. Adding permanent magnets into the SynRM rotor core the electromagnetic characteristics the motor are improved. The motor with the added permanent magnet is similar to an interior permanent magnet synchronous motor, but the amount of permanent magnet is smaller with respect to conventional PM. This new motor can be called permanent magnet assisted SynRM (PMSynRM). To achieve superior performance with this new topology, a PMSynRM optimization is required. In this paper, it is proposed two low-cost ferrite V permanent magnets assisted synchronous reluctance rotor geometries (VPMSynRM). The first proposed rotor geometry has one V flux barrier (1V) and second proposed geometry has two V flux barriers (2V). We will add ferrites into these flux barriers to improve the performance of motor. In the extreme case (this is also our case) these flux barriers will be completely filled with ferrites, so this rotor configuration is also known in the literature as interior inclined V permanent magnet synchronous motor. Finite element (FEM) approach has been used to show the performance of the proposed rotors. The motivation of this study is to reduce the cost of the rotor by changing the type of PM and by the choice of suitable rotor geometry.

Keywords: Ferrite V permanent magnets, Permanent Magnet Assisted SynRM (PMSynRM), rotor geometry optimization, Synchronous Reluctance Motors (SynRM), variable saliency ratio

RESOURCE EFFECTIVE TEXTILE PROCESSES FOR FUNCTIONAL AND SMART TEXTILES

Vincent Nierstrasz

University of Borås, Sweden

Correspondence address: vincent.nierstrasz@hb.se

Abstract:

Conventional textile dyeing and finishing as well as functionalization processes are characterized by large scale production runs and typically utilize large quantities of water, energy and chemicals, making them less suitable for the production of functional and smart textiles. There is a need to introduce flexible, more resource effective textile functionalization processes thereby avoiding unnecessary use of water, energy, chemicals and minimization of waste.

Research at the research group Textile Material Technology at the University of Borås focuses on the development of advanced functional and smart materials using novel, resource-effective processes to produce such materials in an effective and efficient way.

Examples of such technologies in the TMT group are:

- Digital printing
    - Inkjet for functional and smart textiles
    - 3D printing
    - Valvejet (Chromojet)
- Supercritical CO_2 (liquid CO_2)
- Spray technology
- UV curing
- Plasma
- Catalysis and Biocatalysis

It is a very multidisciplinary domain were e.g. interface and surface science, (bio)catalysis, chemistry, biotechnology, digital technologies (inkjet, valvejet and 3D printing), 3D body scanning, coating, printing, dyeing, and nanotechnology meet.

Keywords: advanced textile materials, functional and smart textiles, novel textile technologies, resource-effective processes, textile functionalization

PHOTODEGRADABLE POLYMERS AND POLYMER NETWORKS

Maria Vamvakaki

Technical University of Crete, Greece

Correspondence address: vamvakak@materials.uoc.gr

Abstract:

Main chain degradable polymers have been extensively employed for use in biomedical applications, including drug and gene delivery and tissue engineering. However, lately considerable attention has been attracted on the on demand main chain polymer degradation using certain external stimuli. Among the different triggers proposed for use to cleave the polymer bonds, light has emerged as a particularly attractive stimulus to induce a photo-mediated main chain polymer degradation because of its spatiotemporal control, as well as its noninvasive nature [1]. Light degradable polymers have been proposed for use in photo-patterning, polymer recycling and photo-triggered drug delivery. In this work, novel families of photo-degradable polymers and polymer hydrogels will be discussed. First, transparent, soft, photodegradable and thermo–reversible hydrogels comprising PEG as the elastic strands and dithioacetal linkages at the cross-links, that undergo degradation upon exposure to light, will be presented [2]. By varying the length of the PEG elastic chains, the physicochemical and mechanical properties, including the porosity, photodegradation rate and storage modulus of the hydrogels were altered. Mechanistic studies revealed a chemical recycling process to the initial reagents as the main photoproducts, enlightening the mechanism of network reformation upon heating the system at mild temperatures, as verified by shear rheology experiments. Moreover, the hydrogel successfully underwent reversible photodegradation and reformation upon heating, restoring the initial mechanical properties of the polymer network and thus revealing the re–processability of the system. In the second part, photo- and acid-degradable poly(acylhydrazones) synthesized via a step–growth reaction of dicarbonyl and diacylhydrazide comonomers is presented [3]. The amphiphilic nature of the alternating copolymers, as well as the presence of acylhydrazone groups along the polymer chains, which promote inter– and intra–chain hydrogen bonding interactions, fostered their self–assembly into spherical nanostructures with sizes that were dependent on the molecular structure of the copolymer. The photo–sensitivity of the synthesized copolymers to light was verified by irradiation studies in aqueous solution, while a mechanistic study shed light into the photodegradation mechanism and the produced photoproducts.

References

1. T. Chen H. Wang, Y. Chu, C. Boyer, J. Liu, J. Xu, ChemPhotoChem 2019, 3, 1059; G. Pasparakis, Th. Manouras, M. Vamvakaki and P. Argitis Macromol. Rapid Commun. 2012, 33, 183; Angew. Chem. Int. Ed. 2011, 50, 4142-4145; Nat. Commun. 2014, 5, 3623.
2. M. Psarrou I. Chatzaki, A. Mavromanolakis, D. Vlassopoulos and M. Vamvakaki 2023, submitted.
3. M. Psarrou, M. G. Kothri and M. Vamvakaki, Polymers 2021, 13, 2461.

Keywords: light degradable polymers, main chain degradable polymers, photo-mediated degradation, photo-degradable hydrogels, stimuli-responsive polymers

SECTION 1.

Interdisciplinary studies

IMMOBILIZED BACTERIAL CELLS ON A NATURAL CARBONACEOUS MATERIAL FOR DIETHYL PHTHALATE BIODEGRADATION

Emanuel Gheorghita Armanu[1], Simone Bertoldi[2], Christian Eberlein[2], Hermann J. Heipieper[2], Marius Sebastian Secula[1], Irina Volf[1]

[1]Gheorghe Asachi" Technical University, Faculty of Chemical Engineering and Environmental Protection "Cristofor Simionescu", 73A Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]Helmholtz Centre for Environmental Research (UFZ), Department of Molecular Environmental Biotechnology, Permoserstraße 15, 04318, Leipzig, Germany

Corresponding author: Emanuel Gheorghiță Armanu, gheorghita-emanuel.armanu@student.tuiasi.ro

PhD Supervisor: Professor Irina Volf,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Plasticizers (e.g. diethyl phthalate, dibutyl phthalate, di-2-ethylhexyl phthalate, etc.) stand out as prevalent persistent organic pollutants in the environment, intensly used across various industries to increase flexibility, durability and deacrease viscosity of plastics. The global production of plasticizers (90 % being phthalate esters) has arised rapidly in the last decades, it is estimated to reach at 8.5 million tonnes annually, with no sign of decreasing. Due to their complex molecular structures, strong bonds and often long aliphatic chains, phthalate acide esters (PAE) pose significant challenges for microbial degradation.
Understanding the urgent need to mitigate PAE contamination, novel eco-friendly methodologies are required. One promising technology involves immobilizing bacterial strains onto natural substrates, this process has the potential to enhance bacterial biodegradation capabilities within polluted environments.
A Pseudomonas bacterial strain from polluted soil samples was isolated and used as a new "workhorse" for degradation processes. This strain demonstrated the ability to metabolize PAE and use it as a carbon and energy source. Subsequent toxicity measurements were carried with Pseudomonas sp. in batch cultures tests at different concentrations of diethyl phthalate (4, 8, 16 and 32 mM). The porous carrier was obtained through a thermochemical process optimized for a suitable bacterial colonization. Hydrothermal carbonization (HTC) of vine wood (VW) waste exdeed a hydrochar with promising porous structure, as it was revealed by Scanning Electron Microscopy (SEM) analysis. This porous structure, characterized by a broad pore size distribution (~1-50 µm), appears to be favourable for bacterial colonization and biofilm formation. UPLC data analysis showed a 4-time increased resistence in the immobilized cells compared with the non-immobilized ones tested with diethyl phthalate. Furthermore, the hydrochar not only can support bacterial growth but also enhances cellular division capacity, mitigates nutrient depletion from the cultivation media and improves bacterial resilience against high PAE concentrations. Therefore, the effectiveness of bacterial biodegradation rate can be improved by optimizing hydrochar properties (e.g. pore volume, surface area and functional group content). Thus, the integration of carbonaceous materials with PAE-degrading bacteria holds immense promise as a cost-efficient and sustainable approach for environment decontamination.

Keywords: microbs, plasticizers, biofilm, adsorbtion, support matrix

SYNTHESIS AND CHARACTERISATION OF BENT CORE LIQUID CRYSTALS WITH CHOLESTERYL CHIRAL UNIT

Iulian Berladean[1,2], Irina Carlescu[1], Yahia Boussoualem[2], Nicolae Hurduc[1] and Abdelylah Daoudi[2]

[1]"Gheorghe Asachi" Technical University of Iasi, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, Department of Natural and Synthetic Polymers 73 Prof.dr.doc. D. Mangeron Street, 700050 Iasi, Romania
[2]Univ. Littoral Cote d'Opale, UR 4476 - UDSMM - Unite de Dynamique et Structure de Materiaux Moleculaires, 59140 Dunkerque, France

Corresponding author: Iulian Berladean, iulian.berladean@student.tuiasi.ro

PhD Supervisor: Professor Nicolae Hurduc
"Gheorghe Asachi" Technical University of Iasi

Abstract:

This work presents the synthesis, structural and mesomorphic characterization of bent-core compounds derived from 2,7-dihydroxynaphthalene. The molecular structure of the synthesized compounds was designed in a way to combine the properties of the bent-core molecules and the chirality of cholesteryl unit. Thus, the bent-core derivative has an achiral arm with azobenzene unit and alkoxy end chain and a second arm with cholesteryl unit. The influence of lateral substitution with fluorine at the achiral arm on mesomorphic properties was also studied. Structural characterization was performed by 1H-NMR and 13C-NMR to identify the molecular structure of intermediate and final compounds. Mesomorphic characterization was performed by DSC, to identify the phase/temperature transitions and associated enthalpies and POM respectively, to identify the mesophase types, wich proved to be chiral nematic (*N) and smectic for all bent-core analyzed compounds. Thermal stability and mesophases temperature range varies depending on the length of the alkoxy end chains and lateral substitution with fluorine atom. In conclusion, 6 new bent-core compounds incorporating the chiral cholesterol unit have been synthesized and characterized. Their molecular structure was confirmed by 1H-NMR and 13C-NMR. They show liquid crystalline properties, forming chiral nematic and smectic mesophases.

Keywords: Bent-core, liquid crystals, cholesteryl, nematic chiral, smectic

CHARACTERIZATION AND ELIMINATION OF ARTIFACTS CAUSED BY CONDUCTED EMISSIONS IN ULTRASOUND IMAGING EQUIPMENT

Alexandru-Marian Bordaş, Adelina-Cristina Căsuţă

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering,
59A Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Alexandru-Marian Bordaş, bordas.alexandru@yahoo.com

PhD Supervisor: Professor Valeriu David
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

This study addresses the challenge of artifacts induced by electrical interferences in ultrasound imaging devices, focusing on their origins and how to effectively eliminate them. The purpose of the research is to investigate the mechanisms underlying artifacts generated by electromagnetic interferences and to propose practical solutions to minimize their effects. In the first phase, the different types of artifacts are categorized, more precisely those of an internal nature and those of an external nature. Later, we focused on those of an external nature, specifically those produced by external factors such as conducted and radiated electromagnetic interference. Following the studies carried out, it was discovered that a large percentage of the artifacts present due to electromagnetic interference come from conducted emissions. Radiated emissions also impact the quality of ultrasound images, but considering the rate at which they appear, the focus is on conducted emissions. Therefore, the researched solution to reduce these types of artifacts was the use of EMI filters connected to the electrical network. Also, following the research carried out, we highlighted the prevalence of electrical artifacts in the case of cardiac probes, the frequency range used for this type of probe being the most prone to artifacts, affecting diagnostics reliability. We also found that in the color doppler mode, using cardiac (sectorial) probes, the system is most prone to electrical artifacts, and the method identified for their reduction and removal is the use of specialized EMI filters for this requirement. From the tests performed using an EMI filter, a considerable difference was highlighted with relevant results regarding the improvement of the quality of the ultrasound image, this also being reported by the user. Although it proved to be a good solution, there were situations where even with an EMI filter, the artifacts were not fully diminished. The main goal of this study is to identify the weaknesses of the existing filters on the market and to design a specialized filter for the elimination of artifacts to improve the quality of the image, and more precisely the quality of the medical act.

Keywords: ultrasound, artifacts, electromagnetic interference filter, image quality, conducted EMI

SAFETY HELMETS RECYCLING AND SELECTION: A SHORT REVIEW

Cristian-Stefan Bunduc, Leandru Gheorghe Bujoreanu, Ramona Cimpoesu, Costica Bejinariu

"Gheorghe Asachi" Technical University of Iasi, D. Mangeron 67, 700050, Iasi, Romania

Corresponding author: Cristian-Stefan Bunduc, cristian-stefan.bunduc@academic.tuiasi.ro

Ph.D. Supervisor: Professor Costică Bejinariu,
Gheorghe Asachi Technical University of Iasi, Romania

Abstract:

Safety helmets or hard hats are among the most important personal protective equipment (PPE), especially in the construction industry or any other industry that includes working at different heights or in areas where the risk of falling cannot be avoided. Currently, there are many types of safety helmets on the market; therefore, both the design and the type of materials used for their manufacturing are related to their areas of application. Among these, some of the most important are industrial safety helmets, due to the impossibility of eliminating the risks of head trauma in different working conditions. This category occupies a special place, especially when it comes to workplace safety. Nevertheless, usually the most serious and disruptive occupational injuries, i.e., work-related traumatic brain injuries, are due to the misuse or use of non-suitable helmets. However, in some cases, even if the type of helmet was chosen correctly, the failure of this PPE can be related to the material's durability since aging processes cannot be avoided. Therefore, before use, the safety helmets must be subjected to rigorous inspections to assure the safety of the operator. In practice, these tests are almost impossible since most of them can only be performed by specialized personnel or equipment and not by visual inspection of the operator. Consequently, to prevent any accidents, the users are forced to replace the hard hats after short periods of use. To assure sustainability in this sector, it is highly necessary to develop safety hats that use green materials for their manufacturing while finding eco-friendly methods of recycling the old ones. This study presents a short overview of the literature regarding the use and recycling of safety helmets, focusing on the shortcomings of each type of material that is used for their manufacturing. Therefore, it was observed that even though most of the hard hats are made of plastics (thermoplastics, ABS, polyethylene, etc.) or composites, their reuse is strongly limited due to the inevitable degradation of the materials used for the manufacturing of their shell.

Keywords: safety helmets; composite materials; personal protective equipment; hard hat; materials selection

THE IMPACT OF TRANSCRANIAL ELECTRICAL STIMULATION ON NEUROPSYCHOLOGICAL PROCESSES IN FEAR MEMORY

Alexandru Buzamat

”Gheorghe Asachi” Technical University of Iasi, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Alexandru Buzamat, alexandru.buzamat@student.tuiasi.ro

PhD Supervisor: Professor Marian Poboroniuc
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Millions of individuals worldwide are affected by Post-Traumatic Stress Disorder (PTSD) and anxiety disorders, causing profound disruptions to their quality of life and imposing substantial burdens on healthcare systems. Despite advancements in psychotherapy and pharmacotherapy, there remains a significant rate of partial response to current treatments, especially because of the renewal effect - a phenomenon where a previously extinguished fear reaction reappears in different contexts. The project aims to address a gap in current research by examining the effects of transcranial direct current stimulation (tDCS) on the renewal effect. Paradigms must be appropriately designed as well. Fear responses through EEG (e.g. recorded by means of performant g.Nautilus / g.USBamp systems and analyzed within g.BSanalyze application, g.tec medical engineering GmbH, Austria) and behavioral measurements in healthy subjects will be recorded in a 3-day context dependent conditioning paradigm, tDCS being applied during the extinction phase only for the experimental group. In addition to the engineering team responsible for configuring BCI systems and recording data, bioengineers and psychology specialists are also involved. If tDCS is found to be effective in reducing the renewal effect, these findings could then be applied to patients with PTSD and various anxiety disorders, potentially improving the outcomes of desensitization therapies.

Keywords: PTSD, Anxiety Disorder, tDCS, EEG, BCI

K-MEANS CLUSTERING-BASED OPTIMAL PLACEMENT METHODOLOGY OF ELECTIC VEHICLE CHARGING STATIONS IN PHOTOVOLTAIC RICH DISTRIBUTION NETWORKS

Ecaterina Chelaru, Gheorghe Grigoraș

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, 67 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ecaterina Chelaru, ecaterina.chelaru@student.tuiasi.ro

PhD Supervisor: Professor Gheorghe Grigoraș,
“Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

The advancement of technology has raised people's expectations and increased their consumption of resources, which can have adverse effects on the environment. To achieve sustainable development and protect the environment, distributed generation has been promoted, and electric vehicles (EVs) have been widely used. The large-scale integration of small-scale renewable energy sources installed to consumers (also called prosumers) can cause technical issues (increased voltage level, high energy losses, and inverse power flow through the power transformer from the electric distribution substation) in the electric distribution networks. One of the measures that distribution network operators can apply is the optimal placement of EV charging stations (EVCSs) to mitigate technical issues. The paper presents a clustering-based placement methodology of the EVCSs in the rural and peri-urban electrical networks, considering the hourly power flows and average phase voltages as the input data for each node. The K-means clustering algorithm has been used to determine the optimal number of clusters. The “candidate” clusters (containing the nodes where the EV charging stations) have been considered based on the highest inverse power flows and the increased average phase voltages calculated for a reference day when the power injections of the prosumers had the maximum value. The nodes from the “candidate clusters” where the EVCSs will be placed have the minimum average percentage error of the power flow and voltage calculated in relation to a virtual node characterized by the average features of the cluster. The optimal number of the EVCSs and placement nodes have been identified based on the minimum value of an objective function containing the weighted values of the energy losses and mean square deviation of the voltage in the electric distribution network in various scenarios regarding the typical power demand profiles of EVCSs. A real low voltage aerial electrical distribution from a peri-urban area with 36 pillars and 53 end-users, including 26 prosumers, has been used to test the proposed methodology. The obtained results revealed that two EVCSs can be placed in the network to mitigate the technical issues regarding the voltage level, energy losses, and inverse power flow through the distribution transformer.

Keywords: electic vehicles, charging stations, K-means clustering, optimal placement, distribution networks

NANOENCAPSULATION OF PHASE CHANGE MATERIALS: A SHORT OVERVIEW

Nicoleta Cojocariu

"Gheorghe Asachi" Technical University of Iasi, Faculty of Materials Science and Engineering,
67 D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Nicoleta Cojocariu, nicoleta.cojocariu@student.tuiasi.ro

PhD Supervisor: Professor Alina-Adriana Minea
Gheorghe Asachi Technical University of Iasi, Romania

Abstract:

Phase change materials (PCM) are characterised by high latent heat and good stability during phase transition. The present study explores the synthesis methods and characterisation of nanoencapsulated phase change materials, their thermal properties and various engineering applications. In recent years there has been a significant increase in research regarding heat transfer, its storage methods, minimizing heat losses and improving heat transfer rates during heating or cooling processes. The increased thermal storage properties and thermal capacity of phase change materials are given by the latent heat of melting and solidification. However, the main limitations on the use of PCMs for heat transfer applications are poor thermal stability, volume variations and low thermal conductivity. Micro- and nanoencapsulation are the two most popular coating approaches where the material (PCM) is retained inside of suitable membrane which provides large surface area for efficient heat transfer and to overcome leakage problems. Nanoencapsulation can be achieved by three main methods: chemical, physicochemical and physicomechanical. For multiple applications, nanoencapsulated phase change materials (NePCM) can be used by dispersing them in a suitable base fluid, in emulsions, mixed with surfactants, depending on the case. It is well known that mixing nanoparticles in a fluid involves a change in the liquid's thermophysical properties, therefore, it can be exploited both the heat transfer capacity of the base fluid as well as the thermal storage properties of PCM.

Keywords: phase change materials, nanoencapsulation, heat transfer, thermal storage

THE INFLUENCE OF LOW FREQUENCY TRANS DERMAL ELECTRICAL IMPULSES ON THE INCREASE OF THE VAGUS NERVE TONE

Mihai Costache

Alexandru Ioan Cuza University, Iași, Romania, Physics Faculty, 11 Carol I Blvd.

Corresponding author: Mihai Costache, mihai.costache@student.uaic.ro

PhD Supervisor: Professor Emilia-Dorina Creanga,
"Alexandru Ioan Cuza" University of Iasi, Romania

Abstract:

The vagus nerve, also known as the vagal nerves, are the main nerves of the parasympathetic nervous system, forming the 10th pair of the 12 cranial nerves, and controlling specific body functions such as digestion, heart rate and immune system. They are considered to be involuntary, meaning you can't consciously control them, that's why it's important to have a good function of these nerves.
Many studies confirm that after the age of 50, the activity of the vagus nerves decreases, resulting in the disfunction of the above-mentioned functions. The purpose of this study is to increase the vagal nerve tone in a non-invasive way, by means of low frequency trans dermal electrical impulses in places where this nerve is close to the skin: the right ear tragus and the right carotid artery.
I constructed a variable frequency and amplitude electrical impulse generator using a NE 555 CMOS timer, which generates trains of impulses of variable amplitude and frequency, centering the studies on the 45 Hz frequency, because it is widely used and considered to be of maximum benefit. The shape of the impulses is "spike", simulating very well the impulses generated by the neurons i.e. the action potentials.
I used an electronic Pango Shenzen device to measure the pulse and the arterial blood pressure, with a + / - 4 % error tolerance, as well as a semi-automated Winner 858 device with a + / - 3 % tolerance.
The patient who benefitted of this therapy has paroxistic tachycardia and essential hyperblood pressure. The pulse and blood pressure before the therapy were respectively 88 and 149 / 98.
After I connected the trans dermal patches and established a comfortable amplitude threshold (I increased the amplitude of the impulses from 0 to a level of "pleasant tickling sensation") for 30 minutes, I measured the following values: 82 and 85 for the pulse and 132/76 and 137 / 81 for the arterial blood pressure by using the 2 devices. In conclusion the treatment results show improved heart function indicators as a result of the intensifying of the activity of the vagus nerve, which is an inhibitory nerve with important role in the homeostasis. More studies on a higher number of patients, possibly using different types of impulses and different frequencies, are planed in order to conclude in a favourable way on this method.

Keywords: Vague nerve, electric stimulation, home made generator, heart activity

BIOACTIVE COMPOUNDS IN SEA BUCKTHORN AND THEIR EFFICACY IN INFLAMMATORY SYNDROME OF THE ORAL CAVITY

Oana Cucoveică, Leonard-Ionuț Atanase

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Chemical Engineering and Environmental Protection
Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Oana Cucoveica, oanacucoveica@yahoo.com

PhD Supervisor: Professor Leonard-Ionut Atanase,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The use of sea buckthorn oil in various food supplements, pharmacological preparations with local applications has been studied until now by numerous researchers. They talk about its benefits in the treatment of metabolic syndrome as well as anti-ulcerative properties, tissue regeneration, epithelization. Buckthorn oil inhibits gastric secretion and proteolytic activity in the gastric mucosa, increases the hydrophobicity of the mucosal surface, and delays the gastric break.
β-sitosterol and β-sitosterol-β-D-glucoside are compounds directly involved in the anti-ulcerative property.
Oral diseases are characterized by the inflammatory cascade and microulcerations that destabilize the oral microbiome and the keratinized protective layer.
In these conditions, a careful analysis of the benefits of the bioactive compounds from buckthorn oil and its potential to be used in oral preparations is required, as well as a review of the results already obtained in the specialized literature.
the present work appreciates this potential and summarizes the applications together with other substances with a promoting role in oral health.

Keywords: Inflammatory syndrome, oral health, sea buckthorn, nano emulsion, antiage

ROBOT TECHNOLOGY USED IN REHABILITATION – A STUDY COMPARISON WITH OVERGROUND GAIT TRAINING IN HEMIPLEGIC PATIENT

Marius Dobîndă

"Alexandru Ioan Cuza" University of Iasi, Faculty of Physics,Carol I Blvd., 700506, Iasi, Romania

Corresponding author: Marius Dobinda, marius.dobinda@student.uaic.ro

PhD Supervisor: Professor Emilia-Dorina Creanga,
"Alexandru Ioan Cuza" University of Iasi, Romania

Abstract:

As gait is the main form of locomotion for humans it is understandable its importance and quality. Neurological pathologies, much often than other pathologies, alters this capacity in the most complex way. Gait rehabilitation is an important objective in physical therapy but is a time and resources consuming event. Overground gait training represents a major part of physical therapy services.
The nowaday technology, although expensive, has the capability to offer more effective solutions to overground gait training by partially substituting physical therapist intervention. The most current robotic technologies used in gait rehabilitation is RAGT (Robotic-Assisted Gait Training). Treadmill-based RAGT (t-RAGT) is most commonly used in combination with body weight support. This is performed either with end-effector robots that drive two footplates simulating the phases of the gait, or with exoskeleton orthoses that move the lower body extremity joints in coordination with the phases of gait.
The purpose of this review is to make a gait analysis, from the point of view of biomechanics on an end-effector type robot compared to a normal treadmill and overground surface, and to analyze the affected limb during gait cycle by using a gait analysis system build on a arduino device. The subject group was composed by males and females with the same diagnosis and similar level of autonomy (FAM scale).
The interpretation of the results is based on the way of how the application of concepts of classical mechanics, work, power, force (static and dynamic friction, traction, normal reaction), physiological work and efficiency can differ from patient to patient. The data recorded during the study confirmed that, using robotic systems, the gait pattern is close to normal. If from the kinematic point of view the movement occurs on a trajectory close to the physiological one, from the dynamic point of view we understand that this shape is created by the action of external forces.

Keywords: gait analysis, biomechanics, end-effector robot, treadmill, overground gait, arduino.

EXPLORING INNOVATIONS IN HYBRID HYDROGELS FOR EFFECTIVENESS IN TREATING VARICOSE ULCERS IN THE CONTEXT OF VASCULAR HEALTH

Elena Farcaș[1], Leonard-Ionuț Atanase[2,3]

[1]"Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, "Gheorghe Asachi" Technical University of Iasi, Romania, Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]"Apollonia" University of Iasi, 700511, Iasi, Romania
[3]Academy of Romanian Scientists, 050045 Bucharest, Romania

Corresponding author: Elena Farcaș, elena.farcas@student.tuiasi.ro

PhD Supervisor: Professor Leonard Atanase,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Varicose ulcers, a severe manifestation of chronic venous insufficiency, represent significant treatment challenges and affect patients' quality of life globally. Innovative therapeutic approaches are crucial to improve healing processes and mitigate complications. A review of existing studies in this field focuses on the progress of hybrid hydrogels incorporating fiber-reinforced polymers or microparticles loaded with therapeutic agents, specifically targeting the effective management of varicose ulcers.

Recently, various studies have paved the way for the use of hybrid hydrogels in medical applications. These hydrogels, known for their ability to encapsulate bioactive molecules, adjust healing environments dynamically due to their physicochemical properties. A new research direction would be the integration of natural and synthetic polymers loaded with pharmaceuticals, forming a matrix that not only supports controlled drug release, but also simulates the properties of the extracellular matrix to facilitate better cellular interactions and tissue integration.

The innovative aspect of the new research direction is the application of coaxial electrospray techniques to create core-shell nanoparticles embedded in hydrogel matrices. These nanoparticles are loaded with essential oils known for their antimicrobial properties, and the hydrogel base is infused with heparin to provide antithrombotic benefits. This combination enhances antimicrobial and healing efficacy, making these hydrogels superior to traditional treatments.

The potential of these hybrid hydrogels extends beyond current applications, suggesting a transformative impact on chronic wound management. By incorporating advanced bioengineering techniques, these hydrogels offer dual functionality - simultaneously delivering therapeutic agents while promoting tissue regeneration. This duality is particularly effective in environments where traditional healing methods are insufficient. In addition, continued advances in polymer science could allow the incorporation of additional functionality, such as pain management agents or sensors for real-time healing assessment. This holistic approach in hydrogel technology marks a major leap forward in both the conceptual and practical aspects of treating varicose ulcers, aligning with the latest trends in vascular health research and biomaterials innovation.

Keywords: hybrid hydrogels; transdermal delivery; heparin; nanoparticles

KEY ASPECTS REGARDING THE IMPLEMENTATION OF A PHOTOVOLTAIC PARK IN ORDER TO CREATE A REDUCTION IN CARBON EMISSIONS

Stefan-Andrei Nădăbaică

"Gheorghe Asachi " Technical University of Iasi, Romania, Faculty of Electrical Engineering,
21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Nadabaica Stefan-Andrei, stefan-andrei.nadabaica@student.tuiasi.ro

PhD Supervisor: Professor Maricel Adam,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Solar energy is a renewable and infinite source of energy that creates no harmful greenhouse gas emissions – as long as the sun continues to shine, energy will be released.
The carbon footprint of solar panels is already quite small as they last for over 25 years. In addition, the materials used in the panels are increasingly recycled, so the carbon footprint will continue to shrink.
In this context, the paper describes the design and implementation of a photovoltaic park adapted to the needs of a medium-sized town in Constanta County, with an emphasis on energy efficiency and cost reduction.
By analyzing the energy consumption of consumers in the administration of the town and identifying its solar energy generation potential, an optimally sized photovoltaic system is presented to cover a significant part or even all of the consumers' energy requirements.
In this sense, a detailed evaluation of the location of the park is carried out, taking into account factors such as sun exposure and topography. This information is used to determine the most suitable configuration of the photovoltaic park, including the number and location of the solar panels, as well as the equipment needs for connecting and discharging the generated power to the grid. A profitability analysis is also presented, evaluating the initial costs of building the photovoltaic park, as well as the long-term savings generated by the reduction of energy bills and possible subsidies or tax advantages associated with the use of solar energy for commercial purposes.
Some technical aspects of the equipment needed to create the photovoltaic system will be presented (solar panels, electrical protections, inverter, connection systems etc.), as well as some measures to optimize the performance of the system, such as monitoring and maintenance, will also be considered.
Finally, a plan will be presented for the implementation and operation of the photovoltaic park, including the stages of installation, testing and integration into the existing electrical network. It will be emphasized that by adopting this system, this town will be able to reduce their carbon footprint and improve their sustainability, while optimizing their operational costs and strengthening their energy independence

Keywords: solar energy; carbon emissions; photovoltaic park; reduced costs

IMPROVING THE PROFITABILITY OF SOLAR PLANTS BY INTEGRATING THEM WITH SCADA SYSTEMS AND THE ENERGY EQUILIBRIUM MARKET THROUGH THE IMPLEMENTATION OF ENERGY STORAGE SYSTEMS

Aurel-David Paizan

"Gheorghe Asachi" Technical University of Iasi, Faculty of Electrical Engineering,
21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Aurel-David Paizan, aurel-david.paizan@student.tuiasi.ro

PhD Supervisor: Professor Maricel Adam,
“Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

In recent years, we've seen a significant rise in the implementation of solar farms and wind turbines. However, solar energy production is increasingly facing disadvantages due to the imbalances it introduces into the OPCOM (Romanian gas and electricity market operator*)* market. Romania's National Electrical Grid is not fully equipped to manage the distribution of energy produced, particularly to large industrial consumers or for the import-export market. During peak production times, this inefficiency often results in electricity prices plummeting into negative territory, which in turn disrupts wind turbine electricity generation.

The current approach to managing this issue is rather drastic. Wind farms have resorted to systems that can shut down turbines, either partially or completely, to avoid the cost of delivering energy. Essentially, it becomes more economical to cease operations temporarily than to incur the expenses associated with contributing power to the grid. Similarly, because solar plants tend to produce electricity simultaneously and at comparable rates, they face lower compensation or, in some cases, incur costs for the energy they generate.

This situation calls for a detailed analysis of viable solutions to mitigate these challenges.

Ideally, to boost the efficiency of electricity production, the National Electric Grid would be upgraded to handle all generated energy. Additionally, the integration of more industrial electricity consumers and the transition to electrified transportation would be beneficial. However, such developments will take considerable time. A more immediate resolution would involve outfitting particularly large solar farms with robust Energy Storage Systems and high-power inverters that can handle large energy charging or discharging. These installations would manage the supply and demand of energy, allowing for the strategic sale of electricity back to the grid at favorable rates or contributing to the Energy Equilibrium Market when necessary.

This paper will outline the systems that enable access to the Energy Equilibrium Market, detailing the process of integration and the necessary equipment. The importance and advantages of participating in this market will also be discussed, highlighting how it can stabilize pricing and support the overall energy infrastructure.

Keywords: solar energy; electrical grid; storage systems; equilibrium; stability; energy market

ADVANCING RESPONSIBLE TOURISM-IMPLEMENTING SUSTAINABLE DEVELOPMENT GOAL TARGETS IN TOURIST DESTINATIONS

Raluca-Maria Mighiu-Ţâbuleac[1], Maria Gavrilescu[1,2]

[1]"Gheorghe Asachi" Technical University of Iasi, "Cristofor Simonescu" Faculty of Chemical Engineering and Environmental Protection, Department of Environmental Engineering and Management, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]Academy of Romanian Scientists, 3 Ilfov Street, Bucharest, Romania

Corresponding author: Raluca-Maria Ţâbuleac, raluca-maria.tabuleac@student.tuiasi.ro

PhD Supervisor: Professor Maria Gavrilescu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Ever since the United Nations (UN) introduced the Sustainable Development Goals (SDGs) in September 2015, sustainable development has become a central topic of discussion among legislatures, professionals, and decision- makers worldwide. Recent studies have emphasized the crucial role that the tourist sector plays in effectively accomplishing the SDGs. Tourism is a significant industry that creates employment opportunities and produces revenue, consequently adding to the gross domestic product and fostering economic growth in a tourist destination. Increased globalization, changes in transportation, growing populations, technological advances, the rise of digital platforms, and increased communications channels have all contributed to a significant increase in visits to tourism-related sites. Hence, the tourism industry has made an important contribution to the economic and social progress in many places worldwide, emphasizing the importance of sustainable management of tourist sites. Over the last several years, there has been a consistent increase in demand for tourism activities. This research aims to examine the convergence between responsible tourism and the SDGs, with a specific emphasis on popular tourist destinations. This study seeks to investigate the successful implementation of sustainable tourism practices in addressing certain SDG goals, such as poverty reduction, environmental protection, preservation of cultural heritage, and inclusion within society. The article proposes to determine successful strategies and new approaches in promoting responsible tourism by assessing current literature, analyzing suitable data from Eurostat, and providing case studies from differed destinations. Furthermore, its objective is to offer concrete suggestions to decision-makers, tourism actors, and community members on how to incorporate equitable tourism concepts into their strategies and actions. This will help foster more environmentally conscious, collaborative, and resilient forms of tourism. The findings of this analysis have implications for policy stakeholders, interested parties and professionals involved in tourism management and sustainable development. By achieving a deeper understanding of the economic and environmental dimensions of tourism, stakeholders can develop informed strategies to maximize the benefits of tourism while mitigating its negative impacts on the environment and local communities. Additionally, this study examines the challenges of balancing economic growth and environmental preservation in the tourism sector in Romania, contributing to sustainable tourism development.

Keywords: economic development, environmental conservation, responsible tourism, SDGs, sustainability, tourism impact

A CUTTING-EDGE SENSORY DEVICE FOR EVALUATING PELVIC FLOOR MUSCLE STRENGTH

Alina Roxana Miron, Marian-Silviu Poboroniuc

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Alina-Roxana Miron, alina-roxana.miron@student.tuiasi.ro

PhD Supervisor: Professor Marian-Silviu Poboroniuc,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Assessing muscle strength is crucial in physical therapy, but it's particularly challenging with the pelvic floor muscles (PFM) due to their location and limited mobility. Evaluating these muscles provides insights into the patient's ability to contract and support the pelvic organs (bladder, bowel, uterus) and abdominal structures, maintaining sphincter function, balance during walking, and blood circulation. Additionally, it helps track changes in PFM function and strength throughout the rehabilitation process.

The objective of this study is to develop a novel sensory device specifically designed to measure pelvic floor muscle (PFM) strength, aiming to overcome limitations observed in existing devices. The initial section provides an overview of anatomical and biomechanical data pertinent to this investigation. Various assessment techniques such as palpation, visual observation, electromyography (EMG), ultrasound, or magnetic resonance imaging (MRI) can capture different aspects of PFM activity. However, all these methods require specialized facilities, equipment, trained personnel, and may entail discomfort for the patient.

Due to the wide range of sensors available and their application across various fields, it seemed natural to consider integrating them into this new device. The proposed sensory device will comprise a Foley urinary catheter combined with a sensor activated by a fluid. The sensory system will be connected to the balloon port lumen of the Foley catheter. This design allows for the sensory device to be easily attached to or detached from the urinary probe, making it applicable only to patients who require it.

The advantages of this new sensory device are numerous: the Foley catheter is suitable for both genders, it is cost-effective and commonly utilized, it can serve as a reference point for locating and engaging the pelvic floor muscles, it is managed by medical personnel, it can be worn comfortably for extended periods and even used at home, it reduces the necessity for additional equipment and evaluation space, and it can guide patients in performing exercises while documenting potential treatment progress.

Keywords: pelvic floor muscles assessment, sensorial system, foley catheter

STUDY ON THE PHOTOCHEMICAL SYNTHESIS OF SILVER NANOPARTICLES USING CHEMICAL AND BIOLOGICAL REDUCERS – PRELIMINARY RESULTS

Ramona Plesnicute[1], Iuliana Motrescu[2], Anda Les Agavriloaei[1] , Dorina Creanga[1]

[1]Alexandru Ioan Cuza University of Iasi, Romania, Faculty of Physics, 11 Carol I Blvd., 700502, Iasi, Romania
[2]Ion Ionescu de la Brad University of Life Sciences, Iasi, Romania

Corresponding author: Ramona Plesnicute, mdor@uaic.ro

PhD Supervisor: Professor Dorina Creanga,
Alexandru Ioan Cuza University of Iasi, Romania

Abstract:

Silver nanoparticles (AgNP) have various applications in daily people's life due to their nanometric scale, antibacterial activity and special electro-optical properties. In the U.S. alone, in 2011 the production of minimum 2.8 t of AgNPs was estimated with enhanced perspective for 2025 (up to 800 t) meaning huge amount of particles released in the environment. Biological synthesis aims to minimize the AgNP nanotoxicity by using plant extracts as silver ion reducers. We present the results of chemical reduction (with trisodium citrate (TSC)) and those of biological synthesis with lemon extract and the influence of ultraviolet radiation exposure on the AgNP synthesis completion. The photochemical synthesis was accomplished with chemical reagents, commercially available Citrus fruits, laboratory devices for weighting, heating, stirring and centrifugation while physical methods for the AgNP characteri zation were applied: X-Ray diffractometry, Dark Field optical microscopy, Scanning Electron Microscopy and Energy Dispersive X-Ray Spectroscopy, UV-Vis spectrophotometry. UV-C irradiation was performed with 12 W power tube generator from Philips. The results that first confirm AgNP formation were the electronic absorption spectra recorded in the visible radiation range, with spectral band maximum at typical wavelength. After first reaction step, as soon as reaction medium turned off its color to yellow, the UV exposure was carried out for 10-20-30 min, the results of this second reaction step being evidenced by the progressive increasing of the characteristic band intensity, in time. X-Ray Diffractometry (XRD) revealed characteristic peaks of crystalline silver structures, Scanning Electron Microscopy (SEM) has visualized in both cases tens nanometer particles as well as the Dark Field Microscopy did. Energy Dispersive X-ray Spectroscopy (EDS) confirmed the presence of nanosilver by means of Ag L shell emission line. Although the microstructural investigation methods emphasized similar results regarding the samples' granularity, the highest capacity of silver reduction with AgNP formation was shown for the biological method completed with ultraviolet radiation exposure, as evidenced by the increased intensity in the spectral band for AgNP reduced with lemon extract compared to the spectral results for the chemical reduction with TSC. We will develop further the experimental study of AgNP biological synthesis with focus on the fresh extracts from fruits containing high levels of antioxidants.

Keywords: Silver nanoparticles, chemical reduction, biological reduction, spectral band, microstructural features

DESIGNING, MANUFACTURING AND TESTING OF AN EXPERIMENTAL SETUP FOR THE STUDY OF SHAPE MEMORY EFFECT IN R-PET THERMOFORMED CUPS

Ștefan Dumitru Sava[1], Mihai Axinte[1], Romario Patraș[2], Leandru-Gheorghe Bujoreanu[1]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Materials Science and Engineering, 41 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Architecture, 3 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ștefan Dumitru Sava, stefan-dumitru.sava@student.tuiasi.ro

PhD Supervisor: Professor Leandru-Gheorghe Bujoreanu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

In previous studies, the presence of shape memory effect (SME), at recycled Polyethylene terephthalate (R-PET) and Polyethylene terephthalate glycol (R-PETG), was revealed and analyzed. Both at extruded filaments and 3D printed specimens, of R-PET and R-PETG, the presence of free-recovery SME was observed. In addition, R- PETG filaments were able to develop work-generating SME, over multiple cycles, during which loads over 50 times heavier than active specimens were lifted. However, R-PET specimens were unable to develop work- generating SME.

The present paper aims to report and explore the capacity of thermoformed R-PET cups to develop work-generating SME by lifting various loads, during heating. The cups were experimentally produced by hot deep drawing, with symmetrical geometry and a depth-to-width ratio exceeding 1:1, the process being plug-assisted, to enable the most uniform material distribution for constant wall thickness obtainment.

For this purpose, a special experimental setup was designed and obtained by 3D printing. The setup has to meet the following requirements: (i) firm fixture of the cups through their upper brims, (ii) stable fastening of the hot air gun and temperature measuring multimeter and (iii) clear visualization of both cup bottom lifting and temperature variation, during heating.

The paper describes the technological stages for R-PET cup production, starting from the hot extruded foil (which has anisotropic mechanical properties due to the hot extrusion process) and finishing with the geometry of the final product (which was obtained with various geometric dimensions and the best form factor). Then, the design of each constructive element of the experimental setup was introduced and the final 3D printed part was described. In order to emphasize the occurrence of work-generating SME, the influence of numerous parameters was investigated, namely: (i) distance between cup bottom and hot air gun nozzle; (ii) heating time and intensity; (iii) visualization of cup bottom displacement; (iv) magnitude of lifted loads.

At the end of the paper, experiments were performed for analyzing both a free-recovery and a work-generating SME and the corresponding variations of cup bottom displacement with temperature were plotted

Keywords: recycled PET, shape memory effect, thermoforming, 3D printing, work-generation

IN-DEPTH THEORETICAL AND EXPERIMENTAL REVIEW ON DIELECTROPHORETIC MANIPULATION OF BIOLOGICAL CELLS

Mădălina-Petronela Simion, Tudor-Alexandru Filip, Marius-Andrei Olariu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Mădălina-Petronela Simion, madalina-petronela.simion@student.tuiasi.ro

PhD Supervisor: Assoc. Professor Marius Andrei Olariu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Dielectrophoresis (DEP) is a powerful and well-established technique that allows label-free, non-invasive manipulation, and characterization of biological cells by leveraging their electrical properties. DEP has become a promising technique to separate, isolate and identify biotargets suspended within a medium based on their dielectric properties, fact which might be essential in development of future biomedical applications.
DEP is strongly dependent on the dielectric properties of the cells and the polarisability of the medium, mainly the Maxwell-Wagner (MW) or interfacial polarisation mechanism. To date, DEP microfluidic devices have been improved for sorting biological cells from healthy cells based on differences in cell response to electric field gradients. Cellular DEP behaviour is largely dominated by extracellular factors, including the electrical properties of the cell membrane and cytoplasm, cell size and solution conductivity. Microfluidic dielectrophoretic (DEP) devices demonstrated to be useful in differentiating cells based on their electrophysiological properties with high applicability potential in (pre-)clinical diagnostics and medical research.
The herein review is aiming to provide an in-depth collection of experimental studies on utilization of DEP in handling various biological cells. Thus, starting from the classical setup of DEP, several literature-proposed technological configurations for cells sorting have been discussed, namely: (Electrode-Based) Dielectrophoresis (DEP or eDEP), insulator-Based Dielectrophoresis (iDEP), contactless Dielectrophoresis (cDEP), traveling Wave Dielectrophoresis (twDEP), optically Induced Dielectrophoresis (oDEP), dielectrophoretic Field-Flow Fractionation (DEP-FFF or dFFF).
The literature is presenting a plethora of studies with respect to electrical evaluation of cells, and this review is reporting a collection of information regarding the functioning principles of different types of dielectrophoresis set-ups and electrical investigation. The interpretation of electrical characteristics against frequency is discussed with respect to interfacial/Maxwell–Wagner polarization. Nonetheless, technological challenges and future scientific directions to be approached for ensuring medium-term large-scale uptake of DEP in clinical studies are discussed while clearly differentiating the influence of electrodes' geometry and architecture, medium conductivity, DEP parameters against cells electrophysiology.

Keywords:. dielectrophoresis, biological cells, electrodes, medium conductivity, non-uniform electric field

EXPLORING GRADIENT BOOSTING MACHINE FOR PARKINSON'S DISEASE CLASSIFICATION USING ACCELEROMETER DATA

Andrei Stoleru

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Automatic Control and Computer Engineering, 27 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Andrei Stoleru, andrei.stoleru@student.tuiasi.ro

PhD Supervisor: Professor Vasile-Ion Manta,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Parkinson's Disease (PD) is a neurodegenerative disorder characterized by motor symptoms such as tremors, bradykinesia, and rigidity. Early diagnosis and intervention are crucial for effective management of the disease and improvement of patients' quality of life. In recent years, machine learning techniques have emerged as powerful tools for analyzing biomedical data and aiding in disease diagnosis. This study explores the application of Gradient Boosting Machine (GBM), a popular machine learning algorithm, for the classification of PD based on accelerometer data.

The primary objective of this research is to develop a robust classification model capable of accurately distinguishing PD patients from healthy controls using accelerometer data. The dataset used in this study consists of accelerometer readings collected from PD patients and controls during various activities. These readings capture movement patterns that are indicative of motor impairments associated with PD.

To train the classification model, statistical and frequency domain features are extracted from the accelerometer data. These features include measures of central tendency, variability, and spectral characteristics of the movement signals. The GBM model is trained on these features to learn the underlying patterns that differentiate PD patients from controls.

The results of the study demonstrate the effectiveness of the GBM model in classifying PD patients and controls. The model achieved an accuracy of 58.3%, with a precision of 100%, recall of 37.5%, and F1-score of 54.5%. Additionally, the area under the receiver operating characteristic curve (AUC-ROC) was found to be 68.8%. These findings suggest that the GBM-based classification model shows promise as a diagnostic tool for PD.

The implications of this research are significant for the early diagnosis and management of PD. Accurate classification of PD patients can lead to timely interventions, personalized treatment plans, and improved patient outcomes. Future research directions may involve the refinement of feature selection techniques, exploration of ensemble learning methods, and validation of the model on larger and more diverse datasets. Overall, the study underscores the potential of machine learning approaches in enhancing the diagnosis and understanding of Parkinson's Disease.

Keywords: Parkinson's disease, machine learning, gradient boosting machine, motor symptoms, feature extraction, statistical analysis

SECTION 2.

Computers and information technology; Systems engineering; Electrical engineering; Energy engineering; Electronic engineering, telecommunications and information technology

CYBERWARFARE DYNAMICS: STRATEGIC IMPLICATIONS IN THE DIGITAL DOMAIN

Roxana Emanuela Ambrozie

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electronics, Telecommunications and Information Technology, 11A Carol I Blvd., Iasi 700506, Romania

Corresponding author: Roxana Emanuela Ambrozie, roxana-emanuela.ambrozie@student.tuiasi.ro

PhD Supervisor: Professor Daniela Tărniceriu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

In the evolving landscape of global conflict, cyberwarfare has emerged as a critical domain where state and non-state actors engage in digital battles. This PhD research situates cyberwarfare within the broader context of contemporary warfare and national security. The primary objective is to analyze the effectiveness of offensive cyber operations as tools of strategic policy in the ongoing conflicts. The current global conflict between Democracy and Autocracy presents a compelling case encapsulating the intersection of geopolitics, technology, and security concerns. Embarking on this exploration, it is crucial to dissect the intricate layers of this cyberwarfare phenomenon to grasp its implications for telecommunications and cybersecurity.

Using a mixed-methods approach, the PhD research integrates quantitative data analysis with qualitative case studies. The methodology encompasses a comprehensive review of cyber incidents from the past decade, coupled with simulations of cyber-attacks using a custom-developed digital warfare environment. This dual approach facilitates a robust examination of cyber tactics and their real-world implications.

The findings are expected to reveal a nuanced landscape where cyber operations produce significant strategic advantages, particularly in terms of intelligence gathering and disruption of enemy infrastructure. The results might also highlight the challenges in attribution, the escalation of hostilities, and the potential for collateral damage. A notable case is the analysis of the ransomware operation on the Hipocrate software, which underscores the complexity of cyber-attacks and their reverberating effects on critical infrastructure and international relations. The discussion also delves into the ethical considerations and the necessity for an international framework to regulate state-sponsored cyber activities. We argue that while cyberwarfare presents a powerful tool, it must be wielded with caution to avoid unintended consequences.

Finally, the PhD research underscores the transformative impact of cyberwarfare on modern conflict. It advocates for a strategic approach that balances offensive capabilities with defensive resilience, emphasizing the need for international cooperation to mitigate the risks of cyber escalation. The research contributes to the knowledge on cyberwarfare by providing real evidence of its strategic utility and by proposing a framework for responsible conduct in the digital domain.

Keywords: cyberwarfare, cyber-attacks, ransomware, international relations, global conflict, telecommunications

A COMPARATIVE FEM STUDY BETWEEN PERMANENT MAGNET AND WOUND FIELD SYNCHRONOUS MACHINES

Mihăiță-Emanuel Anton

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Mihăiță-Emanuel Anton, mihaita-emanuel.anton@student.tuiasi.ro

PhD Supervisor: Professor Alecsandru Simion,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

The global climate crisis requires the adoption of viable solutions in terms of reducing pollution. Under the given conditions, one of the solutions imposed on the background of this crisis involves the mass electrification of vehicles and all large consumers of fossil fuels. The main reason for this mass electrification trend is the high efficiency of electric motors in energy conversion compared to internal combustion thermal motors. In this context, the tendency was to compare one of the electric machines used by car manufacturers (PMSM) with an electric machine less used in the car industry (WFSM).

In this paper, the performances of a surface-mounted permanent magnet synchronous machine (PMSM) and a wound field synchronous machine (WFSM) are compared to validate the information found in the specialized literature regarding to these types of electrical machines.

This study focuses on highlighting the advantages of PMSM, such as the ability to generate magnetic field without electric current, high efficiency and high specific power relative to the volume or mass of the machine. In order to have a point of reference, the simulations focused on two 1kW synchronous machines with a 9/10 structure (9 stator poles and 10 rotor poles) with identical stator, the first one excited by permanent magnets and the second excited by an electromagnetic field. These were performed by using the ANSYS Motor-CAD software.

Simulation results using Finite Element Analysis (FEA) are analyzed, and conclusions are presented. The results obtained from the simulations support the hypotheses found in the literature. At the same mass or volume, the PMSM, compared to the WFSM, develops a higher torque and power, offering a better efficiency; the absence of the rotor winding causes the total losses to decrease, reducing the electricity consumption required to excite the machine. The study indicated that PMSM with permanent magnets on the rotor surface (SPM) is a better option in applications where energy stability and high torque are required (excluding the influence of temperature on permanent magnets and their cost).

Keywords: FEM simulation, Ansys Motor-CAD, electrical machine design, PMSM (permanent magnet synchronous machine), WFSM (wound field synchronous machine), SPM (surface permanent magnet)

A HIGH-LEVEL SYNTHESIS APPROACH TO MODELLING AND EVALUATION OF THE AXI5-STREAM PROTOCOL

Cristian-Tiberius Axinte

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Automatic Control and Computer Engineering, 27 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Cristian-Tiberius Axinte, cristian-tiberius.axinte@academic.tuiasi.ro

PhD Supervisor: Professor Vasile Manta,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Advanced eXtensible Interface (AXI) is an on-chip communication bus protocol part of the Advanced Microcontroller Bus Architecture (AMBA) specification. It is being developed, maintained and open-sourced by ARM. Recently, the specification reached its 5th version, named AMBA5. This latest version includes the AXI5-Stream Protocol, which is a modified subset of AXI. It defines an interface for data exchange between a single transmitter and a single receiver, being a suitable protocol for use cases where on-chip high bandwidth, burst type of communication is needed. AXI5-Stream is not yet available as a library component to be provided by major vendors. For this reason, this paper provides an initial model and evaluation of the AXI5-Stream. AXI5-Stream allows for a customizable transfer width (parallel / simultaneous data transfer) ranging from 1 byte up to a recommended maximum of 128 bytes. Although it is a point-to-point protocol, AXI5-Stream could be implemented as the only type of interface of an Interconnect Network block (similar to AXI Crossbar), allowing multiple data streams to be exchanged from multiple transmitters to multiple receivers. This is achievable by leveraging the standard interface signals, namely the destination (receiver) address and the data stream identifier, along with the user-defined information (named sideband data). AXI5-Stream also provides wake-up signaling and interface protection using parity checking. These features enable a standardized approach to addressing the topics of energy efficiency and error detection. AXI5-Stream is suitable for flexible transfers of continuous, high-bandwidth data streams typically found inside dataflow architectures. Examples thereof include custom hardware accelerators or vector processing units (VPUs). High-Level Synthesis (HLS) represents a paradigm shift in the design and implementation of digital hardware. It allows for a functional description of the circuit to be translated into a control-data-flow-graph (CDFG) that is further processed by tools performing various configurable optimizations. The resulting optimized intermediate representation is compiled into synthesizable a Register Transfer Language (RTL) description. The proposed model is verified for correctness on a FPGA (Field-Programmable-Gate-Array) board. Experiments reveal FPGA resource utilization and latency. Finally, the model is wired inside an application scenario, where data is transferred from actual producers to actual consumers.

Keywords: AXI5-Stream, High-Level Synthesis (HLS), Field-Programmable-Gate-Array (FPGA), Hardware Accelerator

STUDY ON THE USE OF DIGITAL TWIN IN THE ANALYSIS OF PHOTOVOLTAIC SYSTEMS

George Balan, Alexandru Salceanu, Dorin-Dumitru Lucache

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering
21-23 Blvd. Prof. D. Mangeron Blvd, 700050, Iasi, Romania

Corresponding author: George Balan, george.balan@student.tuiasi.ro

PhD Supervisor: Professor Alexandru Sălceanu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Photovoltaic systems are an efficient and environmentally friendly solution for meeting energy needs in both the industrial and domestic sectors. Implementing a system that monitors early defects and predicts failure based on weather conditions, could significantly improve the performance and reliability. This paper indicates the importance of monitoring and parameters simulation (electrical and thermal) that influence operation mode of photovoltaic system. It also highlights the benefits of a practical approach to failure management and anticipation events by simulated setup. By integrating the concept of Digital Twin, which consists in creating a digital replica of the photovoltaic system in real time, an intelligent decision system could be developed, being capable of identifying and correcting potential problems before they appear.

The analysis of collected data and the integration of weather forecasts allow simulation and testing of different scenarios, thus providing the possibility to make decisions and optimize PV system operations. Information retrieved via the API interface was processed through Python scripts, while data from photovoltaic system was collected using specialized sensors. Subsequently, all relevant data has been stocked within automated scripts, which then facilitated the creation of a database for integration output parameters from data block of PV created in Simulink. This approach could be a viable solution for optimizing the use of solar energy, helping to reduce costs and environmental impact in both industrial and domestic applications.

The system contains a photovoltaic panel, BMS, sensors monitoring temperature, pressure, and relative humidity. The data obtained from the practical work have been entered into the simulation, confirming, and validating the experimental stand. Many researches on photovoltaic systems develop algorithms to monitor and make the system capable of tracking the sun for maximum efficiency. Thus, a comprehensive approach combining monitoring of parameters of PV with external weather data can significantly improve the efficiency, reliability, and durability of a photovoltaic system.

Keywords: API, thermal degradation, corrosive layout, weather anticipation, prototype stand

COMPARISON BETWEEN AN EXACT AND AN HEURISTIC-BASED METHOD FOR A VECHICLE ROUTING PROBLEM WITH TIME CONSTRAINTS

Mihaela-Alexandra Barb-Ciorbea

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Automatic Control and Computer Engineering, 27 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Mihaela-Alexandra Barb-Ciorbea, mihaela-alexandra.barb-ciorbea@academic.tuiasi.ro

PhD Supervisor: Professor Marius Kloetzer,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

This work is presenting a comparison between two different methods for solving a single vehicle routing problem with time window constraints. Given an environment with a fixed number of cities, a vehicle must find a route such that each city is visited in an imposed time interval. We assume the vehicle has a constant travelling speed and it can pause its motion, if necessary, while the cities are abstracted to a fully-connected weighted graph, and thus the problem becomes a travelling salesman problem with time windows. Both of the investigated methods aim to find the minimum cost path in terms of the travelled distance.

The first approach uses an exact method by formulating the requirements as a mixed integer linear-programming (MILP) optimization problem. The MILP guarantees the optimality of the solution, but it belongs to the NP-hard complexity class. For quantitatively investigating the results, we implement the MILP problem in MATLAB by using the so-called problem-based optimization method, and solve it with the intlinprog solver from Optimization Toolbox. The mathematical programming formulation has two types of variables, integer ones specifying the sequence of visited cities and real ones corresponding to the arrival and departure times from each city.

The second method involves a meta heuristic approach, using ant colony procedure to solve the optimization problem. An arbitrary city (vertex of the graph) serves as the starting point for each ant and at each construction stage the ant advances along the graph's edges memorizing the journey. In subsequent steps the ant choses the edges that do not lead to already visited cities based on the pheromone and the heuristic value. Once an ant has visited every vertex in the graph, it has built a solution. The pheromone on the edges is updated based on the quality of the solutions for every ant.

Besides qualitative information, the performed comparison relies on multiple numerical simulations performed in MATLAB environment. We thus highlight the advantages and disadvantages of both studied methods, by taking into consideration criteria as the simulation time and the relative difference between the obtained costs versus the number of cities.

Keywords: Vehicle routing, time window constraints, ant colony optimization, integer linear programming, travelling salesman problem

NEW FIRE AND SMOKE DATASET USED FOR TRAINING YOLO AND PERFORMANCE EVALUATION

Constantin Catargiu

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electronics, Telecommunications, and Information Technology, 11A Carol I Blvd., Iasi 700506, Romania

Corresponding author: Constantin Catargiu, constantin.catargiu@student.tuiasi.ro

PhD Supervisor: Professor Iulian Aurelian Ciocoiu,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Fires can have extremely serious consequences on the environment, that's why over time, different methods for early detection of this phenomenon have been developed, but this field remains open to improvements. The foremost reason for early detection is to save lives. Fires can spread rapidly, emitting toxic gases, and blocking escape routes. Another benefit of rapid detection is that it allows for quicker intervention to minimize property damage. Fires can cause significant destruction to buildings, homes, valuable assets and can have devastating environmental consequences, including air pollution, deforestation, and habitat destruction

This paper introduces a YOLO (You Only Look Once) based approach for fire and smoke detection, aimed at achieving real-time identification and precise localization of fire-related incidents. Traditional fire detection systems often rely on static image processing techniques, which can be computationally intensive and prone to false alarms. In contrast, this proposed system harnesses the efficiency and accuracy of YOLO, a state-of-the-art object detection algorithm, to simultaneously detect and localize fire and smoke in video streams. In this paper I will present the results in terms of accuracy and speed obtained using YOLOv5, YOLOv6, YOLOv7, YOLOv8, YOLOv9 and YOLO-NAS model.

For this research I manually created a dataset using Roboflow platform. To create this dataset, I used images obtained by searching on Internet, images from public datasets published on Kaggle or Roboflow and frames from around 950 videos which capture various scenes from environments such as: building fires, car fires, indoor fires, forest fires or landfill fires. The dataset contains 21 118 images with 3 classes: fire, smoke and other. It is publicly posted and can be accessed on Roboflow platform, for free and can be found here. After training the models on this dataset i obtained a mAP@50=0.85 for all classes (0.92 fire, 0.90 smoke, 0,75 other) . The results of the training, including model weights of various sizes, have been saved in Google Drive. Additionally, I present case studies showcasing the practical deployment of the system in real-world scenarios, including indoor environments, outdoor spaces, and industrial settings. Overall, the YOLO-based approach represents a promising advancement in fire and smoke detection technology, with the potential to enhance safety measures and minimize damages in critical infrastructure and public spaces.

Keywords: Object detection, YOLO, Inference, Training, Dataset

IDENTIFICATION AND CHARACTERIZATION OF ELECTROMAGNETIC INTERFERENCES IN THE MEDICAL IMAGING CLINICAL CENTER

Adelina-Cristina Căsuță, Alexandru-Marian Bordaș

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Adelina-Cristina Căsuță, casuta.adelina@gmail.com

PhD Supervisor: Professor Valeriu David,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Electromagnetic interferences pose a significant threat to the accurate functioning of medical imaging equipment, raising concerns about patient safety and diagnostic reliability. These signal disturbances are an important factor that can lead to a lot of malfunction situations without a visible cause of medical equipment: MRI scanner (Magnetic Resonance Imaging), CT (Computed Tomography), and X-ray machines. Our study is focus on identify the problem areas and the potential risks from electromagnetic interferences. The electromagnetic fields in the surrounding environment can also play an important role in the proper functioning all of the of medical equipment in the medical unit. When electromagnetic signals from sources like power lines, radiofrequency devices, or even nearby medical equipment interfere with the imaging process, they can create distortions in the images produced. The first step in the organizational decision of the medical unit must be the detection of background electromagnetic fields near the area where the medical equipment is or will be installed. In order to perform effective measurements, it is necessary to establish a measurement plan in accordance with the building plan, then to identify any technical situations that may intervene in the performance of the electrical installation of the building. Based on spot measurement and long-term survey of magnetic fields in a clinical centre, we try to determine the spatial and temporal variability of background fields. After the first step, which is represented by collecting the data from the field, a detailed analysis, data processing, statistics, and the establishment of possible vulnerable areas in the case of electromagnetic interference. The solution for minimize damages includes conducting thorough electromagnetic interference assessments in imaging areas, implementing shielding or filtering techniques. Therefore the need to improve screening methods for risk areas and possible organizational changes in the location of medical equipment was established and ensuring proper grounding of equipment.

Keywords: Electromagnetic interferences, magnetic resonance equipment (MRI scanner), background magnetic field, spot measurements, long term survey

RISKS AND LIMITATIONS OF THE USE OF TELEMEDICINE DEVICES FROM THE PERSPECTIVE OF ELECTROMAGNETIC INTERFERENCES

Mădălina Cojocariu, Petronela-Camelia Oprea

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Mădălina Cojocariu, madalina.cojocariu@student.tuiasi.ro

PhD Supervisor: Professor Alexandru Sălceanu,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

This paper presents an overview of state-of-the-art telemedicine devices and explores their diverse applications. Aspects related to possible electromagnetic interference are evaluated, both from the perspective of their impact on the equipment's operation and from the perspective of their reduction.
Telemedicine devices are used in various medical specialties, including cardiology, nephrology, dermatology, psychiatry, and primary care. These devices facilitate remote patient monitoring, consultation, diagnosis, and treatment, empowering healthcare providers to deliver timely interventions and improving patient outcomes. Moreover, telemedicine devices enable efficient collaboration among healthcare professionals, fostering interdisciplinary approaches to patient care.
EMC studies involve comprehensive evaluations of how telemedicine devices interact with electromagnetic fields and how they can operate safely and effectively without causing or being affected by interference. By conducting these studies, manufacturers and regulatory bodies can identify potential risks, address any issues related to EMI, and establish guidelines to ensure the proper functioning of telemedicine devices in different settings.
Compliance with regulatory standards is essential to guarantee that telemedicine devices meet specific requirements regarding electromagnetic emissions, immunity to interference, and overall safety. By adhering to these standards, manufacturers can demonstrate the reliability and safety of their devices, instilling confidence in healthcare providers and patients regarding the use of telemedicine technologies.
Overall, electromagnetic compatibility studies are critical in the development and deployment of telemedicine devices, as they help mitigate potential risks, ensure patient safety, and maintain the integrity of healthcare services. By prioritizing EMC considerations, stakeholders can enhance the quality and reliability of telemedicine solutions, ultimately contributing to the advancement of healthcare delivery through technology.
This paper synthesizes recent advancements in telemedicine devices, elucidating their widespread adoption and the role of electromagnetic compatibility studies in enhancing device reliability and safety. Understanding the evolving usage of telemedicine devices and their electromagnetic compatibility considerations is essential for optimizing healthcare delivery in the digital age.
Case studies are presented that evaluate and identify the possible risks of malfunctioning some telemedicine devices due to their increased susceptibility to electromagnetic interference.

Keywords: Telemedicine, medical devices, electromagnetic compatibility, usage rates, effectiveness

CURRENT DEVELOPMENTS IN THE TELEMEDICINE INFRASTRUCTURE IDENTIFIED WITH BIBLIOMETRIC TOOLS

Mădălina Cojocariu, Matei-Constantin Moruz, Petronela-Camelia Oprea

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Mădălina Cojocariu, madalina.cojocariu@student.tuiasi.ro

PhD Supervisor: Professor Alexandru Sălceanu,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

A quantitative literature survey on the study of public libraries was carried out using bibliometric methods. This approach allows researchers to obtain descriptive and statistical data that provide valuable information about the evolution of the literature, thus identifying the current state of the art, research gaps, and trends in telemedicine.

The analysis conducted in this study of 150 articles published between 2000 and 2024 in PubMed-supported databases with the keyword "telemedicine" provides a broad perspective on the evolution and deepening of knowledge in this field. Using RStudio software, the data have been processed and analyzed efficiently and accurately. RStudio is a powerful and versatile platform specializing in programming in the R language. This software offers several useful features that enhance the programming experience, such as automatic code completion, syntax highlighting, graphs, and table previews, thus facilitating data analysis and interpretation.

The RStudio interface is intuitively designed, allowing users to simultaneously view graphs, data tables, R code, and results. This efficient interface organization helps improve workflow and optimize the data analysis process.

Through the bibliometric study conducted using RStudio software, the researchers gained a deeper understanding of technological developments in telemedicine, identifying future research directions and contributing to the continued development of this vital field for improving healthcare. The literature trends comprised six study groups on this topic (pandemic, studies, people, adults, children, and telemedicine), subdivided into various research themes such as digital platform, telemedicine service management, telemedicine service operation, end-user perception, opportunities, and healthcare professionals. One result observed was a significant increase in publications in the area due to the COVID-19 pandemic.

Therefore, the need for a bibliometric study on this topic allows researchers to find the works they need from the multitude of existing publications to compile a bibliography on this topic of interest quickly or to maintain a quality ranking of works in absolutely any field of study, to assess the pace of its development, to identify specialists, institutions and world-renowned countries that have contributed to the development of science through such tools.

Keywords: Bibliometry, bibliometric platforms, telemedicine, digital platform

GENERATIVE AI: ITS IMPACT, CHALLENGES AND CONSEQUENCES ACROSS IT OCCUPATIONS

Alexandra-Iulia David

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electronics, Telecommunications, and Information Technology, 11A Carol I Blvd., Iasi 700506, Romania

Corresponding author: Alexandra-Iulia David, alexandra-iulia.david@student.tuiasi.ro

PhD Supervisor: Professor Iulian Ciocoiu,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

The accelerated technological advancement surprised people all around the world. The innovations bring many benefits and improve our lives, but changes tend to scare people and make them overreact. That is also the case in the IT sector. The revealing of AI in a difficult economic context aroused a lot of panic and it was associated with massive layoffs across tech giants, but data show the contrary: people need to adapt, grow their skills, and focus on their creative skills, communications, and emerging technologies. According to BLS (U.S. Bureau of Labor Statistics), employment for software developers, quality assurance analysts, and testers is expected to grow by 25% from 2021 to 2031. While automation will play a crucial role in our day-to-day lives, the number of created jobs will outperform the automated ones. The software will become even more prevalent and pretty much every company will become a tech company. While some workforce categories may be affected by automatizations, there will be new challenges, opportunities, and spaces to grow. A recent study conducted by the World Economic Forum shows us that AI may disrupt some job categories, but it also creates many opportunities. It is all about focus changing and the adoption process. According to a survey conducted by Stack
Overflow, where over 89000 respondents were quoted, over 43.79% of them are currently using AI-gen on a daily basis, 25.46% plan to use it in the future, while 29.4% don’t use it and don’t plan to use it in the future. The numbers told us that people still have not had the best time to completely adapt to the latest technologies, even in the tech sector, where people tend to be more flexible regarding tech adoption.
While the shortage of skill talent may be somehow diluted by AI adoption in the short term, the long-term problem will remain the same, or it will become even more prevalent in the near future.

Keywords: Gen-AI, job market dynamics, automation, software, innovation, skills

EMPATHETIC HORIZONS: EXPLORING THE DEPTH AND BREADTH OF HUMAN EMPATHY IN AN INTERCONNECTED WORLD

Daniela Anamaria Arsene Dolhăscu

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Daniela Anamaria Dolhăscu, daniela-anamaria.dolhascu@student.tuiasi.ro

PhD Supervisor: Professor Codrin Donciu,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

This paper explores the intricate landscape of empathy, extending its investigation beyond traditional human interactions to include empathetic engagements with robots and inanimate objects depicted in human-like contexts. Traditionally centred on interpersonal relationships, empathy is reexamined through a contemporary lens that integrates technological interfaces and non-human entities into the empathetic framework. We undertake a comprehensive review and synthesis of recent studies to uncover the complex nature of empathy, which is distinctly influenced by narrative contexts, cognitive appraisals, and moral judgments.

Our research underscores the critical role of empathy in interactions between humans and robots, emphasizing its significant implications for the design and ethical frameworks of technology in an increasingly automated world. The subjectivity embedded in empathetic processes, particularly in scenarios such as pain assessment, and the influence of moral evaluations on empathetic responses are meticulously explored. This offers fresh insights into the malleability of empathetic engagements across diverse contexts.

We discuss the dynamic interplay between affective, cognitive, and moral dimensions of empathy. This includes examining how narrative contexts influence our empathetic responses and how ethical considerations shape our emotional engagements. Our findings reveal that empathy's responsiveness to context and cognition highlights a complex, evolving process that adapts with changing scenarios and interactions.

Furthermore, the paper discusses the implications of these findings for our understanding of human-machine co-existence. It advocates for a holistic view of empathy that integrates emotional resonance with cognitive and moral processing, essential for navigating the evolving landscape of human and machine interaction. This narrative synthesis not only aims to broaden our comprehension of empathy but also proposes a new paradigm in which empathy extends beyond human-to-human interactions to encompass our relationships with artificially intelligent agents and anthropomorphic objects.

Through this extended analysis, we aim to contribute significantly to the existing literature by redefining the boundaries of empathy, proposing that the future of empathetic technology and design considers these broader, more inclusive perspectives. This approach not only enriches our understanding of human emotions but also facilitates a deeper appreciation of the potential for empathy in our global, interconnected society.

Keywords: human empathy, human-robot interaction, cognitive appraisals, moral judgments, pain perception, empathetic subjectivity, narrative context, technology and empathy

AN OVERVIEW AND CURRENT CHALLENGES IN RESPECT TO SCREEN-PRINTED ELECTROCHEMICAL ELECTRODES EMPLOYABILITY AS DISPOSABLE BIOSENSORS

Tudor-Alexandru Filip[1], Mădălina-Petronela Simion[1], Ina Țurcan[2,3], Marius-Andrei Olariu[1]

[1] "Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2] "Ion Ionescu de la Brad" University of Life Sciences, Faculty of Horticulture, 3 Mihail Sadoveanu Street, 700490, Iasi, Romania
[3] "Alexandru Ioan Cuza" University of Iasi, Faculty of Physics, 11 Carol I Blvd., 700506, Iasi, Romania

Corresponding author: Tudor-Alexandru Filip, tudor-alexandru.filip@academic.tuiasi.ro

PhD Supervisor: Professor Marius-Andrei Olariu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Electroanalytical techniques are useful tools for analysing, monitoring and characterizing processes of electrochemical reactions, converting them into electrical signals that can be measured. The bio-electrochemical transduction method is widely used in the design of sensors for analyzing biological phenomena. Due to the complexity of real samples (blood, saliva, sweat, etc.) [Caniatti], the latest discoveries in nanotechnology, microscopy techniques, and interdisciplinary studies already reported may have an impressive impact on the characteristics of electrochemical experiments (simultaneous compound detection, low concentration compound identification, interference studies, etc.) [Nan].

Screen-printed electrodes (SPE) are the core of disposable electrochemical biosensors with a promising role in the electrochemical experiments in biomedical field (analyte detection-protein, viruses, enzyme; diseases monitorisation; biomarkers identification, etc.) [Şen], providing both quantitative and qualitative information on bioelectrochemical reactions occurring at electrode surface. SPEs are of critical importance in development of portable, low-weight, miniaturized, and effective devices for biological fluid characterization for in-situ experiments. Although there are many positive aspects to SPEs, such as their low cost, ease of use, and simple setup [Wang], their sensitivity and selectivity are common technological drawbacks. The scientific community recommends various approaches to enhance main parameters (development of new inks, adjustment of machine's parameters, control of electrical parameters, etc.) and to modify the morphology of the electrodes' surface using a wide range of nanomaterials (ink-mixing, electrode position, dropcasting, etc.) [Paimard].

The geometric parameters related to the electrode's design and the relationships between them might be a solution in addressing the sensitivity and selectivity issue raised. As far as we know, there have been few published works aimed to study and analyze the impact of the geometrical parameters on the overall electrochemical performance of the sensor. Thus, the herein paper is presenting a collection of data as a result of an in-depth analysis of experimental work reported by scientists in the recent (2019-2024) literature of the biomedical field.

Keywords: Working electrode, screen-printing technology, printed electronics, printed device, electrochemical response

DESIGNING ALGORITHMS FOR OPTIMIZING VEHICLE MINIMUM TRAVEL DISTANCE

Mihaela Gavrilă[1], Eduard Mihăilescu[1], Daniela Tărniceriu[1], Mădălina Murariu[1], Delia-Elena Bărbuță[2]

[1] ”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electronics, Telecommunications, and Information Technology, 11A Carol I Blvd., Iasi 700506, Romania
[2] ”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Automatic Control and Computer Engineering 27 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Mihaela Gavrilă, mihaela.gavrila@student.tuiasi.ro

PhD Supervisor: Professor Daniela Tărniceriu,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

This study presents a novel modification of Dijkstra’s algorithm for optimizing the minimum travel distance between points in a vehicle routing context, using a reduced graph approach. The primary focus is on enhancing the computational efficiency of shortest path searches within large and complex graph structures, a critical aspect in geographic information systems (GIS). By integrating a modified version of Dijkstra’s algorithm, the research seeks to overcome the limitations of traditional methods, which are often ill-suited for large-scale applications due to excessive computational demands.

The methodology involves comparing the modified Dijkstra’s algorithm against the standard version and the A* heuristic algorithm. The comparison is based on several performance metrics, including the runtime and the cost of paths found within various graph sizes. The algorithms are tested within a controlled simulation environment that utilizes realistic geographic data to mimic real-world routing scenarios.

Key findings indicate that the modified Dijkstra’s algorithm achieves comparable path costs to the original algorithm but does so with significantly reduced computational overhead. Specifically, the approach demonstrates a reduction in runtime, making it more suitable for real-time applications in large graphs. Furthermore, when compared to the A* algorithm, the modified approach consistently finds the optimal path in a similar or shorter amount of time, thereby validating its efficacy and efficiency.

The study concludes that the proposed modification not only retains the accuracy of traditional Dijkstra’s algorithm but also enhances scalability and speed, addressing the critical needs of modern GIS applications in vehicle routing. This research contributes to the ongoing development of more efficient routing algorithms, with potential implications for navigation systems and automated vehicle logistics.

Keywords: Minimum travel distance, efficient routing algorithms

PERFORMANCE IMPROVEMENT OF DISTRIBUTION TRANSFORMERS FOR THE ENERGY SYSTEM

Veronica-Carmen Gheorghe, Radu Burlică

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Veronica-Carmen Gheorghe, veronica-carmen.gheorghe@student.tuiasi.ro

PhD Supervisor: Professor Radu Burlică,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Rapid advances and developments in the design, manufacture and monitoring of transformers have generated an increase in power, with transformers occupying important positions in the national and international power system. In order to equalize them around the world transmission capacities and reduce electricity losses in the network, it is necessary to increase the operating voltages to 400 kV and 750 kV respectively, aiming to equalize them around in world.

In this paper we describe the design of distribution transformers with parameter optimization, loss minimization, technical solutions to minimize transformer and core dimensions.

The starting point of this paper is to make a comparison between two 400 kVA transformers, a distribution transformer with conservator and a hermetic transformer with air cushion (EPA). We will use the same construction of the transformer core with columns and yokes made of iron with angle-cut unoriented crystals and will consider another construction of it in the near future.

As is known, the power of a transformer is increased by 25-35%, using Cu conductors instead of Al conductors, without changing the cooling system to another more efficient cooling system. The paper compares both the output parameters generated by the design process, the values obtained from the transformer sizing, for radiator cooled heating transformers and that of the piped tank.

It has been proven that all materials used in the manufacture of a distribution transformer must have superior properties, using the newest materials in the field we increase the performance of distribution transformers and we will have reduced dimensions for it. Using the robotic manufacturing line, to obtain the exact dimensions required, without any risk of deviation/tolerance in the shape and dimensions of each of the transformer components, we close the manufacturing defects. The methods used so far have obvious design and manufacturing flaws. These are the steps that pave the way to being able to design and manufacture the much-coveted ideal transformer.

Keywords: Losses, effincitty, copper conductors, coils, core

VARIATION OF NUSSELT NUMBER FOR HEAT TRANSFER THROUGH A RECTANGULAR DUCT

Andrei-Aurelian Ianos, Gălățanu Cătălin-Daniel

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Andrei-Aurelian Ianos, andrei-aurelian.ianos@student.tuiasi.ro

PhD Supervisor: Professor Gălățanu Cătălin-Daniel,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Heat and mass transfer is a generally well-grounded theoretical phenomenon. For particular situations, the phenomenon can be described by certain dimensionless criteria, such as the Nusselt number. The particular situation studied is the cooling of the photovoltaic panel by means of a heat exchanger with water working agent. The present work aims to bring more data needed for heat transfer analysis, in order to improve their functionality, starting from the general methodology of studying similarity criteria. In order to achieve the objective, the Ansys 2020 R2 simulation program was used. The chosen experimental device consisted of a rectangular aluminum pipe, with: length L= 300mm, height h=10mm, width l=20mm and thickness of 6mm. This type of pipe was chosen due to the multiple placement possibilities with space saving, but also because this form is used to make many installations. The surface Nusselt number was determined under the following working conditions: the Reynolds number is 998, constant at the inlet; the temperature was varied along the length, working at 30º C and 75º C, and respectively the speed, from 0.01 m/s to 0.05 m/s, inclusive, for each individual case. These reduced speeds are the consequence of the heat flow that must be evacuated. The heat input is from the lower wall, and the heat flow is ensured by an electrical resistance. Low speeds were chosen, at which heat transfer is more efficient, and can be applied to bivalent heat systems with small dimensions. In addition, they allowed an exact analysis of the development of the studied phenomenon. It was observed that the Nusselt number decreases with increasing speed for the same temperature but also for the same speed as the temperature increases. From the comparative analysis of the data, the evolution of the heat transfer according to the Nusselt number can be observed, at first the heat transfer by conduction, then an intermediate process with a convective character, and then a final process in equilibrium can be observed.

Keywords: Aluminium, Ansys, convective heat transfer, pipe, Reynolds

BALANCED HYBRID FES&MECHATRONIC CONTROL SOFTWARE METHOD FOR HAND REHABILITATION IN STROKE PEOPLE

Radu Ionașcu, Marian-Silviu Poboroniuc

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Radu Ionașcu, radu.ionascu@gmail.com

PhD Supervisor: Professor Marian-Silviu Poboroniuc,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Globally, numerous individuals suffer from significant upper limb impairments following strokes, hindering their ability to carry out daily activities. Various rehabilitation devices have been developed to tackle these challenges, including mechanical, pneumatic, and those incorporating functional electrical stimulation (FES). These devices, utilized in both research and healthcare environments, are often controlled by microcontrollers programmed to administer different therapeutic interventions. However, a notable drawback of current systems combining mechanical engineering with electrical stimulation is their lack of precision in controlling the movements of the affected hand. Moreover, accurately assessing the remaining movement capability of the patient's impaired hand presents a challenge, making it challenging to provide the precise level of assistance required by the patient.

To address these challenges, this paper presents an innovative approach utilizing a balanced control software technique for a hybrid device integrating FES with mechatronic elements. This system employs a Proportional-Integral-Derivative (PID) controller, a well-established control mechanism renowned for its effectiveness in diverse applications, to finely adjust the electrical current delivered to the patient's hand. This adjustment is made based on direct feedback on the patient's movements, enabling a high degree of movement precision and customization of therapy according to the patient's specific requirements.

The proposed solution aims to significantly enhance the ability to control hand movements with greater accuracy than current devices. By utilizing real-time feedback to regulate the level of electrical stimulation, the system can offer more effective support, thereby improving the rehabilitation process. The objective is to make rehabilitation more efficient and tailored to the unique capabilities and recovery progress of each patient. This approach not only addresses the existing gaps in hand rehabilitation technology but also presents a promising avenue for advancing stroke recovery patient care. The utilization of a PID controller in this context marks a significant advancement in creating ambulatory easy to use rehabilitation devices, potentially leading to better outcomes for individuals with stroke-induced hand disabilities.

Keywords: Upper limb rehabilitation, FES, balanced control, exoskeleton, rehabilitation glove

INTEGRATION OF INTERNET OF THINGS AND DATA MINING CONCEPTS IN ENERGY CONSUMPTION MANAGEMENT: A LITERATURE REVIEW

Răzvan Livadariu, Gheorghe Grigoraș

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Răzvan Livadariu, razvan-petru.livadariu@student.tuiasi.ro

PhD Supervisor: Professor Gheorghe Grigoraș,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

In today's digital age, the integration of the Internet of Things (IoT) and Data Mining (DM) concepts is becoming a significant milestone where technology and innovation are converging to influence the way the resources are managed to obtain optimal energy use. The paper completes a review of the current state of integration of these concepts in the energy management domain, providing a detailed image at how smart devices and advanced data analytics techniques help end-users contribute to improving energy efficiency. Thus, the integration of IoT and DM concepts has been explored to analyse how significant benefits can be obtained based on efficient energy management. New horizons are opening up in anticipation and energy demand by collecting and analyzing data from IoT devices and the application of advanced DM algorithms. This not only improves energy efficiency but also reveals opportunities for implementing sustainable strategies and reducing the carbon footprint.

Projects and initiatives have been reviewed to identify the state-of-the-art regarding the effective integration, highlighting the advantages and disadvantages. The challenges associated with this technological evolution have been investigated, bringing to the fore critical discussions of data security, device interoperability, and ethical issues involved in the widespread use of technology in energy management. The advantages of integrating IoT-based energy management systems, such as Home Energy Management Systems (HEMS) and Smart Industrial Power Saving Algorithms (SIPSA), in increasing energy efficiency, cost reduction, and contribution to environmental protection have been highlighted. The ability to customize the settings and adapt power consumption according to individual needs and external conditions can provide significant benefits to end-users. On the other hand, disadvantages can include high initial costs and the need for constant internet connectivity to ensure the systems properly work. These aspects may limit access to the benefits offered by these technologies for some user categories with limited financial resources.

Keywords: data mining, internet of things, smart devices, energy consumption management, energy efficiency

EFFICIENT OPERATION OF ENERGY STORAGE SYSTEMS IN MICROGRIDS ENRICHED WITH EV

Mihai-Andrei Luca, Mihai Gavrilaș

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Mihai-Andrei Luca, mihai-andrei.luca@student.tuiasi.ro

PhD Supervisor: Professor Mihai Gavrilaș,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Traditional electric grids are inefficient to meet the modern challenges, i.e., renewable energy integration, distributed generation, and demand side management. In this regard, the smart grid has evolved as a clever solution that combines conventional electricity systems with information and communication technologies and allows utility and consumer interaction in two directions. It also includes distributed storage, smart meters, RE sources, energy storage systems, and sensors. Additionally, it promotes user involvement in energy savings, cooperation through the demand response mechanism, and prosumer trading. Furthermore, to combat the escalating environmental issue of CO2 emissions, the globe is adopting renewable energy options at an astounding rate. Because they don't emit any greenhouse gases or other pollutants, renewable energy systems have a huge potential to reduce carbon emissions. However, renewable energy sources depend on generating energy from natural resources like sunshine, wind, water, and geothermal, which are typically unpredictable and dependent on the season, year, and weather. Renewable energy can be consistently and carefully used as needed after being stored utilizing a variety of methods to take into consideration these erratic usage patterns. Fleets of plug-in electric vehicles and plug-in hybrid electric vehicles can be considered as dynamic mobile energy storage structures serving as carriers of energy in both time and space. Their expected impacts can be critical from a local point of view: voltage sags, load unbalance, harmonics, and other power quality issues. From a global point of view, impacts expected on the grid are: frequency regulation, stability, expansion plans for upgrading infrastructure and matching supply and demand. In the most likely scenario, domestic PEV load is expected to be supplied from the residential electrical distribution system. This article presents the issue of the impact of the operation of EV on the operation of the distribution network. A case study was conducted in which the effect of EV charging was analyzed in the classical way and using a load management system, presenting the results and benefits of applying this system in a microgrid.

Keywords: microgrid, storage, electric vehicles, load management, centralized approach

THE IMPACT OF ENERGY PRODUCTION FROM RENEWABLE SOURCES ON THE INVESTMENT PLAN OF ELECTRICITY DISTRIBUTORS

Gabriel – Dorin Melus

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Gabriel-Dorin Melus, dorin-gabriel.melus@student.tuiasi.ro

PhD Supervisor: Professor Ciprian Nemes,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The renewable energy sector in Romania faces a multitude of challenges that require careful analysis and innovative solutions. First, the industry faces regulatory uncertainties, which often change the rules of the game.

The ability to strike a balance between attracting investment and ensuring fair rates of profitability for renewable energy projects is a delicate task for industry professionals to tackle.

About 80% of the global population lives in countries that import more fossil fuels than they export. This means that nearly 6 billion people are potentially vulnerable to geopolitical or economic crises related to access to these resources.

Renewable energy sources – sun, wind, water – are available in any country, without the need for imports or depending on the goodwill of other nations. We have yet to fully tap into this potential, but there is a huge opportunity here.

The International Renewable Energy Agency (IRENA) estimates that 90% of the world's electricity could come from renewable sources by 2050. Renewable energies offer a way out of import dependence, allowing countries to diversify their economies and protect against unpredictable fluctuations in fossil fuel prices.

Romania has committed to reach a share of consumption from renewable energy sources of 42.5% by 2030 and 89.9% by 2050, according to the Integrated National Plan in the Field of Energy and Climate. In this context, Romania aims to develop a capacity of 11.1 GW of solar energy by 2030.

These new production capacities must be integrated by the Transport Operators and Distribution Operators in their own networks through major investments in order to create all the conditions for access to the transport and distribution networks. In this sense, long-term and medium-term planning becomes a priority for all actors part of the National Energy System.

Keywords: renewable, energy, investments, distributor, access

HOMOMORPHIC HASHING: ENABLING PRIVACY-PRESERVING ANALYTICS IN THE ERA OF BIG DATA

Eduard Mihăilescu, Mihaela Gavrilă, Doru Florin Chiper

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electronics, Telecommunications, and Information Technology, 11A Carol I Blvd., Iasi 700506, Romania

Corresponding author: Eduard Mihăilescu, meduard@etti.tuiasi.ro

PhD Supervisor: Professor Doru Florin Chiper,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

This paper introduces a novel Dynamic Hash-based Configuration Validation System designed to enhance the security of virtual digital ecosystems. As virtual environments become increasingly prevalent, their inherent complexity and frequent updates pose significant security challenges, particularly in maintaining the integrity of configurations. This research develops a system utilizing cryptographic hash functions to continuously validate the configurations of virtual machines (VMs) against pre-approved baselines stored on a secure, immutable blockchain. This enables real-time detection and response to unauthorized changes, thus enhancing security and ensuring regulatory compliance. The introduction of this system is particularly relevant in the context of increasing cyber threats and the growing complexity of virtual infrastructure management, where the ability to provide a scalable and effective security solution that adapts to the dynamic and intricate challenges of modern virtualized settings is essential.

The methodology focuses on deploying real-time monitoring agents on each virtual machine (VM), which generate cryptographic hashes of current configurations and compare these against the baseline hashes recorded on the blockchain. Discrepancies between the hashes trigger immediate alerts and initiate potential corrective actions. The experimental setup consisted of a Docker-based virtual environment that hosted a web application prone to erratic crashes, a Nexus repository backup system, middleware for the blockchain, and the blockchain storage system. The system made periodic backups of the images and simultaneously created hash timestamps stored on the blockchain. For the monitoring technology stack, the authors employed open-source technology, consisting of Node Exporter, Prometheus, and Kibana. When monitoring parameters exceeded preset baselines, special scripts stopped the web application service and restored the images based on hashed timestamps from the blockchain in a secured and transparent manner.

Experimental results affirm the system’s effectiveness in rapidly detecting unauthorized changes, thereby maintaining operational efficiency. Additional potential advantages of the proposed system include the establishment of a verifiable audit trail, which is significant for ensuring transparency and accountability in the management of virtual infrastructures.

Keywords: Homomorphic hashing, virtual environments, encrypted data

STUDY ON THE ELECTROMAGNETIC EMISSIONS OF THE DEVICES THAT COULD BE USED IN A NEUROSURGERY OPERATING THEATRE

Matei-Constantin Moruz, Petronela-Camelia Oprea

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Matei-Constantin Moruz, matei-constantin.moruz@student.tuiasi.ro

PhD Supervisor: Professor Alexandru Sălceanu,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

There is a great diversity of medical equipment that might work almost simultaneously in a modern hospital today. Like all electrically powered apparatus, they emit electromagnetic fields and could be susceptible to electromagnetic interference.
The problem of these emissions is even more critical at the level of an operating room, in a neurosurgery hospital. First of all, from the perspective of electromagnetic interference, which could disrupt the operation of vital devices. But the possible negative effects that these emissions could produce, both on the medical staff and the patient, who is in critical condition, should not be neglected either.
We have focused our attention on some electrosurgery and radiosurgery devices which, in principle, are generators of electromagnetic emissions that could be disruptive to other devices. We have measured the strength of the emitted fields, more precisely, the electric field component (V/m). We compared older devices with latest generation ones. We have performed measurements for several possible layouts. The influence of various wiring solutions, positioning and power supply of the victim-aggressor tandem has been studied. The measurements have been made with Narda SRM-3006 (Selective Radiation Meter) system. It is a portable, high-performance device, ideal for the selective measurement of non-ionizing electromagnetic radiation, being additionally equipped with calibrated field probes. The frequency spectrum practically covers the entire range of frequencies used in radio communications: between 9 kHz and 6 GHz. With this device, the electromagnetic field levels in various locations of the operating theatre have been measured, which were then compared with the reference levels established by the ICNIRP and ITU norms. We have developed a series of recommendations regarding the mitigation of electromagnetic emissions, complementary to reducing the risks of disturbing other (vital) equipment.

Keywords: electrosurgery, radiosurgery, electromagnetic emissions and interferences

CLASSIFICATION OF FOCAL AND GENERALIZED EEG EPILEPTIC SIGNALS USING EMPIRICAL WAVELET TRANSFORM AND MULTIPLE CLASSIFIERS

Mădălina-Giorgiana Murariu, Mihaela Gavrilă, Daniela Tărniceriu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electronics, Telecommunications, and Information Technology, 11A Carol I Blvd., Iasi 700506, Romania

Corresponding author: Mădălina-Giorgiana Murariu, madalina-giorgiana.murariu@academic.tuiasi.ro

PhD Supervisor: Professor Daniela Tărniceriu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Epilepsy is a neurological disease characterized by the occurrence of repeated, spontaneous seizures, which can be either focal or generalized. Surgical intervention is advised for treating epilepsy in scenarios where anti-epileptic treatment is ineffective. The success of the surgery depends on the accurate identification of the epileptic regions, particularly the focal areas. Electroencephalographic (EEG) signals are invaluable for distinguishing between focal and generalized epilepsy. This paper introduces two classification methods designed to accurately classify interictal epileptiform EEG signals collected from 16 patients with focal and generalized epilepsy during sleep state at the EEG Epilepsy and Monitoring Center in Cluj-Napoca, Romania. The proposed methods use the Empirical Wavelet Transform (EWT) technique in two distinct modes to extract the defining characteristics of each epileptic signal. The first approach employs EWT to decompose the signals into five components, computing four statistical measures: median, kurtosis, skewness, and fluctuation index. In the second approach, EWT decomposes the signals into five sub-bands corresponding to brain rhythms. For each extracted component, six statistical measures are computed: median, kurtosis, skewness, Stein's unbiased risk estimation entropy (SURE), threshold entropy, and centered correntropy. The classification process is made separately, for each method and each group of signals, and includes 13 different classifiers to ensure high accuracy in identifying the type of epilepsy and to capture the inherent variations in EEG data. The results of the study reveal that the proposed methods have improved the accuracy of data classification compared to the previous studies. The EEG signals are classified into focal and generalized categories with maximum accuracies of 83.13% using the Fine Tree classifier, 82.19% using the Weighted KNN classifier, 70.31% using the Gaussian Naive Bayes, and 81.56% using the Quadratic SVM classifier. In the second approach, data classified on sub-bands shows the best results was obtained using the Weighted KNN classifier, Kernel SVM, Gaussian Naive Bayes, and Fine Tree classifiers. The positive outcomes of these methods indicate their potential use in clinical settings to assist in decisions for epilepsy patients by delivering precise and effective EEG signal classification.

Keywords: Classification, epilepsy, focal, generalized signals, empirical wavelet method

DAY-AHEAD LOAD SHIFTING AS A DEMAND SIDE MANAGEMENT STRATEGY

Mihaela Năstase, Mihai Gavrilaș

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Mihaela Nastase, mihaela.nastase@student.tuiasi.ro

PhD Supervisor: Professor Mihai Gavrilas,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

The main goals of building energy management systems (BEMS) are on the first place that of reduction, whether we are taking about the reduction of energy, financial costs, greenhouse gas emissions; second to improve and optimize energy efficiency, and to cover the energy demand, through the implementation of certain methods and algorithms with the help of strategies and methodologies developed by the Governments and the European Commission. They also enable customers, as well as suppliers, to achieve their goals through forecasts and demand patterns.

The current work, focuses on a broad level on the divisions and subdivisions of BEMS with some of the most important features of each, and in particular on the method that was the basis of the case study presented in this paper, more precisely demand response. The scope is the need of reducing the excess of energy demand at the time of peak hours and at the same time of reducing the utility bill of the consumers. On a smart grid level, considering different types of customers with different patterns of consumption, and the demand side management as the most common method used, and based on the fact that the energy consumed on each hour of the day has a different price common to all three areas, several equations were presented as starting points in development of other mathematical functions. All this strategies of lessening were evaluated and compared depending on the degree of difficulty of implementing the method, the type of consumer, with accent on the peak and off-peak hours and the way they offer various paths of load shifting of the day-ahead.

It could be observed that the mathematical algorithms developed in the case study represent a simple and also more efficient alternative in terms of reducing energy consumption and implementing the solution compared to the reference equations.

Keywords: Building energy management system, load shifting, peak hour, forecasted load, reduction, demand response

INNOVATIVE VIRTUAL REALITY-BASED DESIGN AND EVALUATION OF A MECHATRONIC SYSTEM FOR HAND NEUROREHABILITATION

Elena Nechifor[1], Sorin-George Nechifor[1], Marian-Silviu Poboroniuc[1], Cătălin Dosoftei[2], Gabriel-Florentin Chiriac[2]

[1] "Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2] "Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Automatic Control and Computer Engineering 27 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Elena Nechifor, elena.nechifor@student.tuiasi.ro

PhD Supervisor: Professor Marian-Silviu Poboroniuc,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Since 1970, there has been significant activity in the field of medical rehabilitation, both in terms of medical advancements and technological innovations. Concurrently, there has been a noticeable progression in the development of cutting-edge technologies for medical rehabilitation. This trend is fueled by the growing number of patients, leading researchers from universities and research centers to concentrate on designing and producing intelligent electromechanical devices. One such innovation is our mechatronic system, which leverages virtual reality (VR) technology. This system incorporates Microsoft's Hololens2 glasses, equipped with image processors capable of generating holographic 3D images. These holograms can be seamlessly integrated into the user's environment, allowing for interaction using hand gestures or eye movements. Additionally, the system includes a pneumatic glove designed for hand rehabilitation, enabling users to control the virtual objects with both their hands and eyes. This system facilitates training in various aspects of finger rehabilitation, including range of motion, flexion, speed, independence of movement, and grip strength. Recent experimental findings underscore the importance of intensive training, particularly in acquiring new motor skills, to induce long-term brain plasticity.

Virtual reality emerges as a compelling, adaptable tool under exploration for its potential in rehabilitating patients with neuromotor disorders. Hand exercise simulations, resembling interactive games, have been devised to provide real-time feedback on performance quality, fostering active engagement and concentration among subjects/patients. The system's control is emulated via a computer program, integrating electrical, mechanical, and pneumatic components. This comprehensive system incorporates objective assessment tools such as gloves to evaluate finger movements, allowing for real-time monitoring of hand function and therapy progress. Data collected is securely stored in an online Oracle database for subsequent analysis. Consequently, the integration of conventional therapy with this advanced mechatronic system has shown promise in enhancing patients' hand dexterity, facilitating the restoration of self-service autonomy crucial for daily living activities.

Keywords: Rehabilitation, mechatronics, virtual reality, pneumatic glove, holographic 3D images

UPPER LIMB REHABILITATION WITH EXOSKELETON MECHATRONIC SYSTEMS AND VR TECHNOLOGY

Sorin-George Nechifor[1], Elena Nechifor[1], Marian-Silviu Poboroniuc[1], Cătălin Dosoftei[2], Gabriel-Florentin Chiriac[2]

[1] "Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2] "Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Automatic Control and Computer Engineering 27 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Sorin George Nechifor, sorin-george.nechifor@student.tuiasi.ro

PhD Supervisor: Professor Marian-Silviu Poboroniuc,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Medical Robotics and Rehabilitation Robotics have a long history, with the latter focusing on utilizing robotic technologies like measurement, actuation, and control to aid in the rehabilitation and assistance of individuals with disabilities. However, the development of practical robotic systems capable of aiding those with functional limitations is a relatively recent endeavor. Over time, devices have been engineered to assist in enhancing mobility and motor functions, particularly in the hands and arms. In the European Union, including Romania, there is an anticipated rise in the number of individuals with disabilities characterized by motor skill impairments and muscle weakness, largely due to population aging. We have devised a mechatronic exoskeleton system integrated with virtual reality(VR) technology. This system utilizes Microsoft's Hololens2 glasses, equipped with image processors to generate holographic 3D images that seamlessly blend with the user's surroundings. Control over these images can be facilitated through arm gestures and eye movements, which are synchronized with the mechatronic exoskeleton system for arm rehabilitation. The biomechanical interaction is a direct result of such devices, which aim to compensate for functional deficits in individuals with motor pathologies. Recent advancements have focused on implementing robotic devices that can be intuitively controlled, minimizing the need for extensive training. This is achieved through algorithms capable of detecting user intent and the integration of novel user interface channels. The system also incorporates objective assessment tools to evaluate arm movement. For instance, mechatronic exoskeleton systems monitor the user's current arm function and therapy progress, storing this data in an online Oracle database for subsequent analysis. Given the unpredictable nature of accidents and illnesses throughout life, there is a growing interest among researchers in developing new mechatronic devices aimed at enhancing the quality of life for individuals facing such challenges.

Keywords: Mechatronic exoskeleton systems control, virtual reality, holographic 3D images, graphic user interface

PREDICTIVE MAINTENANCE FOR MEDICAL VENTILATORS BASED ON SOUND AND ELECTROMAGNETIC FIELD MEASUREMENTS

Lidia Nedelcu, Marina-Georgiana Roman

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Lidia Nedelcu, lidia.nedelcu@student.tuiasi.ro

PhD Supervisor: Professor Cristian-Győző Haba,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The use of medical devices in the Intensive Care Unit and Operating Room is essential for patient monitoring, diagnosis, treatment, and surgical interventions. Predictive maintenance of equipments is becoming a popular topic in maintenance, as it involves using data and analytics to forecast when equipment is likely to fail and taking proactive measures to prevent breakdowns before they occur. The use of predictive maintenance for medical equipments will also have a significant impact of medical care operations by reducing maintenance costs, improving maintenance planning and increase equipment availability.

In this study we are analyzing the possibility to use predictive maintenance for medical ventilators, also known simply as ventilators or breathing machines. These devices were created to aid or take over the respiratory function of patients requiring assistance. The equipments can provide important data showing that they are not working in optimal parameters.

The purpose of this work was to collect sound and electromagnetic field data from the medical equipment in order to develop a predictive maintenance strategy to be use with this type of equipment. To perform the electromagnetic field measurements, we used a portable detector and made low frequency measurements on 3 axes. To record the acoustic data of the ventilators, the microphone of a smartphone was used as a sensor and data was recorded and processed using the Matlab software. The measurements were performed in an isolated space in the St. Spiridon Emergency Hospital in Iasi, where the environment noise was reduced to a minimum and no other equipment was operated during the measurements. Considering four types of medical ventilators and four different ventilation modes, measurements were performed keeping at the same time, the same ventilation parameters. The mechanical ventilators on which we performed the measurements are different from each other in terms of their constructive elements and their design. After centralizing the data, we noticed differences both in the case of sound measurements and in the case of electromagnetic field measurements. There were no high-intensity sounds or noises, and the electromagnetic interference values were minimal. These initial measurements will be considered as the data set representing normal operation of the devices. Further measurements will be performed on equipments having different faults, with effects we expect to be visible in the modified values of sound or the electromagnetic field.

Keywords: Predictive maintenance, medical ventilator, sound measurements, electromagnetic measurements, intensive care unit

GESTURE IDENTIFICATION AND AUTHENTICATION BASED ON EMG SIGNALS USING BAG-OF WORDS CLASSIFIER

Iulia-Petronela Onică, Iulian Ciocoiu

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electronics, Telecommunications, and Information Technology, 11A Carol I Blvd., Iasi 700506, Romania

Corresponding author: Iulia-Petronela Onică, iulia-petronela.onica@student.tuiasi.ro

PhD Supervisor: Professor Iulian Ciocoiu,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

The human body generates various types of data that can be acquired and analyzed for different purposes. The electrical activity of the muscles can be easily acquired without any invasive medical procedures, having many useful applications such as: diagnosing neuromuscular disorders, guiding rehabilitation, advancing research in fields related to human movement and physiology. Electromyographic (EMG) signals as biometric data are commonly used for identification and authentication purposes for security systems and access control.

Using the gesture recognition and biometrics electromyogram dataset, the bag-of-words classifier efficacy will be debated in this experiment. Its simplicity, efficiency and robustness to noise, makes this classifier a reliable candidate to accurately recognize the input gestures. Following to create a model that is expected to learn, it has to be trained and then tested in order to evaluate its performances. Firstly, the data will be split between train and test dataset, each of them being differently composed, depending on one of these scenarios: within day analysis, single cross-day or cumulative cross-day analysis. After employing some clean-up preprocessing techniques, feature extraction will be performed, followed by codebook generation. Each codeword will be encoded to make it easier for the model to work with. Eventually, the frequency of appearance for each codeword will be monitored and represented via a histogram. Up to this point, same procedure is applied to both train and test dataset by using the same codebook. In the end, classification will be carried out and final evaluation of how well the model learned will be examined.

For these types of studies, there are several performance metrics which are relevant: Area Under Curve (AUC), Equal Error Rate (EER) or Cumulative Match Characteristic (CMC curve). Experimental results have shown over 97.2% authentication accuracy for the forearm dataset, over 96.7% for wrist dataset, while for identification, the CMC curve exceeds 99% accuracy when the rank is greater than 1. By addressing these considerations appropriately and taking into account variables like encoding procedure, number of codewords or vector quantization type, it is possible to achieve efficient identification and authentication of gestures from EMG signals using the bag-of-words model.

Keywords: Bag-of-words classifier, authentication, identification, EMG signals, AUC, CMC curve

STUDY UPON THE INFLUENCE OF MOBILE PHONE PROTECTIVE CASE ON SAR DISTRIBUTION

Petronela-Camelia Oprea, Mădălina Cojocariu

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Petronela-Camelia Oprea, petronela-camelia.oprea@student.tuiasi.ro

PhD Supervisor: Professor Alexandru Sălceanu,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

From the multitude of electromagnetic field sources that are part of our daily environment, wireless communications occupy a dominant position. Among the devices that use this type of communications, the closest to our hearts (both literally and figuratively) is the mobile phone. It uses quasi-simultaneously, in addition to the best mobile network available (be it 5G/4G/3G or even 2G), Wi-Fi, Bluetooth or Ultra Wideband (UWB) technologies. This accumulation of radio frequency electromagnetic waves is absorbed (partially) by the bodies they encounter, resulting in their heating. This unwanted increase in temperature is most faithfully illustrated by the distribution of the Specific Absorption Rate (SAR) parameter. The most accurate results can be provided by "in silico" tests, simulations performed with the help of human phantoms obtained with the help of slices provided by Computer Tomograph (CT) and Magnetic Resonance Imaging (MRI) technologies. In our paper, comparative results of the SAR distribution obtained around the heart are presented, for 6 distinct situations: phone without case, with case without conductive shielding and with case with conductive shield. For each of these situations, the phone was considered with the display facing the heart or turned 180 degrees. No matter how much we rely on the advanced technology of mobile phones to support our lives, there are also concerns about its impact on our health.
It is also important to note that SAR simulation in the CST Studio Suite simulation program involves special attention to the geometric details of the model and the simulation parameters. For the human body we used a predefined model in the CST simulation environment, namely the Hugo model. This model shows all the internal organs to which they have defined electrical, magnetic, thermal and mechanical properties.
At the end of the paper are presented conclusions and useful recommendations, resulted from these simulations developed in CST Studio Suite.

Keywords: Specific Absorption Rate, CEM, simulation, CST Studio Suite, mobile phone, Wi-Fi

AN OVERVIEW OF THE IMPROVEMENTS SUPPORTED BY ICNIRP 2020 GUIDELINES COMPARED TO THEIR PREVIOUS EDITIONS

Petronela-Camelia Oprea, Matei-Constantin Moruz

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Petronela-Camelia Oprea, petronela-camelia.oprea@student.tuiasi.ro

PhD Supervisor: Professor Alexandru Sălceanu,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

The wireless communication networks established between the most different devices, structures or equipment are an inseparable part of our daily life. Communication technologies use electromagnetic waves as carriers, belonging to a wide spectrum, 100 kHz-300 GHz. These radio frequency electromagnetic waves are part of the wider spectrum of non-ionizing radiation (NIR), which extends from infrasound mechanical waves to ultraviolet waves.

A highly respected authority in the field of NIR is the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This non-profit organization with a scientific mission is a non-state actor that is official collaborator of both the World Health Organization (WHO) and the European Commission.

In the last decades, the concern of various bodies and stakeholders regarding the possible adverse effects of NIR has increased. The spectacular diversification of technologies that generate or only use NIR, complementary to the refinement of methods for investigating possible health effects, required a permanent update and nuance of the protection norms established in the previous century. This dynamic, stimulated both by scientific progress and by an increasingly concern for the quality of life, imposed the updating of the ICNIRP guidelines.

ICNIRP first developed a comprehensive set of guidelines in 1998. These recommendations were updated in 2010.

The most recent scientific progress acquired in NIR domain, especially from the perspective of their biological effects and methods of monitoring, control and reduction, have been included in the 2020 version of the ICNIRP guidelines. Our paper summarizes these improvements, insisting on the main scientific justifications that were at their base.

Updates related to the importance of transparency in the development of normative acts, new thresholds, changes to restrictions, the introduction of a new frontier (6 GHz) related to the formulation of exposure restrictions, and the modification of some reference level values are discussed. A special attention is given to details regarding the definition of Specific Absorption Rate (SAR).

Keywords: ICNIRP, guidelines, SAR, non-ionizing radiation, health effects

THEORETICAL APPROACHES TO BIBLIOMETRIC TOOLS FOR SAR DISTRIBUTION

Petronela-Camelia Oprea, Matei-Constantin Moruz

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Petronela-Camelia Oprea, petronela-camelia.oprea@student.tuiasi.ro

PhD Supervisor: Professor Alexandru Sălceanu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Rapid technological development over the last century has significantly impacted scientific research and societal progress. Scientific research is essential for the advancement of knowledge and technology, contributing to the overall progress of society. Researchers play an important role in communicating their ideas and discoveries to society through publications, articles, and patents.

In this context, bibliometrics has emerged as a beacon of scientific visibility, empowering researchers with tools for organizing, ranking, and evaluating scientific output and researchers at institutional, national, or global levels. These bibliometric tools not only stimulate scientific research but also ignite the spark of innovation, contributing to the development of new technologies and methods in various fields.

This study aims to delve into the vast potential of the simulation, modelling, and determination of SAR (Specific Absorption Rate) distribution in the RStudio module software. RStudio, a powerful tool in the hands of researchers, enables data import, access, transformation, exploration, visualization, and modelling. RStudio's capabilities extend to machine learning and making predictions based on analyzed data. This tool, built on the R programming language, a statistical and graphical computing system, is a gateway to endless possibilities in data analysis and modelling.

The R system consists of two main components: the R language, which is used for programming and data analysis, and a runtime environment providing a graphical user interface. Using RStudio, researchers can perform complex data analysis, modelling, and prediction, thus contributing to advancing knowledge in various fields. The findings of this study reveal important issues related to the management of online library journal collections, and the extensive analysis and modelling possibilities offered to researchers. The continuous development of technology has opened up new horizons in research, allowing researchers to better explore and understand the world around them.

This complex interaction between scientific research, technology, and bibliometrics contributes to the continuous progress of society and the development of innovative solutions to current and future challenges.

Keywords: bibliometry, bibliometric platforms, Specific Absorption Rate, scientific papers, simulation

FOREARM ELECTROMYOGRAM-BASED BIOMETRICS USING BAG-OF-WORDS CLASSIFIERS

Irina Pavel, Iulian Ciocoiu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electronics, Telecommunications, and Information Technology, 11A Carol I Blvd., Iasi 700506, Romania

Corresponding author: Irina Pavel, irina.pavel@etti.tuiasi.ro

PhD Supervisor: Professor Iulian Ciocoiu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Surface electromyograms (sEMG) have been a revolutionary proposal for biometric authentication and identification to address the drawbacks and limitations of traditional biometrics such as fingerprints, facial recognition, and voice identifiers. Since EMG signals are unique for each person, they offer promising solutions for decoding passwords based on biometric information when a certain motion is being performed.

The data set used for the experiments was collected on the forearm using 8 electrodes, equally spaced around the forearm, from 43 individuals over three distinct days performing 16 hand gestures. The Gesture Recognition and Biometrics Electromyogram (GrabMyo), an open-access multi-channel multi-day database, facilitates robust analysis and experimentation.

Applications for identification and authentication were assessed using a bag-of-words (BoW) classifier, heavily influenced by document analysis, complemented with Fast Fourier Transform (FFT) based characteristics. To ensure effective feature extraction, each signal segment was divided using the frequency division technique (FDT).

The processing flow of time series data, such as EMG signals, the BoW approach involves various stages: fixed-length segments extraction, codebook or dictionary generation through clustering, assignment of feature vectors to specific codewords, histogram representation of the frequency of the codewords, and classification decision by comparing histograms of codewords frequencies.

Evaluation metrics including Cumulative Match Characteristics (CMC), Area Under Curve (AUC) and Equal Error Rate (EER) were used to assess the effectiveness of three different encoding techniques resembling Vector Quantization (VQ), Locality-constrained Linear Coding (LLC), and Sparse Coding (SPC). The approach showed robustness against variations in the encoding process, the codebook dimension and the length of the password based on the performed gesture.

Overall, the results highlight the potential of EMG-based authentication and identification in real-world applications, providing more security than conventional biometric systems. Future experiments may explore additional optimizations and integration to more user-friendly and efficient systems.

Keywords: Biometrics authentification, EMG, bag-of-words, gesture, open-access data set

A COMPARATIVE ANALYSIS OF THE EMOTION CLASSIFICATION IN FACIAL THERMAL IMAGES

Sorin Marius Pavel[1], Dorel Aiordăchioaie[2]

[1] "Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electronics, Telecommunications, and Information Technology, 11A Carol I Blvd., Iasi 700506, Romania
[2] "Dunarea de Jos University of Galati", Faculty of Automation, Computers, Electrical and Electronics Engineering, Str. Science no. 2, Galati - 800146, Romania

Corresponding author: Sorin Marius Pavel, sorin.pavel@ugal.ro

PhD Supervisor: Professor Dorel Aiordăchioaie, "Dunărea de Jos" University of Galati, Romania

Abstract:

This paper intends/aims to accomplish a comparative study/analysis of the detection and classification process (classification accuracy) of three categories of facial thermal images (raw original facial images, facial images with different levels of added noise and cropped images with ROIs (regions of interest with the mouth and eyes areas)), each divided into three other categories corresponding to certain emotional states (neutral, happy and sad). Three methods were implemented for the selection and extraction of features from thermal facial images, these methods are: First-Order features, Second-Order features - Haralick features and Run-Length features. For the process of classification a feedforward neural network with an architecture configuration consisting of a hidden layer with 100 to 600 neurons was used. The Levenberg-Marquardt algorithm was used in the neural network training process. The input thermal images (the three categories of facial thermal images) are organized in paired classes, i.e., neutral with sad and neutral with happy.

The main goal of the work consists in identifying appropriate methods for extracting features from different categories of facial thermal images that, in collaboration with a neural network (used as classifier), provides the best results in the process of recognition of emotional states. In this work were used images from three databases belonging to CCETIC (Research Center in Electronics, Information and Communication Technology) within the ETC department of the ACEEE faculty (Dunarea de Jos University of Galati).

Considering the limitations present in the case of thermal images (for example, lower resolution, reduction of the over all quality, difficulty in interpretation etc) compared to the images in the visible spectrum, the results obtained in the classification process are encouraging.

The results of the classification process depends on the categories of images used and the utilized feature extraction method, i.e., apparently certain methods favouring a certain category of images. The final results in terms of the accuracy of the classification process are between 64% and 86%. These results are encouraging, but indicate the need for additional adjustments regarding the feature extraction process (for example, we should use/consider in the classification process only the selection of important features) and possibly/probably to use other more advanced neural networks/classification methods. The future scope is to include the three categories of facial thermal images in a CNN (convolutional neural network) approach.

Keywords: thermal images, neural network, feature extraction, classification accuracy, detection

ON THE DESIGN OF PLANAR INDUCTORS IN POWER APPLICATIONS

Olimpian-Toma Păuleț, Dorin Octavian Neacșu

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electronics, Telecommunications, and Information Technology, 11A Carol I Blvd., Iasi 700506, Romania

Corresponding author: Olimpian-Toma Păuleț, olimpian.paulet@etti.tuiasi.ro

PhD Supervisor: Professor Dorin Octavian Neacșu,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

The evolution of electronic circuits and their utilization across various industries such as vehicle electrification and wireless power transfer leads to the improvement of power sources, aiming for higher efficiencies, the ability to work at high frequencies, and achieving smaller dimensions. In this context, the use of planar coils offers the advantage of reduced size compared to traditional coils, as they exhibit a regular form. The primary focus on these lies in the calculation method during their construction. In the perspective of implementing planar coils, the geometry discussed refers to construction in circular or rectangular spiral form. However, it is common to use polygons with more than four sides to enhance the inductor's performance.

Within this study, the MathCAD computational environment is employed, where the geometric model adopted is both circular and rectangular. The planar inductor is defined by a series of specifications such as the number of turns (N), spacing between turns (S), turn width (W), inner (d) and outer (D) diameter, mean diameter (Dm), and fill factor (ρ). Based on analysis, the parameter representing turn thickness has a minor influence on the inductance value; nevertheless, it is utilized in determining the maximum current accepted through the coil winding. In power applications, the design takes into account the maximum current that will pass through the coil; thus, from the design stage, it is determined considering a series of effects (cross-sectional area, current density for the material used, and maximum temperature during operation). Reducing the space between turns improves magnetic coupling and reduces the area of the planar coil construction, with the reverse desired only if reducing inter-turn capacitance is necessary.

The development of planar coils focuses on frequency specifications of currents, mutual inductance, self-inductance, and AC resistance towards construction and positioning within the layout. For correct design, resistance and inductance calculations in AC are considered, for the frequency range of 500 kHz to MHz, where secondary effects such as proximity effect and skin effect influence the ohmic losses of coils.

Keywords: planar inductors, planar coil construction, PCB inductors, integrated circuits design, PCB coils, power converter

IMPROVING THE CONTROL’S NUMBER IN BRAIN-COMPUTER INTERFACE APPLICATIONS BASED ON MOTOR IMAGERY

Silvia - Nicoleta Plăcintă

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Silvia - Nicoleta Plăcintă, silvia-nicoleta.placinta@student.tuiasi.ro

PhD Supervisor: Professor Marian-Silviu Poboroniuc,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

In essence, a Brain-Computer Interface (BCI) is the system that creates a direct communication pathway between the brain and external devices. One primary domain where BCI’s find significant applicability is for individuals experiencing locked-in syndrome - a clinical state marked by the absence of motor functions due to conditions such as amyotrophic lateral sclerosis (ALS), cerebral palsy, stroke, multiple sclerosis, or spinal cord injury. Beyond this, BCI’s are also extensively utilized in diverse applications including neurorehabilitation therapy which aims to help stroke patients in recovering impaired motor function, controlling robots, monitoring sleep quality, and enhancing gaming experiences.

Motor imagery (MI) refers to the mental rehearsal of limb movements without physically executing them. This approach benefits from the advantage that the brain activity associated with movement is well-localized in the primary motor cortex. Brain signals related to the user's movement intention can be detected and converted into command signals for a device, such as a robot.

On the other hand, MI has the disadvantage of a limited number of commands that can be generated, namely two, imagining the movement of left hand generates one command, and imagining the movement of right hand generates the second command. Sometimes, a third command involves imagining leg movement. The aim of this paper is directed towards addressing this aforementioned limitation by finding a way to increase the number of possible commands.

For this purpose, the study utilized g.GAMMAcap2 with 16 active electrodes g.Sahara, together with the biosignal amiplifier g.USBamp. Within the Matlab Simulink programming environment a model was implemented following the standard steps of brain-computer interface architecture, which include EEG (electroencephalography) signal acquisition, preprocessing, feature extraction, and classification.

In the current stage of the work, in the mentioned programming environment, the paradigm based on motor imagery has been successfully implemented. This paradigm has the role to control the progression of an experimental trial. Experimental trials were conducted to collect data, which was later processed offline. The main aim of this processing was to develop a classifier capable of accurately distinguishing between the two user intentions, the imaginations of left or right hand movement. The highest accuracy of the classifier obtained has a value of 90%.

Keywords: Brain - computer interface, motor imagery, EEG, paradigm, Simulink implementation

DOMAIN-SPECIFIC FPGA-BASED DIGITAL ACQUISITION SYSTEM FOR HARDWARE ACCELERATORS INTEGRATION

Cosmin-Andrei Popovici, Andrei Stan, Vasile-Ion Manta

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Automatic Control and Computer Engineering
27 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Cosmin-Andrei Popovici, cosmin-andrei.popovici@academic.tuiasi.ro

PhD Supervisor: Professor Vasile-Ion Manta,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Domains like IoT (Internet of Things), ADAS (Advanced Driver Assistance System), Smart Homes and Smart Cities and XaaS (Everything-as-a-Service) put a great pressure in the last fifteen years on computer engineers for designing processors capable of higher precission computations performed in shorter times, interconnected in ultra-high-speed communication networks and consuming less electrical power in order to be supplied by batteries and clean renewable energy solutions.

For almost two decades now, classical VLSI laws such as Moore's and Dennard's cannot be applied anymore for embedding twice as many transistors in the same silicon area every two years and keeping the energy density constant at the same time. The most feasible solution for mitigating this problem is designing DSAs (Domain-Specific Architectures) like application-specific hardware accelerators. Hardware accelerators replace the necessity of implementing domain specific algorithms programatically by embedding hardware implementation variants of the same algorithms in modules running in parallel with the software developed for classical CPUs.

An electronic field which can benefit from using domain-specific architectures instead of classical general-purpose microcontrollers is Digital Signal Processing (DSP). Developing logical circuits or complex digital systems won't be possible today without using logic analyzers, protocol decoders, digital oscilloscopes, and digital recorders. These tools are used in the processes of prototyping and verifying digital systems by recording, displaying, decoding, and analyzing internal or external signals.

This article proposes an example of a domain-specific architecture, a Digital Acquisition and Control System, named FpgaDaq, deployed on FPGA, operating at 100 MHz, using DDR3 RAM memory and 100 Mbps Ethernet for the communication with hosting PC running a custom GUI (graphical user interface) application. This design offers between 8x and 43.34x better propagation delay (constant 20 ns) for performing and outputting logical operations over variable number of inputs (between 2 and 31 signals) than a general-purpose microcontroller which runs at 6x times higher frequency. It is also initiating UDP transmissions containing digital records and their timestamps 19.31x times faster than a Xilinx MicroBlaze processor implementation running at 2x times higher frequency on the same FPGA. The solution is able to detect changes in parameters of PWM inputs and to send them to the hosting PC right after the first cycle of the modified signal ends.

The proposed design is deployed on Xilinx XC7A100T FPGA as standalone solution and may be integrated as processor extension for RISC-V cores in a future project.

Keywords: VLSI, DSA, FPGA, digital systems, digital acquisition, signals, PWM, processors, microcontrollers

MONITORING DISTRIBUTION NETWORKS TO DETECT WATER LOSSES - CASE STUDIES

Alexandru Postăvaru, Catrinel-Raluca Giurma-Handley

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Hydrotechnics, Geodesy and Environmental Engineering, 64 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Alexandru Postăvaru, alexandru.postavaru@student.tuiasi.ro

PhD Supervisor: Professor Catrinel-Raluca Giurma-Handley,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Water network management has become increasingly complex and challenging, with aging infrastructure, increasing demand, and changing regulations. To effectively manage water networks, it is essential to have access to accurate and timely information about the network's condition, performance, and potential issues. Acoustic noise logger correlator technology is a tool that can help water utilities to achieve these goals and improve network efficiency, reliability, and sustainability.

Acoustic noise logger correlator is a sophisticated technology that uses acoustic sensors and advanced algorithms to detect and locate leaks, bursts, and other anomalies in water distribution networks. The system consists of a network of acoustic sensors installed at strategic points in the network, such as at valves, hydrants, and junctions. The sensors continuously monitor the network for acoustic signals, such as pressure waves, caused by events such as leaks, bursts, and valve operations.

Another advantage is the ability to provide historical data about network performance, which can be used for trend analysis, modeling, and planning. This can help utilities to identify long-term issues and plan for future network upgrades and improvements.

In addition to leak detection and network optimization, can also be used for asset management and condition assessment. The sensors can detect acoustic signals that are indicative of pipe deterioration, such as corrosion, sediment buildup, and pipe wall thinning. This information can be used to prioritize maintenance and replacement activities, reducing costs and improving network reliability and sustainability. Overall, is a tool that, by monitoring water flow and pressure within specific areas of the network, utilities can identify areas that are experiencing excessive wear and tear, such as corrosion or sediment buildup. This information can be used to prioritize maintenance and replacement activities, reducing costs and improving network reliability and sustainability. In conclusion, district management area is a crucial component of modern water network management. It provides utilities with accurate and timely information about water flow and pressure within specific areas of the network, enabling them to detect and reduce water losses, optimize network operations, and improve network reliability and sustainability.

Keywords: Water management, network optimisation, best practices in water losses, acoustic noise logger, leak detection

RESILIENCE OF POWER SYSTEMS TO CYBER ATTACKS: EVALUATING TOOLS AND METHODOLOGIES FOR ENHANCED RESILIENCE

Alin-Ionuț Pricop, Mihai Gavrilaș

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Alin-Ionuț Pricop, alin-ionut.pricop@student.tuiasi.ro

PhD Supervisor: Professor Mihai Gavrilaș,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

In the context of escalating cyber threats targeting critical infrastructure, the security of power systems is gaining prominence. This paper delves into various tools and methodologies that might support the enhancement of cybersecurity for these systems. It focuses on advanced simulation techniques and red-team scenarios, aimed at evaluating the resilience of power systems against cyber-attacks.

The analysis includes a review of testing software such as Nessus and Metasploit. The functionalities of these tools and their potential roles in identifying vulnerabilities within the power sector are discussed. This exploration seeks to understand how such tools might assist system administrators in broadly enhancing security measures.

Moreover, the paper reflects on the comparative benefits and limitations of automated versus manual testing methods. It proposes that blending both approaches could yield a more comprehensive understanding of system vulnerabilities and cybersecurity as a whole.

The discussion extends to the significance of integrating cybersecurity practices within the existing operational frameworks of power systems. The potential impact of automation in enhancing testing efficiency and reducing human errors is considered, emphasizing the value of such technologies in the broader context of operational security.

In conclusion, the paper presents a discussion on the potential utility of various tools and methodologies in addressing the cybersecurity challenges facing power infrastructures. It underscores the necessity for ongoing dialogue and the exploration of innovative strategies to enhance the resilience of power systems against evolving cyber threats. This approach advocates for fostering a proactive security culture in the power sector, aimed at enhancing the sector's capability to anticipate and mitigate emerging cyber risks. The paper calls for a broader industry engagement in refining cybersecurity practices, highlighting the importance of a collective effort in advancing security measures. This ongoing discussion is crucial for fostering a deeper understanding and more adaptive approaches to cybersecurity in the energy sector.

Keywords: Cyber-attack, resilience, power systems, cybersecurity, nessus, metasploit

STUDY ON ELECTROMAGNETIC INTERFERENCE IN DIFFERENT OPERATING ROOMS

Marina-Georgiana Roman, Lidia Nedelcu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Marina Georgiana Roman, marina-georgiana.roman@student.tuiasi.ro

PhD Supervisor: Professor Valeriu David,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

In the typical hospital environment, the electromagnetic field is an important factor to consider due to its potential impact on medical devices.
Managing the risks of electromagnetic interference (EMI) in critical care areas presents several challenges due to the complex environment, wireless technologies, sensitive medical equipment, emergency situations, and the complexity of maintaining and upgrading medical equipment. In terms of maintenance and upgrades, it is important to ensure seamless integration without compromising safety and without generating electromagnetic interference. Biomedical engineers play a key role in understanding the unique EMI landscape of the hospital. Measurements have been taken to assess the risk of electromagnetic interference (EMI) in critical care areas according to specific protocols and guidelines.
An anaesthesia and intensive care unit is an environment with a variety of complex medical equipment and procedures designed to effectively manage critical cases.
In order to determine the reduction of electromagnetic interference, magnetic flux density measurements were carried out in 3 different areas of the hospital environment: the intensive care unit (ICU), the orthopaedic surgery clinic and the general surgery clinic. Measurements were made at different times of the day, under different operating conditions of the medical equipment present, in the absence or presence of users, at a distance of 1 meter from the sources and at a height level of 1 meter from the floor.
Using point measurements, we determined first the background magnetic field in the area, and then the magnetic field strength in several points respecting the same positioning pattern.
To determine the spatial variation of the magnetic field strength we used a commercial instrument manufactured by EXTEC with a frequency range between 30 Hz and 300 Hz and a basic accuracy of ±4%. To determine the temporal variability of the field we used a laboratory automatic instrument capable of measuring magnetic flux densities in the frequency range up to 100 kHz with a relative error of less than 5%
Analyzing the measurements for automatic monitoring of the electromagnetic field, significant differences in electromagnetic head levels were observed. We thus did a statistical processing of the data obtained.
The results surveillance showed that abnormally high levels were recorded during interventions, with all devices switched on, including the C-arm machine, which is an advanced medical imaging device based on X-ray technology and a radio device switched on.

Keywords: electromagnetic field, medical devices, intensive care unit, human exposure, operating room, electromagnetic field measurements

ADVANCED SPEECH SEGMENTATION IN ROMANIAN NEWS BROADCASTS THROUGH MEDIAN FILTERING

Vasile-Silviu Sărmășanu

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Automatic Control and Computer Engineering
27 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Vasile-Silviu Sarmasanu, vasile-silviu.sarmasanu@student.tuiasi.ro

PhD Supervisor: Professor Vasile-Ion Manta,
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

This paper presents an in-depth exploration of speech segmentation advancements within Romanian news broadcasts, achieved through the application of median filtering techniques.
Other research explores the classification of audio signals into distinct categories, such as speech, music, and background noise, utilising neural network models trained on quantitative datasets. Various techniques, including spectrograms, Mel frequency coefficients, and Fourier transformations, are employed in this classification process. Within this methodological framework, convolutional neural networks (CNNs), recurrent neural networks (RNNs), and autoencoders are integral components, each providing distinct capabilities in capturing and interpreting temporal patterns intrinsic to audio signals.
Motivated by the need for segmentation approaches in the context of Romanian news broadcasts, this research introduces a novel methodology that harnesses the power of median filtering. Through strategic application of median filters, the aim is to achieve a uniform distribution of amplitude levels, particularly in regions corresponding to speech pauses.
Central to this methodology are two key parameters: the determination of minimum pause zone lengths and the establishment of maximum amplitude thresholds for identifying speech pauses. By finely calibrating these parameters resulting in segments that faithfully capture the narrative structure of the news content.
Extended speech pauses over one second may lead to over segmentation, while smooth transitions between news stories risk under segmentation. Balancing these risks involves fine-tuning segmentation algorithms to accurately identify story boundaries, minimising both oversplitting and undersplitting errors. Incorporating contextual heuristics aids in achieving precise segmentation without unnecessary fragmentation or amalgamation.
Experimental validation of the proposed methodology involves rigorous testing of two distinct median filter sizes (51 and 201), as well as a novel combined filter. Results from these experiments underscore the efficacy of the approach in achieving smooth and precise segmentation outcomes, despite the computational overheads associated with median filtering.
The insights gained from this research offer valuable contributions to the broader discourse on audio stream segmentation techniques, while also paving the way for further innovation and refinement in this domain.

Keywords: audio stream segmentation, Median filter, Romanian news broadcasts, segmentation approaches, over segmentation, under segmentation

INFLUENCE OF PHOTOVOLTAIC PANELS ON THE NETWORKS OF DISTRIBUTION OPERATORS

Nicolae Stănciulescu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Nicolae Stanciulescu, nicolae.stanciulescu@student.tuiasi.ro

PhD Supervisor: Professor Ciprian Nemes,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Promotion of renewable energy and sustainable technologies for electricity production, such as solar energy, wind energy or hydropower. These clean energy sources would reduce environmental impact and reduce dependence on polluting energy sources.
Photovoltaic panels can generate fluctuations in grid voltage when energy is suddenly injected into the electrical system. These voltage variations can create problems for power grids.
Photovoltaic panels can generate power quality distortions by influencing factors such as power factor, harmonic factor, and frequency. These distortions can affect the operation of other equipment in the network and may require the installation of additional filters to maintain power quality.
Under load or short-circuit conditions, photovoltaic panels can generate excess electrical current, which can lead to system overheating and equipment failure or fire hazard.
The main disadvantage is related to the fact that the voltage in the electricity network differs greatly depending on the area, or even on the same street. In many situations, even photovoltaic systems produce these voltage differences. The operating principle of the inverter for an on-grid system involves increasing the voltage by 5-20 V, above the level already existing in the electricity network. Concretely, if the energy in the network is at the standard value of 230 V, the voltage that will go from the inverter to the network will be around 240-245 V. This case, however, is an ideal one, many times the value of the voltage in the network does not have the standard value of 230 V. The most problems that occur in the electricity network, with the more than 7000 photovoltaic systems installed, were when the voltage in the network, even if the photovoltaic system was not working, exceeded the value of 240 V.
Implementation of the power quality management policy: constant monitoring and control of the quality of the supplied power, especially in terms of voltage, frequency, and power factor
Creating a crisis and emergency management system in the electricity distribution system, to respond promptly and efficiently to any negative events or major technical problems.

Keywords: renewable, energy, distributor, access

INNOVATIONS AND TECHNOLOGICAL UBIQUITY, FOR THE DEVELOPMENT OF E-BUSINESS, AT THE GOVERNMENT LEVEL

Marius Ștefan

Bucharest University of Economic Studies, Bucharest, Romania

Corresponding author: Marius Ștefan, marius.stefan@mfe.gov.ro

PhD Supervisor: Professor Bogdan Ghilic-Micu,
Bucharest University of Economic Studies, Romania

Abstract:

Adaptability to the specific conditions of the action environment, in economic, social, political and technological terms, enables the degree of success of an organization. Technologies and new forms of communication have a decisive role in the management of the organization's activities, realized through effective strategies and policies. Existence in an environment in perpetual transformation and digitization, requires the ability to identify, select, store, manage, process and intelligently use stored information, aiming at the efficient and rapid development of electronic business.

The technological ubiquity manifested by a significant presence in different levels of society, both personal and professional, reflects the degree of integration of emerging technologies in everyday life, also conditioning the existence of modernity marked by the spread of innovative solutions, new technologies as well as the adoption the transformation of traditional ways of communication, work, learning and socialization towards an influential modeling of the degree of digital transformation in the information society.

In the information society of knowledge, the quality of life, as well as the perspectives of social change and economic development, depends to a large extent on information and its management, the institutional field of managing IT applications for European funds becoming a matter of national importance, with values critical to national security. The reinvention of governance can be achieved through digitization and government computerization, which involves the modernization of the current IT infrastructure through specific external funding sources, such as European funds, doubled and secured by advanced cyber protection and defense capabilities against possible vulnerabilities or cyber-attacks.

Knowledge and scientific information are of enormous importance in the global information society, by: supporting innovation, promoting economic development, making decisions in an efficient and transparent way, at the governmental level and especially for the implementation and use of intelligent technologies in the development of the degree of digitization of public services through financing provided by European funds and the National Recovery and Resilience Plan.

Keywords: Emerging technologies, synergy in innovation, e-business, digital transformation, awareness, cyber security, automation of repetitive processes

CHARACTERIZATION OF SPATIAL AND TEMPORAL DISTRIBUTION OF CHARGING STATION LOADS AND ANALYSIS OF INFLUENCING FACTORS

Yining Wang, Zhenji Zhang, Daqing Gong

Beijing Jiaotong University, School of Economics and Management, Nr. 3 Shangyuan Village, Xizhimenwai, Haidian District, Beijing 100044, China

Corresponding author: Yining Wang, 22110179@bjtu.edu.cn

PhD Supervisor: Professor Zhenji Zhang,
Beijing Jiaotong University, China

Abstract:

In the past decade or so, the production and sales of electric vehicles (EVs) have risen simultaneously under the impetus of a number of national policy subsidies and the gradual adaptation of consumers to EVs, and the charging facilities supporting them have also been deployed in large numbers. However, despite the rapid development of charging facilities in terms of scale, there are still problems such as low utilization of facilities during low-peak hours and excessive congestion during peak hours in the application of charging facilities, which results in a waste of resources and a loss of charging experience for the users, and therefore it is valuable to study the spatial-temporal distribution characteristics of the charging station loads and the factors affecting them.

Based on this background, the research content of this paper includes: Discovering the temporal and spatial distribution characteristics of the load volume, the temporal distribution characteristics include the short-time change pattern, multiple periodicity, long-term trend and the influence of special time, and the spatial distribution characteristics are analyzed by defining the spatial dependence of the short-distance and the spatial dependence of the long-distance and analyzing the influences of the two, and at the same time, also considering the influence of the road network information and the point of interest information on the spatial distribution of the load volume, and analyzing the influence of the road network information and the point of interest information information on the spatial distribution of loads.

As a conclusion, in the ablation experiment that gradually introduces multi-source data features, it is verified that the mining of richer spatio-temporal features and influencing factors helps to better understand the spatiotemporal distribution law of charging station loadings. Meanwhile, in the comparison experiments, it can be verified that the model constructed in this paper has a higher fit to the data. The main reason is that on one hand, the data with more source attributes are fused, and on the other hand, the global spatial enhancement module is built into the model to help the prediction model learn the global spatial information directly.

Keywords: electric vehicles (EVs), charging facilities, spatial-temporal distribution, spatio-temporal distribution law, multi-source data features

ELECTRIC VEHICLE CHARGING STATION LAYOUT BASED ON GENETIC ALGORITHM AND AGENT SIMULATION

Yanping Zhang, Dan Chang, Daqing Gong

Beijing Jiaotong University, School of Economics and Management, Nr. 3 Shangyuan Village, Xizhimenwai,Haidian District, Beijing 100044, China

Corresponding author: Yanping Zhang, 22110198@bjtu.edu.cn

PhD Supervisor: Professor Dan Chang,
Beijing Jiaotong University, Beijing, China

Abstract:

With the increasing emphasis on reducing carbon emissions for environmental protection, the market for electric vehicles (EVs) has expanded rapidly. As EVs gain wider acceptance in urban areas, user charging demand has also increased significantly. Consequently, effectively balancing the location of EV charging stations with charging demand to satisfy users has become a crucial factor for the future development of EVs. This study focuses on the trade-off between EV user utility and the cost of charging station layout. This paper determines EV user utility by considering the total population, traffic flow, and social activity attributes within the POI coverage areas in the city. Additionally, this paper calculates the construction cost of charging stations based on fixed costs and electricity consumption. To optimize this balance, a multi-objective non-dominated sorting genetic algorithm II (NSGA-II) is used in this paper, aiming to maximize user utility while minimizing charging station layout costs. Furthermore, with the objective of sustainable urban development, an integrated simulation system is constructed in this paper. This framework incorporates agents representing EVs, EV users, and charging stations, and incorporates their respective behaviours. Using geojson data and other resources, it can generate a realistic urban map and conduct grid-based analysis. Based on the charging station layout in the base year, we utilize agent-based simulation to model the dynamic changes in the urban charging station layout in different future years. In a follow-up study, this paper compares genetic algorithm solutions with other methods such as uniform, random and probability distributions. Ultimately, this study validates the effectiveness and advantages of the genetic algorithm solution. It also explores strategies to reduce charging waiting times and minimize the number of underutilized charging stations. The research findings will provide valuable insights to support government authorities and operators in making informed decisions regarding the deployment of EV charging stations.

Keywords: charging station layout, electric vehicles, genetic algorithm, agent-based simulation

SECTION 3.
Chemistry;
Chemical engineering;
Environmental engineering

STUDY ON THE PRODUCTION OF MAGNETITE NANOPARTICLES STABILIZED WITH SILVER FOR MEDICAL APPLICATIONS

Helmina Ardeleanu, Dana Pricop, Dorina Creangă

"Alexandru Ioan Cuza" University of Iasi, Romania, Faculty of Physics 11 Carol I Blvd., 700506, Iaşi, România

Corresponding author: Helmina Ardeleanu, ardeleanu_helmina@yahoo.com

PhD Supervisor: Professor Dorina Creangă
"Alexandru Ioan Cuza" University of Iasi, Romania

Abstract:

In recent years, numerous bacteria have developed antibiotic resistance, prompting efforts to create new means of treatment. Because of their antibacterial characteristics and biological compatibility, nanocomposites of iron oxide covered with silver (Ag-MNP) were investigated, with the goal of further conjugation with medicinal compounds. The aim of this study is to synthesize magnetite-silver nanoparticles to be used later in different biomedical applications. In the first stage of our work we synthesized biocompatible magnetite nanoparticles (MNP) using the adapted chemical co-precipitation technique while in the second stage we stabilized them in aqueous suspension with glucose and coated them with silver shell. The evidencing of those nanosystems physical-chemical features was carried out with focus on the microstructural and magnetic properties by using transmission electron microscopy (TEM), scanning electron microscopy (SEM), X-ray diffraction (XRD), energy dispersive spectroscopy (EDS), and vibration sample magnetometry (VSM). UV-VIS spectroscopy and Dark Field optical microscopy were also used to demonstrate the characteristics imparted by the localized surface plasmon resonance phenomena. The impact on young vegetation in the environment was analyzed using the quantification of photosynthesis pigments.

Nanometric dimensionality was revealed by both electron microscopy techniques the average particle size ranging in 18-20 nm interval, while the optical microscopy in dark field mode allowed nanoparticle visualization due to plasmonic emission, couple of orders of magnitude larger than the source particles. The spectral band recorded in the visible range around 400 nm is concordant with that of silver nanoparticles. Crystallinity features were revealed by X-ray diffractometry according to the standard diffraction peaks of magnetite as well as of silver. EDS study shown the silver atomic line confirming magnetite coating.

Magnetizability characteristics were provided by the saturation magnetization curves of magnetite and magnetite-silver nanosystems. The biological test nanotoxicity carried out on early melon seedlings supplied with dilute suspensions of 200-800 microL/L of silver-coated magnetite nanoparticles, showed progressive increase of chlorophyll a, and carotene content, and also less increase of chlorophyll b content in the seedling green tissue. The ratio of chlorophyll *a* and chlorophyll *b* contents was increased to the nanoparticle concentration increase denoting over 35% enhancing of photosynthesis apparent efficacy, the result interpretation being most possible related to the dominant iron stimulatory effect on the plant growth.

Therefore, we can conclude that silver-coated magnetite nanoparticles with benefits in biomedical applications are not harmful when released in the environment.

Keywords: Magnetic nanoparticles, properties, biocompatibility, magnetite, silver

METHODS FOR THE ELIMINATION OF PER AND POLIFLUORALKYLIC SUBSTANCES - PROGRESS AND CHALLENGES

Adina Carmen Gavrilescu[1], Manea Florica[2]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Chemical Engineering and Environmental Protection „Cristofor Simionescu"
[2]Politehnica University of Timisoara, P-ta Victoriei no.2, 300006 Timisoara, Romania

Corresponding author: Adina Carmen Gavrilescu, adina-carmen.gavrilescu@student.tuiasi.ro

PhD Supervisor: Professor Florica Manea,
Politehnica University of Timisoara, Romania

Abstract:

Per and polyfluoroalkyl substances (PFAS) represent a broad category of emerging pollutants with over 12,000 components defined by the presence of at least one fully fluorinated methyl or methylene carbon group without H/Cl/I/Br atoms attached. Due to the presence of the strong C-F bond in their molecule, they present attractive properties such as high chemical, thermal and biological stability. Ever since the 50s of the last century, they have been used on a large scale in various industrial applications, household products, care products or foams for extinguishing fires. Their presence in the aquatic environment and the human body, along with the toxic effects following constant exposure and also, their resistance to conventional water treatment technologies, has determined the responsible factors and the scientific world to consider the development of effective methods and technological solutions for their removal and degradation as a priority. The main objective of this study is the analysis of current trends and the progress achieved regarding the application of several methods through separation processes by conventional (coagulation/flocculation)/non-conventional (electroflotocoagulation), advanced (adsorption), and degradation through electrooxidation processes. Although there is a wide variety of PFAS and their derivatives, only a small number of them have been tested in order to develop their removal technologies. Considering the limitations of conventional water treatment methods for PFAS removal and taking into account the current regulations in the field, the need to synthesize and test new materials that increase the efficiency of the elimination and destruction processes has arisen. The removal performances generally depend on the materials used and their properties, and on the design of the processes including the operating conditions, as well as. The present work proposes a structuring of the processes, the materials used and their performances reported in the recent literature in order to achieve an overview and to identify the existing gaps to properly design future research activities for the application of innovative processes in the technological solution for advanced water treatment.

Keywords: PFAS, adsorption, degradation, advanced oxidation, electrochemical process

WASTEWATER CLEANING WITH MAGNETIC NANOPARTICLES – THE CASE OF RHODAMINE B

Andreea Roxana Fanaru Balint[1], Marian Grigoraș[2], Gabriel Ababei[2], Anda Les Agavriloaei[1], Dorina Creangă[1]

[1]"Alexandru Ioan Cuza" University of Iasi, Romania, Faculty of Phhysics, 11 Carol I Blvd., 700502, Iasi, Romania
[2]National Institute of Research and Development for Technical Physics, 47 Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Andreea Roxana Fanaru Balint, fanaru.andreearoxana@yahoo.com

PhD Supervisor: Professor Dorina Creangă,
"Alexandru Ioan Cuza" University of Iasi, Romania

Abstract:

At present time dye effluents released by industrial activity into the environment raise significant issues on biosphere safety. It is generally accepted that biological and physical methods (i.e. enzyme-based degradation and physical adsorption) are the most efficient dye removal means.
We present an experimental laboratory study developed with dye water model of Rhodamine B, a high molecular weight chemical, used mostly for industrial purposes, like dyeing and printing of textile, paper, and leathers as well as with magnetite nanoparticles (MNP), UV-C irradiation and hydrogen peroxide treatment.
The magnetite nanoparticles were synthesized according to co-precipitation technique of ferric and ferrous oxides. Microstructural and magnetic properties were investigated by Transmission Electron Microscopy (TEM) using the Hitachi High-Tech HT7700 device, X-Ray Diffractometry (XRD) using a Shimadzu LabX XRD-6000 device with an incident Cu–Kα radiation beam with λ = 1.5406 Å and Vibrating Sample Magnetometry (VSM) a Lake Shore VSM 7410 device under magnetic field up to 20 kOe. UV-C exposure was carried out on 10 mL Rh B 10 µM solution using a UV tubular lamp from Philips with 30 W total emission power and 12 W emission power in UV-C range. The results of physical characteristics investigation have revealed about 20 nm diameter particles, with standard magnetite diffraction lines (and no other impurities) providing saturation specific magnetization of about 68 emu/g and coercitive field of about 82 Oe. The concentration of 8 g/L of Fe_3O_4 dry powder was found to lead to coherent first order process in the interaction with Rhodamine B. The MNP supply and simultaneous UV-C exposure have resulted in about 30% Rhodamine B degrading efficiency (calculated as relative variation of light absorbance at 554 nm, in the main spectral band of Rhodamine B). The addition of hydrogen peroxide has improved the results, leading to about 45% degrading efficacy for 10 mM H_2O_2 and about 52% for 20 mM H_2O_2 for 120 min of exposure to UV-C. Finally, the best decolorization of the wastewater model studied in here, was evidenced for 8 g/L of Fe_3O_4 dry powder in the lack of other treatments, since the Rhodamine B degrading efficiency was found of over 90%. The main mechanism of dye-MNP interaction is supposed to be the physical adsorption. This is why, the presence of OH radicals released by water photolysis following UV-C irradiation, or by hydrogen peroxide splitting in the host solution, despite their cleavage action on the dye molecules, they compete with Rhodamine B to the occupancy of MNP surface. Further experiments are planned by varying the levels of MNP, UV-C exposure and H_2O_2 concentration.

Keywords: Wastewater, Rhodamine B, magnetite nanoparticles, first order process, adsorption process, decolorization

INFLUENCE OF THE THERMAL AND DIFFUSION PROPERTIES OF SOME INSULATING POROUS MATERIALS

Adriana-Mariana Asoltanei, Marius Sebastian Secula, Eugenia Teodora Iacob Tudose, Ioan Mămăligă

"Gheorghe Asachi" Technical University of Iasi, Romania, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Adriana-Mariana Asoltanei , adriana-mariana.asoltanei@student.tuiasi.ro

PhD Supervisor: Professor Ioan Mămăligă
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Insulating a certain building structure is carried out both against hot and cold climates. The current conditions of insulation are meant to protect indoor environment quality from external conditions. The insulation of structures has become more and more common that currently there are no buildings or structures that are built without the use of insulation. There is an obligation at the level of the European Union that all new buildings be with nearly zero energy consumption (nearly zero energy buildings - NZEB). According to literature data the construction sector is responsible for approximately 40% of the pollution produced and approximately 30% of the consumption of raw materials worldwide. The use of natural materials in construction is a viable and sustainable alternative to build nearly zero energy buildings (NZEB), which have become mandatory in Romania since December 2020. For residential buildings, the EU requires a significant reduction in average primary energy consumption – of at least 16% by 2030, and of 20-22% by 2035. This directive also provides for the renovation of the 16% most energy-inefficient non-residential buildings until 2030, expanding to 26% until 2033, by establishing minimum energy performance requirements. A significant evolution can be observed in the construction industry towards more environmental-friendly and sustainable options, these being achieved with the help of the materials used. Adding porous materials can improve the quality of building materials due to their contribution to thermal and acoustic insulation, moisture management, freeze-thaw resistance, durability, energy efficiency and aesthetic appearance of buildings. Insulating panels made of ecological, natural materials have become more and more frequent. Also, the use of natural thermal insulation contributes to reducing the impact on natural resources. These can be used to insulate any type of surface, however insulating boards require processing with certain chemicals to improve adhesion and also to increase their lifespan. Some materials used must enhance the insulating features and prevent the loss of any of their natural properties, i.e. thermal properties, diffusivity, etc. Studies on the thermal diffusivity and diffusion of some components in these types of materials are needed. The paper presents a study on the main methods of determining thermal diffusivity and effective diffusion coefficients in materials specially used for the aimed applications.

Keywords: insulating materials, thermal diffusivity, effective diffusion coefficient

INTEGRATED SOLVENT-BEAD MILLING SERIAL EXTRACTION ON TWO MICROALGAE STRAIN BIOMASS: CHLORELLA SOROKINIANA AND GALDIERIA SULPHURARIA

Elena Aurino[1], Luigi Marra[1], Francesca Raganati[1], Antonino Pollio[2,3], Antonio Marzocchella[1]

[1]"Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale, Università degli Studi di Napoli Federico II, P. le V. Tecchio 80, 80125 Napoli, Italy.
[2]"Dipartimento di Biologia, Università degli studi di Napoli Federico II, Via Cintia, 80126, Napoli, Italia
[3]"Algal Collection of University of Naples Federico II, Università degli studi di Napoli Federico II, Via Cintia, 80126, Napoli, Italia

Corresponding author: Elena Aurino, elena.aurino@unina.it

PhD Supervisor: Antonio Marzocchella,
Università degli Studi di Napoli Federico II

Abstract:

Microalgae are a promising feedstock for biocommodities. They are able to synthesize several macromolecules such as proteins, lipids, and pigments. Their application range in several biotechnological fields, from pharmaceutical to cosmetic, from energy to feed. A sustainable microalgae exploitation requires the extraction of multicompounds of interest. The development of industrial scale process needs extraction techniques that are cost-effective, easy and scalable. This work aims to design an extraction step for the recovery and partial separation of protein, carbohydrate, and lipids. Two strains have been investigated: Chlorella sorokiniana and Galdieria sulphuraria. A combination of bead milling and solvent extraction has been selected because they are industrial consolidated processes and are characterized by low energy demand. The extraction step has been designed as a two solvent extraction stage in series, hexane and pure or 70% ethanol (H100E and H70E, respectively) have been selected as solvents. The first stage has been dedicated to selective lipids extraction, using hexane. The lipid recovery was 58.1±1.4 %w for C. sorokiniana and 51.6±0.6 %w for G. sulphuraria with a lipid selectivity of 65,1%w and 47.8%w, respectively. The second stage has been carried out with pure ethanol or 70% ethanol aqueous solution (H70E). Both strains were characterized by high extraction of protein in pure ethanol and carbohydrate in the H70E. Each stage has been coupled with bead milling cell disruption in the selected solvent. The cell-bead suspensions have been washed (without further rupture) with a liquid washing volume 2 times larger than the extracting solvent volume. For both biomass, the total lipid recovery was more than doubled after the washing stages. This observation suggests the presence of a consistent mass transfer limitation for lipids, despite an efficient biomass breakage in the early stage of extraction. The designed extraction set up provided a total recovery of lipid higher than 70%w for each strain, reaching a maximum of 80.8 %w for C. sorokiniana with H70E. A maximum protein recovery was measured for C. sorokiniana H100E (100%w), a minimum of protein recovery was measured for G. sulphuraria H70E (32.2%w). G. sulphuraria is a more recalcitrant biomass with respect to C. sorokiniana, as expected.

Keywords: Microalgae, solvent extraction, bead milling, cascade extraction, Galdieria sulphuraria, Chlorella sorokiniana

THERMOSENSITIVE HYDROGELS – SYNTHESIS AND BIOMEDICAL APPLICATIONS

Adina Maria Baroi Dănilă-Dediu

"Gheorghe Asachi" Technical University of Iasi, Romania, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Adina-Maria Baroi Danila-Dediu: adina-maria.danila-dediu@student.tuiasi.ro

PhD Supervisor: Leonard Ionuț Atanase
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Thermo-sensitive hydrogels are part of the category of "smart" (or "intelligent") hydrogels, which present reversible swelling features related to the external environment, such as temperature, pH, and ionic concentration, which can in turn contribute to their collapse or phase transformation. Such type of hydrogels can undergo phase transition or swell/deswell as ambient temperature changes, endow the drug delivery system with enhanced local drug penetration, desirable spatial and temporal control, and improved drug bioavailability; these characteristics facilitate their extensive applications in drug delivery. Thermo-sensitive hydrogels are obtained starting from thermo-sensitive polymers, which contain both hydrophobic and hydrophilic components in their structures. The phenomenon of thermal response is derived from the balance between the hydrophobic and hydrophilic segments of the polymer. Temperature modification changes the interaction between these segments and water molecules, and as consequence the "solubility" of the network changes, causing the sol-gel phase transition. Such systems can be administered by injection and could be advantageous for local drug therapies, e.g., for the controlled release of chemotherapeutics after tumor surgery. Furthermore, they can be applied in combination with bioactive molecules for soft and hard tissue regeneration. Although it has important advantages, such hydrogels show poor mechanical properties, which further affect the loading capacity. In addition, due to the hydrophilic character of the polymer chains and the large amount of water, such systems do not allow encapsulation/loading with hydrophobic drugs. The scope of this communication is to present some type of hydrogels which exhibit transition from the aqueous solution to gel state as a function of temperature. Moreover, the preparation strategies and potential applications in the biomedical field are also presented.

A first category of such materials is obtained starting from synthetic polymers/copolymers that exhibit biocompatibility properties and lack of toxicity. Greater attention is given to systems based on natural polymers and their derivatives, possibly in combination with synthetic polymers.

Keywords: Hydrogels, thermo-sensitive systems, biomedical applications, drug delivery, biopolymers, synthetic polymers

RAFT POLYMERIZATION SYNTHESIS OF POLY(2(DIMETHYLAMINO) ETHYL ACRYLATE) AND ELECTROSTATIC COMPLEXATION WITH DEXTRAN SULFATE

Melinda-Maria Bazarghideanu[1], Marius-Mihai Zaharia[1], Maria Karayianni[1,2], Stergios Pispas[1,2], Marcela Mihai[1]

[1]"Petru Poni" Institute of Macromolecular Chemistry, Grigore Ghica Voda 41A Alley, 700487 Iasi, Romania
[2]Theoretical and Physical Chemistry Institute, National Hellenic Research Foundation Athens, 48 Vassileos Constantinou Avenue, Greece

Corresponding author: Melinda-Maria Bazarghideanu, melinda.bazarghideanu@icmpp.ro

PhD Supervisor: Dr. Habil. Marcela Mihai,
"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

Abstract:

Reversible addition-fragmentation chain transfer (RAFT) polymerization is a versatile and used controlled radical polymerization method for the synthesis of various stimuli responsive polymers under a wide range of reaction conditions (initators, monomers, temperatures). The most significant advantage of RAFT polymerization is the generation of molecular weight-controlled polymers. Over the years stimuli-responsive polymers have attracted attention in the scientific field due to the fact that most of them are relatively inexpensive, recyclable and are capable to form nanoscaled structures of diverse morphologies in aqueous media. These smart materials have been widely used in recent decades for a wide range of medical and environmental applications. Poly(2-(dimethylamino) ethyl acrylate) (PDMAEMA) is a cationic water soluble polymer and is known as a temperature and pH responsive polymer. Natural polymers like polysaccharides also have attracted considerable attention in a wide range of field, due to the fact that are biocompatible, biodegradable, nontoxic and inexpensive. Dextran sulfate is an anionic polysaccharide with approximately 2-3 sulfate groups *per* glucosyl unit and it is widely used in the medical field as anticoagulant. Based on their properties, PDMAEMA in combination with dextran sulfate can be a good choice for the development of new nanomaterials relevant for various biomedical applications. The aim of this study was the synthesis and characterization of PDMAEMA homopolymer obtained via RAFT polymerization and investigation of the electrostatic interaction between dextran sulfate and obtained homopolymer. For the molecular characterization of PDMAEMA, FTIR and ^{1}H NMR spectroscopies were performed. The structure of obtained homopolymer it was confirmed by both spectroscopic methods. The complexes of PDMAEMA and dextran sulfate were prepared in aqueous solution by varying of the dextran sulfate concentration. Dynamic light scattering was used to evaluate the particle size, polydispersity index and the size distributions of the formed complexes, and the apparent zeta potential values were evaluated by electrophoretic light scattering.

Keywords: polymerization, stimuli-responsive polymers, pH responsive, dextran sulphate, complexes

ENHANCED OXIDATIVE DEGRADATION OF REACTIVE RED 120 USING HETEROGENEOUS FENTON CATALYSTS BASED ON IRON OXIDE NANOPARTICLES CONFINED WITHIN THE PORES OF SBA-15 SILICA

Mihaela Bectoras[1], Cezar Catrinescu[1], Adrian Ungureanu[1], Carmen Ciotonea[1], Cédric Gennequin[2], Sébastien Royer[3]

[1]"Gheorghe Asachi" Technical University of Iasi, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]Université du Littoral Côte d'Opale, Unité de Chimie Environnementale et Intéractions sur le Vivant-UCEIV, UR4492, SFR Condorcet FR CNRS 3417, Dunkerque, 59140, France
[3]Université de Lille, CNRS, Centrale Lille, Univ. Artois, UMR 8181 – UCCS – Unité de Catalyse et Chimie du Solide, Lille, F-59000, France

Corresponding author: Mihaela Bectoras, mihaela.bectoras@student.tuiasi.ro

PhD Supervisors: Assoc. Professor Cezar Catrinescu,
"Gheorghe Asachi" Technical University of Iasi, Romania
Professor Cédric Gennequin
Université du Littoral Côte d'Opale, Dunkerque, France

Abstract:

Industrial wastewater poses a significant environmental threat due to its high pollutant content, which can adversely affect ecosystems and public health. Meeting the stringent requirements of environmental regulations demands efficient degradation methods for these pollutants. Among the most promising approaches is the use of Fenton-based processes. This study focuses on the development of iron catalysts (10 wt. % Fe) by encapsulating iron nanoparticles within the pores of a high-surface-area ordered mesoporous silica support for heterogeneous Fenton-type peroxidation of Reactive Red 120 azo dyes. Two synthesis methods were investigated: incipient wetness impregnation followed by mild drying on calcined SBA-15 (for the reference sample) and melt infiltration on non-calcined SBA-15 containing the native triblock copolymer P123 surfactant. The synthesized materials underwent comprehensive characterization using X-ray diffraction, nitrogen physisorption, diffuse reflectance UV–VIS spectroscopy, temperature-programmed reduction, and transmission electron microscopy. The catalytic efficacy of iron oxide-supported SBA-15 materials in the heterogeneous Fenton-type peroxidation of Reactive Red 120 azo dye was evaluated based on several indicators, including pollutant removal (color, characteristic UV- Vis absorbance, and TOC), H_2O_2 consumption, and resistance to leaching. Results indicated that the melt infiltration method was the most effective strategy for encapsulating iron nanoparticles in the pores of mesoporous silica. Consistently, the Fe/SBA-15 catalyst demonstrated superior catalytic activity, fully degrading Reactive Red 120 dye in less than 15 minutes, whereas the reference sample failed to achieve complete degradation within 30 minutes. Overall, the study underscores the positive impact of pore encapsulation in achieving high dispersion of iron oxide nanoparticles and enhancing catalytic activity in azo dye degradation.

Keywords: Wastewater, Reactive dye, mesoporous SBA-15; iron oxide nanoparticles, heterogeneous Fenton catalysts

PESTICIDE RESIDUE SCREENING IN CITRUS BASED ON GAS CHROMATOGRAPHY-TANDEM MASS SPECTROMETRY

Bradut – Bogdan Minea[1], Cristiana Rădulescu[1,2,3]

[1]National University of Science and Technology POLITEHNICA Bucharest, Doctoral School Chemical Engineering and Biotechnology, 060042 Bucharest, Romania
[22]Valahia University of Targoviste, Institute of Multidisciplinary Research for Science and Technology, 130004 Targoviste, Romania
[3]Valahia University of Targoviste, Faculty of Sciences and Arts, 130004 Targoviste, Romania

Corresponding author: Bradut-Bogdan Minea, ingbradut@yahoo.com

PhD Supervisor: Professor Cristiana Radulescu
National University of Science and Technology POLITEHNICA Bucharest, Romania

Abstract:

Lately, there is maximum concern in most states, all over the world, regarding the levels of pesticide residues in food products, considering their chemical properties with direct implications on human health. Many studies have shown that the adverse effects of cumulative exposure to multiple pesticide residues are far more severe than any single exposure. Statistically, the number of food alerts generated by the presence of pesticide residues in fruits on the market, between 2017 and 2021, as well as the situation related to the number of imports and intra-EU trade that took place during the same period was highlighted. This study aims to analyze pesticide residue levels in citrus fruits (i.e., lemons, grapefruit, and orange) imported from non-EU and EU countries, comparative with maximum residue limits (MRLs) provided by Regulation 2005/396/EC, to assess if intake levels pose a long-term risk to human health. The citrus samples collected from ten markets (retail and storage areas) in Romania, were prepared according to the procedure provided by EN 15662:2008 standard. The concentration of pesticide residues from citrus samples was determined by Gas Chromatography-Tandem Mass Spectrometry (GC-MS/MS). The results obtained by GC-MS/MS showed that from 52 citrus samples, 41 samples contained pesticide residues with values between 0.005 and 2.700 mg/kg, and several samples contained forbidden active substances (e.g., spirodiclofen and o-phenylphenol). The pesticide detection rate of the samples was 78.84%. The most frequently detected pesticides according to obtained results were imazalil, thiabendazole, pyrimethanil, pyraclostrobin, fludioxonil, as well as spirodiclofen and o-phenylphenol. The samples with the most detected active substances are from imports outside of the European Union. In addition, in several samples, simultaneously occurred four or even five mixed pesticide residues, hazardous to human health. This study shows that the presence of pesticide residues is constant in citrus fruits due to phytosanitary treatments carried out on crops in the development phase as well as on fruits in the storage phase treatments (e.g. insecticides, fungicides etc.).

***Keywords*:** citrus, pesticide residue, GS-MS/MS, maximum residue limit, RASFF

IN VIVO AND *IN VITRO* INVESTIGATION ON VALORIZATION OF FOOD BY-PRODUCTS AND WASTE

Elena Petronela Bran[1], Daniela Nicuță[2], Luminița Grosu[3], Irina-Claudia Alexa[3], Adriana Fînaru[3]

[1]„Vasile Alecsandri" University of Bacău, Doctoral School, 157, Calea Mărăşeşti, Bacău, 600115, Romania
[2]„Vasile Alecsandri" University of Bacău, Faculty of Sciences, Department of Biology, Ecology and Protection of Environment, 157, Calea Mărăşeşti, Bacău, 600115, Romania
[3]„Vasile Alecsandri" University of Bacău, Faculty of Engineering, Department of Chemical and Food Engineering, 157, Calea Mărăşeşti, Bacău, 600115, Romania

Corresponding author: Elena Petronela Bran, petronelabran@yahoo.com

PhD Supervisor: Professor Adriana Fînaru,
„Vasile Alecsandri" University of Bacău, Romania

Abstract:

Rapid population growth and lifestyle changes have led to a significant increase in food waste from various industrial, agricultural and domestic sources. If not managed properly, food by-products and wastes can create a serious threat to the environment and human health, making proper disposal of food waste a significant global problem. On the other hand, various types of food waste or by-products, such as eggshell, whey or pomaces contain important bioactive compounds (vitamins, minerals, proteins, lipids, fiber, organic aid, polyphenols, etc.), some found in large quantities. These bioactive compounds offer the potential to convert food by-products and waste into valuable products, in areas such as biofertilisers, bioenergy, biosurfactants, nutritional foods, etc. Our research team has expressed its interest in investigations concerning the reuse of food by-products and waste, with the aim of finding innovative solutions to valorize them especially in regard to their fertilizing potential on *in vivo* and *in vitro* seed germination processes and plant growth and development.

As a first approach in our study, the effect of grape pomace extracts on growth and development of oregano plant was studied by carrying out *in vitro* propagation of oregano on a basal medium supplemented with different concentrations of grape pomace extracts. Biometric measurements, growth rate and biomass accumulation have been narrowly monitored for all samples and compared to the control sample. It was found that grape pomace hydroalcoholic extracts influenced the regeneration processes of *Origanum vulgare* explants inoculated *in vitro*. The stimulatory or inhibitory effect on the morphogenetic response depends on the proportion in which basal medium was supplemented.

In addition, *in vivo* plant-growth experiment was set up to investigate the separated or joined effect of some by-products and waste such as: eggshell, whey, grape and sea buckthorn pomace on *Phaseolus vulgaris* growth and development. The visual observation and preliminary biometric measurements results showed that the high nutrient content of these food by-products and waste fertiliser promoted favourable soil conditions for the growth and development of plants.

In conclusion, use of food by-products and waste as biofertilisers is a possible environmental solution to address the current global food-waste disposal problem.

Keywords: eggshell, whey, grape pomace, sea buckthorn pomace, valorization, plant growth

ELABORATION AND CHARACTERIZATION THE COSMETIC PRODUCT: FROM CONCEPT TO MARKETING

Claudia Bulai Maxim

"Gheorghe Asachi" Technical University of Iasi, Romania, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Claudia Bulai Maxim, claudiamaxym@gmail.com

PhD Supervisor: Pofessor Daniela Șuteu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Responsible cosmetics is an emerging trend in the cosmetics industry, reflecting growing consumer concerns about personal health, the environment and the ethics of production.
In the European Union (EU), the manufacture of cosmetics is governed by the EU Cosmetic Products Regulation (EC) No. 1223/2009. Formulating a responsible cosmetic product becomes challenging when it relates to consumer demands for natural composition, high quality, excellent sensory properties and high bioactivity. Replacing unsustainable ingredients with sustainable ingredients with better skin and environmental compatibility requires a great deal of knowledge, investigation and testing. Cosmetic emulsions are the most used cosmetic products. The cosmetic formulator needs a lot of creativity and in-depth knowledge about how to design an emulsion, skin function and anti-aging mechanisms to formulate an effective, stable and safe cosmetic product. At the formulation stage, the focus is on carefully identifying and selecting natural and responsible ingredients and determining the optimal proportions to achieve the desired efficacy and safety. Ingredients in a cosmetic formulation are selected by consulting the annexes of the EU Cosmetic Products Regulation which restricts or limits some ingredients and provides a special regime for ingredients containing allergens. Preliminary stability tests are necessary to predict the behaviour of the emulsion under prolonged conditions of storage and use. Physical-chemical, microbiological and packaging compatibility testing of the finished product is mandatory. Also, the requirements for the cosmetic product dossier, the preparation of the safety report and the calculations of product exposure and labelling are mandatory.
The study examines the production process in detail, the methods of stability and safety testing, and the process of obtaining the necessary certifications to ensure compliance with industry standards and regulations. This presentation provides a comprehensive overview of the responsible cosmetic product development process, highlighting the importance of an integrated approach that combines efficacy, responsibility and sustainability to meet the increasingly demanding requirements of the contemporary cosmetic market.

Keywords: cosmetic product, customer, EU regulation, marketing, quality products

THE USE OF WASTES AS RAW MATERIALS IN OBTAINING MATERIALS WITH PROMISING PROPERTIES

Mihaela Caftanachi[1,2], Maria Harja[1]

[1]"Gheorghe Asachi'' Technical University of Iasi, Romania, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania;
[2]S.C. Gemite RO SRL, Iasi, 52, SF Petru Movila Street, Romania

Corresponding author: Mihaela Caftanachi, mihaela.caftanachi@student.tuiasi.ro

PhD Supervisor: Professor Maria Harja
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Economic and industrial development worldwide has caused a significant increase in waste production and led to an increase in demand for the construction industry. As a result, cement production has reached about 4.1 billion tons per year, and a further increase of 5.8 billion tons is expected by the year 2050. Significant depletion of natural resources and increased pollution is a step for finding solutions for materials based on Portland cement. Following the studies carried out so far, an alternative material would be the one based on alkaline activated aluminosilicate materials, without cement in the composition. The sources of aluminosilicates can be natural such as metakaolin or industrial by-products such as various ashes (fly ash, incineration ash, rice husk ash, etc.), granulated blast furnace slag, red mud, phosphogypsum, etc. These aluminosilicate sources are subjected to an activation procedure consisting of a treatment with a concentrated alkaline solution that helps to dissolve part of the amorphous material and enrich the final material in silica and aluminum oxides. The new alkali-activated materials do not require high temperatures for their manufacture, and are also easier to obtain than those materials based on Portland cement. The reaction underlying these new materials can be carried out at room temperature, thus obtaining high-quality materials that can be used as environmentally friendly building materials with high mechanical and chemical properties. The structure of the alkaline activated material (such as the microstructure of the material, the properties of the aluminosilicate gel formed and the inorganic polymer support) is influenced by the nature and characteristics of the raw material. The raw materials were subjected to SEM, XRD and EDX analyses, while the final product was tested for microstructural properties, mechanical strength as well as chemical resistance. This study aims at the synthesis and characterization of activated alkaline materials obtained from waste, as a substitute for cement in mortar. The novelty consists in the economic mixture proposed, with excellent mechanical and chemical characteristics.

Keywords: alkaline activated aluminosilicate, thermal power plant ash, slag, activation procedure, mechanical strength, chemical resistance

APPLICATION OF CIRCULAR ECONOMY PRINCIPLES IN BLUE ECONOMY SECTORS

Letizia Caroscio[1], Cristian Chiavetta[2], Alessandra Bonoli[1]

[1"]Department of Civil, Chemical, Environmental and Materials Engineering, University of Bologna, Italy
[2"]ENEA - Italian National Agency for New Technologies, Energy and Sustainable Economic Development

Corresponding author: Letizia Caroscio, letizia.caroscio2@unibo.it

PhD Supervisor: Professor Alessandra Bonoli,
University of Bologna, Italy

Abstract:

In the context of doctoral research, the application of circular economy principles within the framework of the blue economy is explored in a sector that represents a fundamental resource for generating wealth, employment, and innovation toward sustainable and collaborative development. The blue economy stands out for its ability to bring together heterogeneous sectors and traditions into a widespread entrepreneurial fabric, which can serve as a catalyst for the creation of new economies and new perspectives on environmental protection. In this context, the research focuses on valorizing the shells of bivalve mollusks, often an overlooked byproduct of mussel farming facilities, in order to transform them into a valuable secondary resource.
The initiation of the research involved adopting the Life Cycle Assessment (LCA) methodology to analyze mussel farming production processes and identify critical points in terms of environmental impact. This approach allowed for the acquisition of primary data from a mussel farming facility located in the La Spezia area (Italy), enabling a detailed evaluation of production phases and potential improvements that could be introduced to make the process more sustainable. Subsequently, in-depth studies were conducted on the chemical-mechanical characteristics of bivalve mollusk shells to explore the potential technical applications of this material. In particular, the possibility of using the shells as biofillers in bituminous mixtures for road pavements was examined. The results of such studies demonstrated that bivalve mollusk shells can represent an effective and advantageous alternative to traditional fillers extracted from quarries, offering comparable performance.
As a subsequent research step, it is also proposed to evaluate the feasibility of using bivalve mollusk shells also as recycled material for the production of bio concrete artifacts destined for the creation of artificial reefs. Such an approach would not only reduce the environmental impact associated with the extraction of virgin materials but also valorize a byproduct otherwise destined for disposal.

Keywords: circular economy, blue economy, life cycle assessment, waste management, mussels shells

MANAGEMENT OF PACKAGING WASTE FROM E-COMMERCE IN THE CONTEXT OF CIRCULAR ECONOMY

Constantin Cîrjan, Daniela Gavrilescu, Carmen Teodosiu

"Gheorghe Asachi" Technical University of Iasi, Romania, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, Department of Environmental Engineering and Management, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Constantin Cîrjan, constantin.cirjan@student.tuiasi.ro

PhD Supervisor: Professor Carmen Teodosiu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Sustainability in e-commerce is a new but significant issue in the context of Europe's transition to a circular economy due to the rapidly growing e-commerce market. In Romania, over 500,000 single-use plastic or cardboard packaging materials are used daily for online shipments. The packaging sector is one of the major consumers of virgin raw materials. The increased use of packaging, combined with low rates of reuse and recycling, hinders the development of a circular economy with low carbon emissions. In recent years, the packaging industry has grown faster than the national gross income, leading to increased CO_2 emissions and other pollutants, as well as overexploitation of natural resources, loss of biodiversity, and pollution.

That is why the main objective of this study is rooted in the integrated approach to managing packaging waste generated by e-commerce within the framework of circular economy.

To minimize the negative impact, efforts are currently underway to develop and implement more sustainable practices in the online commerce industry, including the use of recyclable packaging, optimizing transportation, and promoting ecological practices. Consumers can also play a crucial role by carefully choosing products and merchants with environmental concerns and by adopting more responsible purchasing practices.

Regarding the specific objectives of this study, we may consider a comparative analysis of the packaging waste situation in Romania and the European Union, in terms of quantities of wastes produced and recycled, legislation affecting this sector, as well as the specificity of the Romanian organizations which are recycling these wastes.

The finality of this study will be concretized in the formulation of recommendations regarding the management of packaging waste resulted from electronic commerce in Romania.

Keywords: e-commerce, circular economy, packaging waste, policies

PRELIMINARY STUDY OF REMAZOL ROSSO RB DYE ADSORPTION ONTO DRY FRESHWATER ALGAL BIOMASS

Crinuta Larisa Ortovan, Carmen Zaharia

"Gheorghe Asachi" Technical University of Iasi, Romania, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, Department of Environmental Engineering and Management, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Crinuta Larisa Ortovan, crinuta-arisa.ortovan@student.tuiasi.ro

PhD Supervisor: Assoc.Professor Carmen Zaharia
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Reduction of polluting species from colored wastewater (WW) / aqueous environment to their legal admissible concentration levels requires different treatments based on discoloration, degradation and/or solids separation performed by conventional (coagulation/ flocculation, precipitation, biodegradation, sand filtration, adsorption using activated carbon), recovery (solvent extraction, evaporation, oxidation, electrochemical treatment, membrane separation, ion exchange, incineration) and emerging removal methods (advanced oxidation, adsorption onto non-conventional solids, biosorption, nanofiltration). One of the WW treatment methods with very good results in term of efficiency-costs remains adsorption. Using of 'non-conventional' or 'low cost' materials in adsorption processes for WW discoloration and/or dye removal is an increasing interest challenge that solves the disadvantage associated with the high cost of synthesis / preparation of conventional adsorbents (active carbon, chitin, chitosan, exchangeable resins, polyamides, inorganic polymeric materials).

In this research work, we focused on cheap and easy to prepare 'non-conventional' materials based on freshwater algal biomass, i.e. Spirogyra green algae, applied in laboratory testing for retaining of residual Remazol Rosso RB (RR-RB) azo dye from aqueous solutions, or simulated dye-containing effluents (25-100 mg/L of RR-RB dye). Our preliminary findings underlined the high adsorption capacity to remove the residual dye from aqueous system (> 58-83 mg/g of adsorbent) in static regime ('batchwise' experiments) and established the corresponding variation fields of the principal operating variables, i.e. initial pH (2-8), biosorbent dose (6-20 g/L), contact time (4-20 h) and temperature (5-50^{o}C). As concluding results, the most adequate values of the process operating variables were proposed and tested for highest CRR dye and color removals from aqueous systems, e.g. for 75 mg/LRR-RB dye the removals were of 66.4% color and 45.8% dye working (up to 4 hs) with only 6 g/L of adsorbent, at room temperature (22-25^{o}C) and pH 3-4. These preliminary findings conclude on the beneficial and available possibility of use this algal biomass-based material for WW discoloration and dye removal.

Keywords: adsorption/sorption/biosorption, (RR-RB) reactive dye removal efficiency, freshwater green algae, operating parameter domain.

EXPLOITING THE RECONSTRUCTION BY THE STRUCTURAL MEMORY FOR ENGINEERING LAYERED DOUBLE HYDROXIDES

Denis Cutcovschi, Sofronia Bouariu, Gabriela Carja

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Chemical and Environmental Engineering "Cristofor Simionescu", 71 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Denis Cutcovschi: denis.cutcovschi@student.tuiasi.ro

PhD Supervisor: Professor Gabriela Carja
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Layered double hydroxides have a wide range of applications due to their tunable properties, including drug delivery, catalysis, and wastewater treatment. Their high surface area make them promising materials for environmental remediation and as hosts for various functional molecules. LDHs are eco-friendly anionic clays that are intensively studied due to their photoresponses under UV and visible irradiation. Having a high compositional diversity, LDHs materials have semiconductor properties and are often used in specific photocatalytic processes. By calcination over 600°C, the layered clay structure is destroyed, and a homogeneous mixed metal oxide (MMO) nanocomposite material composed of a metal oxide phase (MIIO) and a spinel-like phase (MIIMIII2O4) is formed. Many studies have reported the fabrication of semiconductor photocatalysts able to generate advanced oxidation reactions under solar irradiation.

In this work, ZnAlLDHs (Zn/Al molar ratio of 3/1) have been synthesized by exploiting the "structural memory" of the LDHs, as a function of the pH of the reconstructed solutions. XRD, TG/DTG, IR, SEM/EDX, and UV-DR were used to investigate the physical-chemical characteristics and the photo-responses of the fresh and calcined samples. XRD patterns of the catalysts reveal the presence of a single crystalline phase with reflections clearly assigned to the regular layered structure of hydrotalcite-like clay, while the XRD patterns for the calcined samples show the formation of MMO.

The photocatalytic activity of the reconstructed LDHs and the derived mixed oxides obtained by calcination at 550 °C was tested in the photodegradation processes of Diclofenac aqueous solution under solar irradiation. The photodegradation of Diclofenac was monitored by UV-VIS and TOC measurements. The experimental data indicates that the samples have remarkable catalytic activity, with a percentage of TOC removed between 78% and 89%. Thus, pharmaceutical pollutants removal from wastewater using solar irradiation and photoactive materials is a challenging alternative to traditional methods of water remediation like nanofiltration or physical/chemical adsorption.

Keywords: layered double hydroxides, structural memory, photodegradation, catalytic activity, nanocomposites.

INFLUENCE OF IMPURITIES IN ELECTROLYTE ON THE MEMBRANE FOR BRINE ELECTROLYSIS PROCESS

Valeria Danilova, Liliana Lazăr, Ioan Mămăligă

"Gheorghe Asachi" Technical University of Iasi, Romania, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, 73 Prof. D. Mangeron Bvd., 700050, Iasi, Romania

Corresponding author: valeria.danilova@student.tuiasi.ro

PhD Supervisor: Professor Ioan Mămăligă
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The alkaline electrolysis process, based on the ion exchange membrane process, plays a particularly important role for industrial decarbonization. By industrial process of brine electrolysis three products are obtained (sodium hydroxide, chlorine and hydrogen) which hold significant importance for the manufacture of a very wide range of products considered with a low carbon footprint (such as: hydrochloric acid, hypochlorite, inorganic chlorides, organic chlorides, amines , polyols, etc.). Hydrogen along with carbon dioxide may be used for obtaining syngas necessary for the synthesis of ammonia with importance for the fertilizer industry, or for methanol production used to obtain olefins or as a fuel. Furthermore hydrogen can be used for transportation sector and for obtaining electricity in cogeneration plants. For these reasons, electrolytic hydrogen is a green energy vector and is classified as a renewable resource.

Hydrogen produced by electrolysis is considered green hydrogen if the cost price is competitive compared to the price of hydrogen produced by classical methods (such as steam methane reforming). This condition requires the operation of the electrolysis process with a high energy efficiency that depends on the quality of the electrolyte. The brine must meet the quality standards specified of by the manufacturer of ion exchange membrane, to protect and avoid its irreversible damage, ensuring high current efficiency and electrolysis performance with minimal energy consumption.

This paper presents a critical study of the specialized literature that tracks the impact of the impurities from the brine used in the electrolysis process, so that the electrolyzers equipped with ion exchange membrane operate for as long as possible, under conditions of high energy performance. Membranes under the commercial name of Nafion, Flemion membranes are high-tech materials ("zero gape") that perform both the function of separating sodium ions from the electrolyte and the function of charge transport, being considered a second order conductor. The main impurities in the electrolyte (ultrapure brine) with a negative impact on the membrane and the efficiency of the electrolysis process are ionic impurities (calcium, magnesium, strontium, barium, aluminum, manganese, iron, sulfate, chlorate, fluoride), as well as non-ionic impurities (silica or clay materials).

Keywords: alcaline electrolysis, green hydrogen, ion exchane membrane, polymer resins, ultrapure brine

HARNESSING THE POWER OF GREEN PAVEMENT TO EFFECTIVELY ADDRESS ENVIRONMENTAL CHALLENGES IN URBAN AREAS

Beatrice De Pascale, Piergiorgio Tataranni, Alessandra Bonoli

Department of Civil, Chemical, Environmental and Materials Engineering, University of Bologna, Via U. Terracini 28, 40131 Bologna (BO), Italy

Corresponding author: Beatrice De Pascale, beatrice.depascale3@unibo.it

PhD Supervisor: Professor Alessandra Bonoli,
University of Bologna, Italy

Abstract:

Research in recent years has focused on optimizing the use of recycled materials in porous asphalt mixtures to achieve desired performance charcteristics while minimizing environmental impacts. This optimization process involves careful selection and grading of recycled aggregates, as well as the incorporation of innovative binder and additives to improve durability. Recycled materilas commonly utilized include reclaimed asphalt pavement (RAP), recycled concrete aggregates (RCA), and other construction and demolition waste (CDW) materials.
In this context, the aims of the present research are to explore and assess innovative and environmentally friendly porous asphalt mixtures, with a particular focus on their environmental impact through Life Cycle Assessment (LCA) analysis. The research endeavors to develop a mixture incorporating recycled and innovative materials, along with green and eco-frinedly binders suitbale for urban pavement.
The significance of porous asphalt and permeable pavement lies in its capacity to address urban stormwater issues, enhance water quality, reduce surface runoff, and facilitate rainwater infiltration into the ground.
Studies employing LCA have demonstrated the potential environmental benefits of using recycled materials in porous asphalt mixtures. These benefits include reductions in energy consumption, greenhouse gas emissions, and resource depletion compared to conventional asphalt mxitures.
To comprehensively evaluate the effects of each material on mechanical and environmental performance, a first phase concerning the laboratory testing is conducted on the innovative materials to select the appropriate product. The second phase concerns the environmental assessment of the pavement considering its entire life cycle to identify the most suitable materials for porous asphalt mixture.
Through the life cycle analyssi, the research aims to assess the environmental impact of the various proposed porous asphalt mixtures, allowing for the identification of the most sustainable solutions suitable for the urban environment. The research thus seeks to provide crucial insights for the design and implementation of eco-friendlier and more resilient road infrastructure in response to current environmental challenges.

Keywords: porous asphalt, Life Cycle Assessment (LCA), recycled aggregates, urban areas, asphalt pavement materials.

A PROSPECTIVE COMPARATIVE STUDY ON THE PERCEPTION OF NEARLY ZERO ENERGY BUILDINGS (NZEB) CONCEPT IN EUROPE

Eduard Străinu, Ioana Tănasă, Dumitru Botan, Brîndușa Slușer

"Gheorghe Asachi" Technical University of Iasi, Romania, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Eduard Străinu, mihai-eduard.strainu@student.tuiasi.ro

PhD Supervisor: Assoc.Professor Brindusa Sluser
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

It is well-known and documented in the specialized literature that the construction sector is responsible for approximately 40% of the pollution produced and approximately 30% of raw material consumption worldwide. European directives promote concepts such as Passive House (PH) or Nearly Zero Energy Building (NZEB) to protect the environment and promote sustainable development. Starting from NZEB, the tendency is to reach Carbon Neutral Building (CNB) or Zero Carbon Building (ZCB) type buildings. However, all these efforts are null without the contribution and awareness of the population. Thus, a questionnaire was launched online in 3 languages of the European Union (Romanian, French, and English). Its purpose was to study the interest, openness, understanding and knowledge of the NZEB concept in European countries and, simultaneously, to make a comparison with Romania. The method used was a survey that was open for gathering data between September.
- October 2023. The questionnaire had 16 questions, with the possibility of choosing from multiple answers or entering one's own version. The questions were adapted according to the context, being more detailed for the Romanian audience (regarding legislation and deadlines) and more general for the foreign audience. In addition to questions related to the NZEB concept, there were questions related to other aspects concerning environmental protection, such as renewable energy sources, sustainable development and the use of new green materials. The results highlight the fact that, in Romania, there is some confusion between the PH and NZEB concepts, while in other countries the tendency is either a clear understanding of the concept or ignorance of it. As complementary results, it emerged that the main impediment to implementing this concept would be the lack of education in this regard. Therefore, better promotion of the concept and awareness of the citizens will help in the future to achieve a higher degree of implementation of the NZEB concept.

Keywords: Nearly Zero Energy Buildings (NZEB) concept, comparative study, constructions, sustainable development, European countries, Romania

RETENTION OF RIFAMPICIN BY ADSOBTION ON PET FIBERS UNDER THE INFLUENCE OF SOME CATIONS AND ANIONS

Elena Fasniuc-Pereu, Laura Bulgariu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Chemical Engineering and Environmental Protection
Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Elena Fasniuc-Pereu, Elena.Fasniuc@gmail.com

PhD Supervisor: Professor Laura Bulgariu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Most of the plastic produced globally is used for single-use packaging purposes. The widespread use of PET (polyethylene terephthalate) has led to the generation of substantial amounts of waste, which poses a significant challenge to the environment. Identifying an alternative for the valorisation of this plastic waste remains a challenging problem due to its outstanding mechanical properties, cost-effectiveness of production, and large use in various industries. As a result, it is recommended to explore innovative methods of recycling PET waste, which can lead to the development of value-added products. Converting PET waste into fibers is one of the most viable solutions that can be used for this purpose. On the other hand, in water environments, antibiotics are among the most commonly found pharmaceutical products and their efficient removal in wastewater treatment plants is constrained by their resistant characteristics. In recent years, there has been a significant rise in the manufacturing and consumption of rifampicin. As a result, higher levels of rifampicin are being released into aquatic ecosystems.

Our previous studies showed that rifampicin can be retained on PET fibers, and the maximum efficiency (32.06mg/g) is obtained under the following conditions: pH = 2.0, 0.01gr PET fibers/25 mL of aqueous solution, a contact time of 24 h, and ambient temperature (230C). But to highlight the applicability of this process in treating real samples, selectivity studies are needed. Therefore, in this study, the selectivity of rifampicin adsorption on PET fibers from aqueous solutions containing different inorganic salts was investigated. Batch systems were used to examine how the nature and concentration of inorganic salts influence the efficiency of the adsorption process. The greatest increase in the adsorption efficiency of rifampicin (initial concentration of 211 mg/L) on PET fibers was obtained in the presence of NaCl (0.1M), when the adsorption capacity obtained is 21.24 % higher.

Keywords: rifampicin, PET fibers, adsorption, selectivity, data modelling

SUCCESSFUL DEGRADATION OF BISPHENOL A UNDER VISIBLE LIGHT IRRADIATION BY DOPED TITANIUM DIOXIDE CATALYSTS

Yassine Jari[1], Lidia Favier[2], Mohamed Chaker Necibi[1], Bouchaib Gourich[1,3], Christophe Vial[4], Alaâeddine Elhalil[3], Azzeddine El Midaoui[1], Nicolas Roche[1,5]

[1]International Water Research Institute (IWRI), Mohammed VI Polytechnic University, Morocco
[2]Univ Rennes, Ecole Nationale Supérieure de Chimie de Rennes, CNRS, ISCR – UMR6226, France
[3]Laboratory of Process and Environmental Engineering, Higher School of Technology, Hassan II University, Morocco
[4]Université Clermont Auvergne, CNRS, Clermont Auvergne INP, Institut Pascal, France
[5]Aix-Marseille University, CNRS, IRD, INRAE, Coll France, CEREGE, CEDEX, France

Corresponding author: Yassine JARI, Yassine.JARI@um6p.ma

PhD Supervisor: Professor Bouchaib Gourich,
International Water Research Institute

Abstract:

The widespread presence of emerging contaminants such as endocrine disruptors in the aquatic environment has attracted the interest of the scientific community during the past decades. These compounds must be removed to reduce their harmful effects on the aquatic system and photocatalytic degradation can be an interesting option because of its effectiveness in the elimination of organic water pollutants. This study investigates the use of titanium-based photocatalysts for environmental remediation. The research involves the synthesis of different titanium dioxide (TiO_2) doped with copper (Cu) systems by a facile sol-gel method using various Cu doping concentrations and evaluates their effectiveness in removing bisphenol A (BPA), an endocrine-disrupting compound, from aqueous solutions. Cu doping has been reported in the literature to enhance the optical absorption of visible light due to the reduction in band gap energy. Batch experiments were conducted to examine the degradation of bisphenol A by synthesized composites. Preliminary experiments to control photolysis and adsorption were conducted to assess their contribution to BPA removal, and the results demonstrated that the removal yield obtained during these processes was extremely low. The photocatalytic activity of the prepared composites was applied to treat 5 mg/L bisphenol A in aqueous solution under visible light irradiation after 6 h. The study revealed that 5 wt% Cu doped TiO_2 photocatalyst showed the highest photocatalytic activity for the degradation of BPA with a degradation efficiency exceeding 80% at neutral pH and room temperature. Furthermore, high removal of total organic carbon (around 74%) was also observed, confirming the ability of copper-doped titanium dioxide to mineralize the target molecule. In addition, this catalyst was regenerated and reused over four successive cycles demonstrating its stability in reaction. The obtained results indicate that elaborated systems are promising nanomaterials for the removal of BPA opening new paths for the development of successful approaches for the elimination of other emergent water contaminants.

Keywords: Emerging contaminants, photocatalytic degradation, bisphenol A, Nanocomposite, visible light.

XANTHAN GUM-BASED EMULSIONS IN FUNCTIONAL TEXTILES FOR SKINCARE APPLICATIONS

Elena-Daniela Lotos[1], Angela Danila[2], Marcela Mihai[1], Bogdan C. Simionescu[1]

[1]"Petru Poni" Institute of Macromolecular Chemistry, 41A Grigore Ghica Voda Alley, 700487 Iasi, Romania
[2]Gheorghe Asachi Technical University of Iasi, Faculty of Industrial Design and Business Management, 29 Prof. Dr. Docent D. Mangeron Blvd, 700050 Iasi, Romania

Corresponding author: Elena-Daniela Lotos, daniela.lotos@icmpp.ro

PhD Supervisor: Acad. Professor Bogdan C. Simionescu,
"Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania
Romanian Academy

Abstract:

Using Daucus carota macerated oil-based O/W emulsions, this study explores the formulation and characterization of functional textiles with skin hydration qualities. The main innovation is the use of Daucus carota macerated oil as an active ingredient to create fabrics that moisturize the skin.

Ten o/w emulsions were obtained by mixing xanthan gum, Tween 80, water, and Daucus carota macerated oil in various ratios. By changing one component content while keeping the other constant, the morphological characteristics (related to size and shape) and emulsion properties (pH, conductivity, turbidity, surface tension, and contact angle) were examined in order to determine the ideal circumstances for producing stable o/w emulsions that are suitable for skin application.

The antibacterial and biocompatibility of chosen emulsions were examined. A high surfactant content is harmful to NHDF cells, according to the biocompatibility test, while emulsions with lower surfactant contents are biocompatible regardless of the amount of Daucus carota macerated oil present. Analysis of antibacterial properties and skin hydration demonstrated the skincare benefits of the emulsion. These results indicate that the bioactive emulsions have suitable potential for use in skincare finishes to textiles.

By applying the bioactive emulsions to a cellulosic fabric, new functional textiles with skin hydration properties and good comfort indexes (hygroscopicity, air, and vapor permeability) can be created. By investigating the moisturizing ability of Daucus carota macerated oil emulsions in generating functional supports with skin hydration capabilities, this study opens new avenues for research in the field of skincare textiles.

The outcomes demonstrate that, in comparison to the situation when the emulsion is applied directly to the skin, the functional textiles that were obtained exhibit superior skin hydration. As a result, the textile support is crucial in forming an occlusive barrier that keeps moisture in and stops the skin's surface from losing water. Therefore, skincare textiles might be a great option for hydrating skin.

Keywords: Daucus carota macerated oil, O/W emulsions, xanthan gum, antimicrobial, skin hydration

CONTINUOUS AUTOTROPHIC CULTIVATION OF *Galdieria sulphuraria*: A PREDICTIVE MODEL TO ASSESS PHOTON FLOW REGIMES AND CO_2 EFFECT ON BIOMASS AND METABOLITE PRODUCTIVITY

Luigi Marra[1], Elena Aurino[1], Francesca Raganati[1], Antonino Pollio[2,3], Antonio

[1]"Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale, Università degli Studi di Napoli Federico II, P. le V. Tecchio 80, 80125 Napoli, Italy.
[2]"Dipartimento di Biologia, Università degli studi di Napoli Federico II, Via Cintia, 80126, Napoli, Italia
[3]Algal Collection of University of Naples Federico II, Università degli studi di Napoli Federico II, Via Cintia, 80126, Napoli, Italia

Corresponding author: Luigi Marra, luigi.marra@unina.it

PhD Supervisor: Professor Antonio Marzocchella
Università degli Studi di Napoli Federico II, Naples, Italy

Abstract:

Microalgae are a promising feedstock to curb food, energy and commodity crises because their capability to converting CO_2 and/or sugars into valuable metabolites. Despite the promising potentialities of microalgae, operating conditions tuning, process intensification and strain selection are mandatory to meet techno-economic sostenability. The extremophilic microalga Galdieria sulphuraria is a promising species because: i) the high protein content (exceeding 45%); ii) the abundance of phycobiliprotein for pharma market and ramified polysaccharides for bioplastic production; iii) the high resistance to harsh conditions, including low pH and heavy metals. Present contribution aims to propose a predictive model to assess the combined effect of CO_2, light intensity and hydraulic residence time in autotrophic continuous flat panel photobioreactor. Tests have been carried out tuning the above-mentioned operating conditions. Results have been reported as steady state biomass concentration and main metabolite fraction as a function of the CO_2 concentration in gas feed and the photon flow regime. Data analysis offered a comprehensive insight into the photosystem's response to various photon flow regimes, facilitating the development of a predictive semi-mechanistic model. The maximum biomass concentration has been 22.41 ± 0.65 g/m^2 under conditions of 300 molPh/m^2 photon flow and 1%v CO_2 enrichement in the air stream fed to the photobioreator. Further increases in both conditions do not lead to a significant rise in biomass concentrations, resulting in a decline of biomass productivity. The maximum biomass productivity has been estimated to be 3.35 ± 0.10 g/m^{2}day. A significant decrease in overall protein and phycobiliprotein content from 50%w and 15%w to 36%w and 10%w respectively, has been measured with the photon flow. As the protein production decreased, both lipid content and productivity increased with photon flow approaching the maximum at phtoton flow > 450 molPh/m^2. There was no significant effect on metabolite fraction tuning the CO_2 concentration in the gas stream. As a result, photon flow has been proved a key operating conditions for the design of a *G. sulphuraria* production unit: its controlled optimization enables the tuning of the dilution rate based on the measured light intensity at the surface to maximize the productivity of target metabolites.

Keywords: Microalgae, extremophile, *Galdieria sulphuraria*, autotrophy, model, photobioreactor

EFFICIENT VISIBLE-LIGHT PHOTOCATALYTIC REMOVAL OF TARTRAZINE BY ZnO NANOPARTICLES: EVALUATING PHYTOTOXICITY OF TREATED SOLUTIONS

Maria Paiu[1], Lidia Favier[2], Doina Lutic[3], Raluca-Maria Hlihor[4], Maria Gavrilescu[1,5]

[1]"Gheorghe Asachi" Technical University of Iasi," Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, 73 Prof. D. Mangeron Blvd., 700050 Iasi, Romania; [2]Univ Rennes, Ecole Nationale Supérieure de Chimie de Rennes, CNRS, ISCR – UMR6226, F-35000 Rennes, France; [3]"Alexandru Ioan Cuza" University from Iasi, Faculty of Chemistry, Department of Chemistry, No. 11, Carol I Avenue, 700506, Iasi, Romania; [4]"Ion Ionescu de la Brad" Iasi University of Life Sciences, Faculty of Horticulture, Department of Horticultural Technologies, 3 Mihail Sadoveanu Alley, 700490 Iasi, Romania; [5]Academy of Romanian Scientists, 3 Ilfov Street, 050094 Bucharest, Romania

Corresponding author: Maria Paiu, maria.paiu@student.tuiasi.ro

PhD Supervisor: Professor Maria Gavrilescu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The presence of synthetic dyes, such as tartrazine (TZ), in wastewater has raised concerns due to their potential adverse effects on human health and the environment. Advanced oxidation techniques, especially photocatalysis, present promising alternative approaches to tackle this problem. To address this issue, visible-light photocatalytic degradation using ZnO nanoparticles has emerged as a promising approach. This method utilizes the properties of the catalyst to degrade the pollutant molecules when exposed to visible-light. This present study aimed to evaluate the efficacy of ZnO-based photocatalysis in degrading tartrazine under visible-light conditions. Zinc oxide nanoparticles were synthesized, and tartrazine degradation experiments were conducted using different initial pollutant concentrations (in the range of 5-20 mg/L) and a catalyst dose of 0.8 g/L. Concurrently, phytotoxicity tests were performed using Lepidium sativum L. seeds to assess the toxicity of potential by-products generated during the photocatalytic process. The results obtained demonstrated successful tartrazine degradation using ZnO nanoparticles under visible-light exposure. Furthermore, phytotoxicity experiments indicated that the growth of Lepidium sativum L. seeds in the photocatalytic treated solutions was comparable to that in control samples. This suggests that the by-products produced through this method may be less toxic than untreated tartrazine samples. These findings emphasize the potential of ZnO-based photocatalysis as an effective and environmentally friendly method for mitigating water pollution caused by food dye contaminants. The observed reduction in phytotoxicity in treated solutions highlights the importance of considering the environmental impact of degradation by-products. In conclusion, the findings from this study sustain the efficacy of the advanced oxidation method using the ZnO/visible-light system in effectively eliminating the TZ dye, known for its stability and solubility in aqueous environments. The method demonstrates high efficiency with 100% degradation achieved at a concentration of 5 mg/L within 330 minutes. Moreover, the profiles of samples collected post- irradiation at 330 minutes closely resemble those of the control sample. This similarity underscores the effectiveness of the degradation process not only in reducing toxicity but also in minimizing the formation of potentially more toxic reaction by-products than the initial compound. This research significantly contributes to advancing sustainable water treatment methods and underscores the importance of balancing efficacy with environmental considerations in water pollution mitigation strategies.

Keywords: photocatalysis, synthetic dyes, visible-light degradation, phytotoxicity assessment

PRELIMINARY STUDY OF TWO COMMERCIAL FLOCCULANTS APPLIED FOR COLORED WASTEWATER TREATMENT

Marius-Alexandru Afrăsinei, Corina-Petronela Mustereț, Carmen Zaharia

1"Gheorghe Asachi" Technical University of Iasi, Romania, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, Department of Environmental Engineering and Management, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Marius Alexandru Afrasinei, marius-alexandru.afrasinei@student.tuiasi.ro

PhD Supervisor: Assoc.Professor Carmen Zaharia
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The natural water environment protection and reduction of polluting loads in industrial effluents is one of the key obligations of any responsible productive owner and citizen of our modern and climate-changing world. Polluting species from colored wastewater (WW) and/or industrial effluents must be removed until the legal or imposed admissible concentration levels using different combinations of physical-mechanical, chemical, and biological treatment processes for their degradation, discoloration and/or solids separation. One of conventional treatment method used for colored fine solids' separation from industrial wastewater is the coagulation-flocculation process which can be improved by using special groups of coagulation-flocculation agents known as hybrid materials.

In this research work, we foccused on preliminary testing of the efficiency/ performance obtained when are used two hybrid materials, alone and in mixture with conventional coagulants (e.g., ferrous sulphate, ferric sulphate, aluminium sulphate, and ferric chloride, in concentration of 10-50 mg/L) in the coagulation-flocculation experiments by Jar test, i.e. CETTA CLEAR and BIOSOLIT 6124 hybrid materials. The eco-flocculant CETTA CLEAR contains poly aluminium silicate from natural raw materials and is efficient in retaining of organic suspensions and patogen bacteria from natural water resources and WWs, being cost-effective related with polyacrylamide (PAM) commonly used as flocculant. VTA BIOSOLIT 6124 consists of complex mixtures of polymetal hydroxides (Al/Fe=6.5±0.5%) with addition of biological charge-carrier from natural raw materials, being of natural yellow liquid aspect, commonly applied in concentration of 20-40 ppm in the coagulation- flocculation test. Our jar tests were performed in one (100 rpm for 30 min) and two (300 rpm for 5 min, and after 50 rpm for 25 min) steps of stirring followed by minimum 30 min of rest for solids separation by sedimentation. The performance of both hybrid materials used as coagulation-flocculation agents considered the color, dye, and solids (turbidity) removals. Our preliminary findings are encouraging and permit us to continue our research work for finding the most corresponding operating conditions in the textile WW treatment and proposal of a pertinent mathematical model in association with the technical treatment optimization for industrial scale setup use in WW discoloration and dye removal.

Keywords: coagulation-flocculation, synthetic textile wastewater, dye, color and turbidity removal

METHODS OF REMOVAL OF ANIONIC DETERGENTS FROM WASTEWATER

Mihaela Gabriela Staicu[1], Florica Manea[2]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, „Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]"Politehnica" University of Timisoara, Faculty of Industrial Chemistry and Environmental Engineering, Piața Victoriei 2, Timișoara, Romania

Corresponding author: Mihaela Gabriela Staicu, E-mail address: mihaela-gabriela.staicu@student.tuiasi.ro

PhD Supervisor: Professor Florica Manea,
"Politehnica" University of Timisoara, Romania

Abstract:

Surfactants, present in the formula of detergents, are used on a large scale in different industrial fields, such as: textile, paint, paper production, food, pharmaceutical etc. Following the COVID-19 pandemic period, the concentration of surfactants in wastewater increased due to excessive cleaning and washing procedures. Being considered pollutants with high toxicity, there is a major concern regarding the development of sustainable methods of removing surfactants. In this context, the objective of this article is to highlight some current methods for the efficient treatment of water with surfactant content, based on scientific studies reported in the literature, which address the issue of effective mitigation through separation and degradation processes. Among the currently used processes, coagulation - flocculation, electroflotocoagulation and adsorption/filtration have received considerable attention in wastewater treatment technology due to the potential for separation of surfactants. The most recent data indicate the use of natural materials or even different types of waste as coagulation agents or sorbent/filtering material to minimize process costs and to apply the principles of the circular economy. Oxidation processes such as the ozonation process, ultraviolet irradiation, photocatalysis, electrooxidation are designed to ensure advanced degradation and even mineralization of surfactants. The performances of these processes are based on the ability to generate reactive oxygen species, especially hydroxyl radicals, useful in destroying anionic surface agents until complete mineralization. Among these processes known as advanced oxidation processes (AOP), electrooxidation is often found in research studies due to the advantages of electrochemical processes in general: compatibility with the environment, versatility, low operating costs, etc. It is known that the electrode material represents the key for the performance of the electrochemical process. The type of electrochemical process dictates the class of electrode materials, soluble for the electrocoagulation process to generate in-situ coagulants and stable for electrooxidation processes. In addition to commercial electrode materials, the use of industrial waste in the development of electrochemical processes is gaining increased interest both from the point of view of lowering investment costs and as a method of valorising industrial wastes.

Keywords: surfactant, detergents,waste water, separation,degradation

EFFECT OF GRAPE VARIETY AND EXTRACTION PROCEDURE ON THE PHENOLICS CONTENT AND ANTIOXIDANT ACTIVITY OF WHITE GRAPE BY-PRODUCTS

Mihaela Nechifor Tudorache[1], Cristiana Radulescu[1,2,3,4]

[1] National University of Science and Technology POLITEHNICA Bucharest, Doctoral School Chemical Engineering and Biotechnology, 060042 Bucharest, Romania; [2] Valahia University of Targoviste, Institute of Multidisciplinary Research for Science and Technology, 130004 Targoviste, Romania; [3]Valahia University of Targoviste, Faculty of Sciences and Arts, 130004 Targoviste, Romania; [4]Academy of Romanian Scientists, 3 Ilfov, 050044 Bucharest, Romania

Corresponding author: Mihaela Nechifor Tudorache, tudorache.mihaela-db@ansvsa.ro

PhD Supervisor: Professor Cristiana Radulescu
National University of Science and Technology POLITEHNICA Bucharest, Romania

Abstract:

Currently, grape by-products are used for various purposes in agriculture, cosmetics, pharmaceuticals, biorefining, animal feed, and fortified/functional foods. Grape pomace and wine yeast are the main wastes of interest in the food industry. Grape pomace is the waste resulting from the pressing process of red and white grapes, with the final goal being to obtain high-quality wine. Grape pomace is usually composed of stalks/clusters, skins, and seeds/kernels, representing approximately 25% of the total weight of the grapes used in the winemaking process. Understanding the nature of grape by-products, their combinations, and their molecular mechanisms of action in triggering bioactivity is very important. Preclinical, epidemiological, and follow-up studies are warranted to explore the maximum nutraceutical potential of grape by-products for food applications and medical purposes. Recent studies have reported that bioactive compounds from grape pomace are beneficial to human health, particularly in the protection against chronic diseases. Polyphenols, the major compounds in grape pomace, are known to have anti-inflammatory, anti-obesity, antihyperlipidemic, cardioprotective, and cancer-prevention effects, as well as improved insulin sensitivity and glucose homeostasis improvement. Because phenolic compounds are the most important secondary metabolites with antioxidant properties in grapes, the total content of phenolic compounds in grape pomace extracts is usually well correlated with their antioxidant activity. Extracts obtained from pomace can be used in food, pharmaceutical, cosmetic, and other products in the form of liquid extracts, concentrates, or powders. Grape pomace extracts have been used as food protection factors because of their antioxidant capacity, ability to prevent lipid oxidation in fish products, and antimicrobial activity against various bacterial strains. In addition, grape pomace extracts can be used as a functional supplement in food production, for the fortification of beverages, or even as an ingredient of osmotic solutions to obtain dehydrated fruits with increased phenolic compound content. Grape pomace extracts have also been successfully incorporated into edible chitosan films (hydrophobic and hydrophilic), providing antioxidant properties and extending the shelf life extension. In the food industry, phenolic extracts from grape pomace can be used as substitutes for synthetic antioxidants. White grape by-products are examined less in terms of bioactive compounds and antioxidant properties, despite the high demand for food that exhibits good health and prevents diseases caused by oxidative stress. The current study highlighted that grape stem, a serious pollutant in the environment, could be valorized to extract phenolic compounds for use as bioactive and/or functional ingredients. The objectives of this study were: (1) to investigate the composition of grape by-products in terms of phenolic and flavonoid content, as well as their antioxidant activities, in relation to grape variety, extraction procedure, and anatomical part of grapes; and (2) to evaluate the correlation between the phenolic content, antioxidant activity, grape variety, anatomical part, and extraction procedure. In this respect, the established correlation could be utilized to optimize the extraction of phenolics from grape by-products and for further utilization as functional ingredients. In addition, the findings from this study will be useful for winemaking producers and producers of food ingredients, based on the correlations established by the statistical approach. The performed experimental screening was designed to assess several indices of the polyphenolic composition of grape by-products (pomace, steams, and skin and seeds mixture), such as total polyphenolic content, total flavonoid content, and their antioxidant activity, for two white grape Romanian varieties (i.e., Fetească Albă and Tămâioasă Românească).

Keywords: by-products, phenolics, antioxidant activity- IC50, principal component analysis, functional food, hierarchical cluster analysis

EXPLORING POTENTIAL NANOPARTICLE EFFECTS ON CELLULAR RESPONSE IN 3D PRINTED SCAFFOLDS THROUGH LOCAL NANOMECHANICAL REINFORCEMENT

Carmen-Valentina Nicolae[1], Elena Olăreț[1], Raluca-Elena Ginghină[2], Sorina Dinescu[3,4], Andrada Serafim[1], Izabela-Cristina Stancu[1]

[1]Advanced Polymer Materials Group, Faculty of Chemical Engineering and Biotechnologies, National University of Science and Technology POLITEHNICA Bucharest, 1-7 Gh. Polizu street, 011061, Bucharest, Romania
[2]Research and Innovation Center for CBRN Defense and Ecology, 225 Olteniţei Street, 041327, Bucharest, Romania
[3]Department of Biochemistry and Molecular Biology, University of Bucharest, 91-95 Splaiul Independenței Street, 050095, Bucharest, Romania
[4]Research Institute of the University of Bucharest (ICUB), 1 Dr. Dimitrie Brândză Street, 050663, Bucharest, Romania

Corresponding author: Carmen-Valentina Nicolae, carmen.nicolae@upb.ro

PhD Supervisor: Professor Izabela-Cristina Stancu,
National University of Science and Technology POLITEHNICA Bucharest, Romania

Abstract:

Aiming to understand how cellular behavior is influenced by the presence of nanoparticles, we are met with a complex mosaic of mechanical stimuli and biochemical cues. In electrospun gelatin nanofiber meshes loaded with low concentrations of nanodiamond particles (NDs, <1%), preferential cellular adhesion contacts were observed for locally exposed NDs, in the case of hASCs, osteoblasts, fibroblasts and neural precursors. This behavior was observed both through scanning electron microscopy (SEM) and by nanoindentation, whether by mechanical reinforcement, biochemical signaling or both. Here, our objective is to explore whether the same impact on the cellular behavior is induced by low concentrations of NDs loaded within 3D printed samples. In this regard, we developed acellular inks based on a bioinert polysaccharide matrix, incorporating various ND concentrations (0%, 0.5%, 1%, 2% and 3%) and investigated their rheological behavior, injectability and printability. The reinforcing properties of the ND content within the gellan gum matrix were highlighted by assessing the 3D printed scaffolds' morphology via SEM and MicroCT using the compression mode, while nanoindentation was used to explore local mechanical effects. The nanoparticle loading effect on the cellular behavior was observed using murine preosteoblasts (MC3T3-E1), evaluating scaffolds' biocompatibility and cellular proliferation on their surface. To enhance the potential of low concentration ND loading to guide cellular interactions, icariin (ICA) was adsorbed on the surface of NDs. The cellular response to formulations with 2% ND with and without adsorbed ICA was explored, extending the understanding on the guidance of cellular response using nanodiamond particles.

Acknowledgements: This work was supported from the project Integrating mechanically-tunable 3D printing with new bioactive multi(nano)materials for next functional personalized bone regenerative scaffolds, PN-III-P4-PCE-2021-1240, nr. PCE 88/2022. 3D printing and micro-CT analysis were possible due to ERDF/COP 2014-2020, ID P_36_611, MySMIS 107066, INOVABIOMED

Keywords: nanodiamond, gellan gum, 3D printing, nanoreinforcement, bone tissue engineering

THE RECOVERY OF WASTE COOKING OIL BY TRANSFORMING INTO VALUE-ADDED PRODUCTS

Paula Olaru Simionescu Rusu, Alina-Mirela Ipate, Gabriela Lisa

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Chemical Engineering and Environmental Protection "Cristofor Simionescu", 73 Prof. dr. doc. D. Mangeron Street, 700050, Iasi, Romania
[2]Petru Poni Institute of Macromolecular Chemistry, 41A Aleea Gr. Ghica Voda, 700487 Iasi, Romania

Corresponding author: Paula Olaru Simionescu Rusu, paula.simionescu@student.tuiasi.ro

PhD Supervisor: Professor Gabriela Lisa
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The majority of existing studies in the literature present the use of waste cooking oils in obtaining biofuels. However, there are also recent concerns of researchers for obtaining value-added products such as biopolymers, asphalt, detergents, lubricants, etc. In this study, we aimed valorize waste cooking oils in obtaining cosmetic products. The obtained products were evaluated by confocal laser microscopy, Fourier transform infrared spectroscopy (FT-IR) – attenuated total reflection (ATR-FTIR), determination of the water contact angle, scanning electron microscopy (SEM) and characterization with the technique of differential scanning calorimetry (DSC). Confocal laser microscopy revealed the homogeneous structure with uniform distribution of the main components for the cosmetic products made. The ATR-FTIR spectra provided information on the composition of the analyzed creams, and the scanning electron microscopy (SEM) and the determination of the water contact angle revealed the hydrophobic nature of the products obtained. The DSC technique allowed the analysis of thermal properties and phase changes of cosmetic products that may occur during processing but also during their storage. The cosmetic products were prepared in two variants: one using waste cooking oil as the main ingredient and the other using waste cooking oil in which fir buds were macerated for four weeks. ATR-FTIR spectra indicated that the peak in the 3008/3006 zone decreases by almost ten times in the product containing waste cooking oil in which fir buds were macerated, indicating a smaller amount of unsaturated acids in this product. Also, for this product the appearance of a new peak at 1275 cm^{-1}, which can be associated with the vibration of the bonds -C-O-C- specific to etheric groups, is highlighted. Water contact angle evaluation indicates an increase in the hydrophobicity of products containing waste cooking oil in which active principles were extracted from fir buds. DSC curves for the first heating allowed the identification of a melting peak at a temperature of -2.2 °C, characteristic of essential oils extracted from fir buds. In conclusion, cosmetic products have been prepared and characterized that utilize waste cooking oils.

Keywords: waste cooking oil, cosmetic products, fir buds, ATR-FTIR, SEM, DSC

POLYELECTROLYTES/ LACCASE COMPOSITE BIOCATALYSTS FOR WATER CLEANING APPLICATIONS

Larisa-Maria Petrila[1], Rénato Froidevaux[2], Marcela Mihai[1]

[1]"Petru Poni" Institute of Macromolecular Chemistry, 41A Grigore Ghica Voda Alley, 700487, Iasi, Romania
[2] UMRt INRAE 1158 BioEcoAgro, Université de Lille, Avenue Paul Langevin 59655, Villeneuve d'Ascq, France

Corresponding author: Larisa-Maria Petrila, larisa.petrila@icmpp.ro

PhD Supervisor: Dr. habil. Marcela Mihai,
"Petru Poni" Institute of Macromolecular Chemistry

Abstract:

In the urgent search for sustainable and cost-effective wastewater treatment methods to tackle pollution, an increased interest has been prompted on the use of immobilized enzymes as catalysts for pollutants degradation. Leveraging their natural origin, high selectivity, and capacity to convert priority pollutants to less toxic molecules, some enzymes such as laccases and peroxidases has imposed as efficient and green methods for water treatment.

In this study, the fabrication of a novel type of biocatalysts was investigated, obtained by the immobilization of *Trametes versicolor* laccase on polyelectrolyte-based core-shell composite microparticles fabricated by the layer-by-layer deposition of poly(ethyleneimine), poly(acrylic acid) or poly(sodium methacrylate) on silica microparticles. The fabrication of the composite biocatalysts was optimized in terms of amount of laccase immobilized, the preservation of the enzymatic activity and the biochemical properties of the so-obtained biocatalysts being also studied. The resulting composites were employed as green catalysts in the degradation of indigo carmine, a negatively charged dye selected as model pollutant.

The biocatalysts with immobilized laccase demonstrated remarkable stability at pH, temperature and at storage. Moreover, the composite biocatalysts were able to lead to 100% discoloration of the indigo carmine sample in the tested conditions, in less than 60 minutes. Additionally, the biocatalysts conserved a satisfactory stability in process conditions, maintaining more than 95% discoloration efficiency after four reuse cycles.

Our results demonstrate the fabrication of efficient biocatalysts that can be potentially used in water cleaning applications. The observed high stability and the reusability qualify the obtained biocatalysts as a promising alternative to classical wastewater treatment methods.

Acknowledgements:

The results presented were obtained during a research stage at the University of Lille, financially supported by the Romanian Ministry of Education through the Study Loans and Scholarships Agency and by the University of Lille, within the framework of the Mobility Programme MobLilex, 2023.

Keywords: Laccase, water treatment, biocatalysis, composite materials, enzyme immobilization

C1 WASTE GAS FERMENTATION BY *Clostridium carboxidivorans* FOR ALCOHOLS PRODUCTION IN A CONTINUOUS GAS FED BIOREACTOR

Sara Pisacane[1], Fabiana Lanzillo[1], Francesca Raganati[1], Antonio Marzocchella[1]

[1]Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale - Università degli Studi di Napoli *Federico II*, P.le V. Tecchio 80, 80125 Napoli, Italy

Corresponding author: Sara Pisacane, sara.pisacane@unina.it

PhD Supervisor: Professors Antonio Marzocchella, Piero Salatino, Università degli studi di Napoli Federico II, Napoli, Italy

Abstract:

Utilizing renewable carbon-based resources to produce energy and chemicals presents a hopeful strategy to reduce dependence on fossil fuels. Trought the thermo/biotechnological method, the gasification process, the C- based streams (e.g. biomass, plastics) could be converted into syngas, a gas mixture of CO, CO_2, and H_2. It is as a cost-effective substrate obtained by gasification of carbon based waste for the production of numerous valuable products. Some microorganisms could thrive using CO or syngas as carbon and energy source, and just a few strains are able to converting CO/syngas into biofuels. *Clostridium carboxidivorans* is a microorganism known for its ability to produce short- and long-chain acids and alcohols, including acetic acid, butyric acid, hexanoic acid, ethanol, butanol and hexanol. *C. carboxidivorans* is an obligate anaerobic acetogenic bacterium capable of reducing short-chain carboxylic acids into alcohols through the Wood–Ljungdahl pathway.

Present contribution regards the characterization of CO fermentation by *C. carboxidivorans* in a continuous gas-fed bioreactor. Experiments were carried out in 0.25 L MiniBio bioreactors (Applikon). The bioreactor was fed with 100% CO stream at a flow rate of 0.6 L/h. A microsparger was used for optimal dispersion of the gas stream into the medium and fermentation tests were carried out at constant temperature with any without pH control. The fermentation process was characterized in terms of metabolites and cell production, CO conversion, specific rate of cells/metabolite production and yields.

Ethanol was the primary solvent produced and a shift towards longer-chain alcohols was observed under constant pH. The maximum cell concentration was 0.56 g_{DM}/L with and without pH control. The highest solvent concentrations was 1820 mg/L of ethanol without pH control, and 330 mg/L of butanol and 20 mg/L of hexanol with pH control.

The study highlithed the role of the substrate composition and the operating conditions on syngas.

Keywords: *Clostridium carboxidivorans,* ethanol, butanol, CSTR, CO

ANTIFUNGAL ACTIVITY OF EXTRACTS FROM *Sambucus nigra* AND *Juglans regia* BY-PRODUCTS

Anca Sandu - Bălan Tăbăcariu[1,2], Oana-Irina Patriciu[1], Ioana-Adriana Ștefănescu[1], Irina-Loredana Ifrim[1], Adriana-Luminița Fînaru[1]

[1]„Vasile Alecsandri" University of Bacau, Faculty of Engineering, 156 Calea Marasesti, 600115, Bacau, Romania
[2]"Ștefan Luchian" Secondary School, 8 Zorilor Street, 605400, Moinesti, Romania

Corresponding author: Anca Sandu-Bălan Tăbăcariu, anca_tabacariu@yahoo.com

PhD Supervisor: Professor Adriana Fînaru,
„Vasile Alecsandri" University of Bacau, Romania

Abstract:

A current alternative regarding the principles of sustainable chemistry is the replacement of artificial substances with natural ones through the superior utilization of natural resources, which have numerous applications in different fields. The use of bioactive compounds from plants as biopesticides is increasingly common considering their low impact on the environment. The benefits of black elder (*Sambucus nigra*) and walnut (*Juglans regia* L.) have been known since ancient times, due to the presence of phytochemicals such as: flavonoids, polyphenols, alkaloids, anthocyanins, juglones, hydroxycinnamic acids, hydroxybenzoic acids, naphthoquinones. etc. These bioactive compounds have biological activities with multiple benefits on human health such as antibacterial, antioxidant, anti-inflammatory, antihistaminic, analgesic, cicatrizing, antidiabetic, hepatoprotective, antihypertensive, neuroprotective, etc. and important phytosanitary properties, such as: antibacterial, antifungal, and insecticidal, and their extracts can be used as environmentally safe biopesticides, constituting a viable and cheap alternative to environmentally harmful synthetic products. In the present study, the aqueous and hydroalcoholic extracts from green and dry walnut shell, green and dry walnut leaves, dried elder leaves and flowers, obtained by various techniques and characterized from a physico-chemical point of view, were subjected to microbiological analysis using the diffusimetric method. This aimed to evaluate the antifungal potential on the microorganisms *Alternaria* spp. and *Aspergillus* spp. isolated from the cucumber leaves in PDA and Sabouraud medium of both fresh extracts and those stored for a period of time.
Walnut and elderberry extracts have a higher inhibition rate on the growth of the microorganism *Alternaria* spp. compared to *Aspergillus* spp. In the PDA culture medium, the antifungal effect of the extracts is greater than in the Sabouraud medium. The different behavior on the two media explains the antifungal potential of the extracts, especially on *Alternaria* spp. PDA is the most used medium for the growth of fungi, while Sabouraud media is a selective medium for fungi. This behavior leads to the idea that these extracts can be used with better results for plants resistant to certain diseases. In the case of the extracts stored for 3 months, regardless of the culture medium, no antifungal activity was observed on *Aspergillus* spp.

Keywords: elderberry, walnut by-products, extracts, stability, antifungal activity, *Alternaria* spp., *Aspergillus* spp

ANTIBIOTIC AND SILVER LOADED HYDROXYAPATITE FOR BONE TISSUE HEALING

Sergiu Ionuţ Buştiucel, Margareta Gabriela Ciobanu

"Gheorghe Asachi" Technical University of Iasi, Romania, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Sergiu Ionuţ Buştiucel, sergiu-ionut.bustiucel@student.tuiasi.ro

PhD Supervisor: Professor Margareta Gabriela Ciobanu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

For a very large number of people, especially elderly people, the life quality is greatly affected by health problems related to the bone defects caused by trauma or some diseases. In restorative medicine, to solve the problems that occur at the level of the bone structure, in addition to biological bone grafts, implants made of synthetic biomaterials that try to imitate the bone structure are used. Among them, bioceramic materials are widely used, and this is because they have excellent biocompatibility and mechanical properties suitable for their clinical use in orthopedics and dentistry.

A problem that can arise after the implantation of a biomaterial in a bone structure is the appearance of bacterial infections. Therefore, it is extremely important that the bioceramic implant also has an antibacterial function to prevent or treat a possible infection associated with the bone implant. In recent years, a series of studies have been carried out regarding the creation of bioceramics that incorporate antibiotic-type active principles, precisely to induce antibacterial activity of the implant.

In our study, to achieve antibacterial aims, hydroxyapatite scaffolds doped with silver ions were prepared for long-term release of antibacterial ions. In addition, an antibiotic (amoxicillin) was introduced into the apatitic bioceramic to act quickly on pathogenic bacteria that could develop on the implant. The porous scaffolds were obtained by the phase inversion process and were characterized by XRD, SEM and EDX methods. *In vitro* drug release of amoxicillin and silver ions indicated that these hybrid biomaterials can provide a prolonged release of bioactive agents in physiological conditions. The results suggested that these biomaterials with antibacterial function may be of use for the regeneration of bone defects and bone tissue healing.

Keywords: biocomposites, hydroxyapatite, silver ions, amoxicillin, drug release

ADVANCED RECOVERY OF VALUABLE MATERIALS FROM E-WASTE

Ștefan-Leontin Martinaș-Ioniță, Gabriela Antoaneta Apostolescu, Maria Harja

"Gheorghe Asachi" Technical University of Iasi, Romania, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ștefan-Leontin Martinaș-Ioniță, E-mail address: martinasstefan@gmail.com

PhD Supervisor: Professor Maria Harja
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The output of electrical and electronic equipment has increased significantly in recent years due to rising demand; nevertheless, as technology advances, equipment lifespans decrease because of the inclination to update. This leads to the massive amount of electronic rubbish (or "e-waste") that we produce each day. The majority of this garbage is made up of electrical and electronic devices, which cannot be recycled yet nevertheless have an impact on the environment due to their makeup. Printed circuit boards are a major component of electrical and electronic trash. Printed circuit boards are thought to be made up of 40% metal, 30% plastic, and 30% ceramic materials. Although polymers and refractory oxides are frequently present in this trash, metals make up the majority. Common metals detected in this trash include lead (Pb), mercury (Hg), iron (Fe), nickel (Ni), copper (Cu), and silver (Ag). There are two primary extraction techniques that must be used for the sustainable recovery of precious materials. These are exemplified by procedures that will divide the recyclable materials into two groups: non- metals and metals. E-waste is considered hazardous if the amount of metals exceeds the permitted standard. These materials not only affect the environment but can be very valuable from an economic point of view if collected correctly and separately. In this study, the primary methods of separating and extracting valuable elements from electrical and electronic waste were evaluated and the effectiveness of these techniques was evaluated in terms of waste disposal. These can be physical, chemical, thermochemical, pyrometallurgical, hydrometallurgical and biometallurgical methods. Methods such as solvent extraction, ion exchange, membrane separation, compaction, retention on porous polymers, coprecipitation, sequential distillation, precipitation and adsorption were analyzed. These techniques can be used individually or in combination. The technique with the most promising results turns out to be the one in which several separation methods are used in the same technological flow (hybrid method).

Keywords: e-waste, extraction, environment protection, recovery, valuable metals.

PHYSICO-CHEMICAL CHARACTERISTICS OF SOME ECOLOGICAL PRODUCTS USED FOR TEXTILE CARE

Valentina Gabi Miron, Niki Vlad Mancaşi

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Industrial Design and Business Management, 29 Prof. D. Mangeron Blvd., Iasi, 700050, Romania

Corresponding author: Valentina-Gabi Miron, valentina-gabi.stanescu@student.tuisi.ro

PhD Supervisor: Professor Vasilica Popescu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Protecting the environment is an international issue that depends a lot on the involvement of each of us. The collection and reuse of different used products is a first measure that would have a positive impact on the environment because it would significantly reduce waste and implicitly pollution. The purpose of this work is to show that the used oils rezulted after cooking should be collected, recycled to be transformed into ecological products for laundry care: soaps, detergents and conditioners. The laundry soaps prepared by us were obtained through a hot saponification process, using the mixture of 2 vegetable oils, in the following combinations: palm and coconut oils for cooking (PC+CC), palm oil for cooking and wasted coconut oil (PC+CW), wasted palm oil and unused coconut oil (PW+CC), wasted palm oil and wasted coconut oil (PW+CW). The characterization of the vegetable oils was carried out by determining the saponification value (SAP) and the iodine number (IN). SAP is determined by titrating with 0.5 N HCl the remaining solution after hot saponification (30 minutes) of a 1 g oil sample immersed in 25 ml alcoholic KOH. IN indicates the degree of unsaturation of the acids in the oils used for saponification and is expressed in grams of iodine/100 g of oil. In performing the test, a known excess of iodine, in the form of Iodine/KI, is reacted with a known weight of oil, and then the amount of unreacted iodine is determined by titration with a 0.1N solution of sodium thiosulphate. The obtained soaps were characterized physically and chemically by determining the values of IN, INS (Iodine Number Saponification**)**, pH, bubbles, color, density and cleaning/washing capacity. The results indicate that both SAP and IN decrease in the case of used oils compared to the values of virgin oils. The ecological soaps tested have values IN<43, INS<160 indicating that they are too dry for the skin, but excellent for washing clothes because they do not have a high bubbling capacity and clean excessively during washing.

***Keywords*:** recycled oils, iodine number, saponification value, iodine number saponification, laundry soap, soap bar.

WASTES AND ADDITIVES USED TO REDUCE RAW MATERIALS CONSUMPTION

Mihai Vrabie[1,2], Maria Harja[1]

[1]"Gheorghe Asachi" Technical University of Iasi, Faculty of Chemical Engineering and Environmental Protection, Iasi, 73 Mangeron Blvd., 700050 Iasi, Romania
[2]"S.C. Gemite RO SRL, Iasi, 52, SF Petru Movila Street, Romania

Corresponding author: Mihai Vrabie, mihai.vrabie2@student.tuiasi.ro

PhD Supervisor: Professor Maria Harja
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Concerns about raw material depletion and the overconsumption of global water reserves necessitate the efficient use of all resources. One way to make the best use of these resources is to use byproducts from other industries as raw materials to create high-performance materials. Wastes that can be capitalised include fly ash collected from coal-fired power plant electrofilters, furnace slag from the metallurgical industry, and silica fume from the production of silicon metal or ferrosilicon alloys. These by-products have properties that are similar to cement. To prevent excessive use of the water reserve, additives are used to reduce the amount of water used in material production. These additives have the ability to ensure the workability of the materials that will be obtained using a much smaller amount of water.

In this study, the effect of using by-products and a superplasticizer on the properties of a material was investigated. The purpose of using these by-products was to reduce the amount of cement used, cement being replaced to some extent with these by-products. At the same time, the use of superplasticizer, in addition to improving the obtained material properties, has an obvious effect on the reduction of water consumption in the preparation of the mixture. These industrial wastes and the used superplasticizer were analysed using SEM, XRD, EDAX, and TG. After conducting research, the material's compressive strength at 28 days ranged between 31 and 35 MPa. The use of a superplasticizer raised the value to 40 MPa. The same effect was seen with flexural strength (8 to 10.2 MPa) and substrate adhesion (1.98 to 2.28 MPa). The use of a superplasticizer maintains workability (16-18 cm in the slump test) while reducing water consumption (50.95% to 34.96%).

In this paper was demonstrated that using by-products as partial substitutes for cement, as well as adding a superplasticizer to the mixture during preparation, results in a high-performance material that also helps to protect the environment.

Keywords: by-product, water reserve, fly ash, furnace slag, properties

SECTION 4.

Civil engineering and installations

THEORETICAL ANALYSIS REGARDING COOLING PHOTOVOLTAIC THERMAL PANELS WITH WATER - CASE STUDY

Marius Alexa, Nicolae Ţăranu, Sebastian Valeriu Hudişteanu, Nelu Cristian Cherecheş, Florin Emilian Ţurcanu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Installations, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Marius Alexa, marius.alexa@student.tuiasi.ro

PhD Supervisor: Professor Nicolae Ţăranu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The use of photovoltaic thermal panels has a number of advantages such as substantially increasing energy efficiency, but also producing thermal energy by extracting heat from the water circulated through the cooling system; they can also act as radiators for large urban agglomerations.
The amount of heat generated by photovoltaic panels is the main factor in efficiency. The amount of heat depends on the amount of solar radiation available, panel efficiency, system configuration, and the number of photovoltaic panels installed. Photovoltaic thermal panels are designed to produce as much electricity as possible, but also thermal energy for domestic hot water, preheating of the thermal system, treatments based on thermal baths in recovery clinics and hospitals.
The number of panels installed will also affect the efficiency of the system and the amount of heat generated. The second factor affecting heat gain and loss is the ambient temperature at which the system operates. The ambient temperature will affect the amount of energy generated due to the efficiency of the panel and system configuration. The study analyzes how PVT cooling is achieved by taking heat, by a cooling system that has water as agent and from a constructive point of view is made of Cu pipe, with a diameter of 22mm, fixed on the back of the photovoltaic panel and divides it into 3 equal zones, thus obtaining the thermal equilibrium of the system. 120 variants were analyzed, in non-stationary regime, for calculating the increase in water temperature and the influence of input parameters on the thermal equilibrium mode (4 values of mass flow, 2 values of water temperature at the entrance to the circuit, 3 constructive variants) for the period May – June, which leads to the amount of heat extracted from the cooling system.
The amount of heat has been calculated on a case-by-case basis, taking into account system efficiency: the pump mounted on the return of the cooling system operates only if the water temperature at the outlet of the installation is greater than or equal to 30°C, so that there is real heat exchange by achieving thermal equilibrium.

Keywords: sustainable energy, solar energy, near zero energy building, thermal efficiency, photovoltaic thermal panels, cooling photovoltaic thermal panels

SHEAR STRUCTURAL RESPONSE OF STRENGTHENED UNREINFORCED STONE MASONRY WALLS USING TRADITIONAL AND MODERN TECHNIQUES EXPERIMENTAL SET-UP

Florin-Sergiu Alupoae, Nicolae Țăranu, Dragoș Ungureanu, Cătălin Onuțu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services,
1 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Florin-Sergiu Alupoae, florin-sergiu.alupoae@student.tuiasi.ro

PhD Supervisor: Professor Nicolae Țăranu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

This paper outlines the setup required for an experimental investigation into the shear structural behavior of unreinforced stone masonry (URSM) walls, enhanced through both traditional methods and basalt fiber reinforced polymer (BFRP) techniques. Five stone masonry wall modules were specifically designed and fabricated for this purpose. The primary objective of this experimental study is to quantify the effectiveness of various strengthening methods by comparing the structural response of the BFRP-strengthened modules to that of an unstrengthened module. Additionally, one stone masonry module was reinforced using traditional methods.

Stone masonry stands as one of the earliest and most extensively employed structural systems, owing to its advantageous traits such as cost-effectiveness, superior thermal insulation, readily available materials, impressive long-term performance, and durability.

The proposed experimental program aims to evaluate the in-plane shear performance of the strengthened URSM walls utilizing either traditional or BFRP-based methods and to discern any enhancements achieved through these methods. Five URSM panels were conceptualized, with one serving as an unstrengthened benchmark throughout the study, while the remaining four were reinforced.

Upon curing of all components, the modules were prepared for the loading phase, with shear tests conducted using a PR-500 no.15 test machine. An acquisition system was employed to monitor the applied force.

By comparing the results of the BFRP-strengthened modules to those of the traditionally reinforced one, the advantages of modern rehabilitation techniques can be observed. The experimental program is poised to yield valuable insights into key aspects of stone masonry strengthened walls, including failure mode characterization, ultimate force identification, and stress-strain state analysis.

This paper presents the experimental setup for a study aimed at elucidating the shear structural behavior of strengthened URSM walls, offering comprehensive details on the preparation and instrumentation of the stone masonry panels. To ensure robust conclusions, the experimental study was meticulously designed to consider various strengthening variables, such as the type of reinforcing mesh, mortar, and through-wall connectors.

Based on the findings of this experimental program, the validity of existing analytical and numerical models can be assessed, potentially leading to refinements or the proposal of new models as needed.

Keywords: Stone masonry, strengthening methods, traditional materials, basalt fiber reinforced polymer (BFRP) techniques

SUSTAINABLE HIGHWAY CONSTRUCTION PLANNING BY ADVANCING ENVIRONMENTAL CONSERVATION THROUGH AN INTEGRATED SOIL MAPPING AND LAND MANAGEMENT PLATFORM

George-Călin Baltariu, Ilinca-Maria Baltariu

"Gheorghe Asachi" Technical University of Iasi, 1 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
2 "Alexandru Ioan Cuza" University of Iasi, 22 Carol I Blvd., Iasi, 700505, Romania

Corresponding author: George-Calin Baltariu, george.calin.baltariu@gmail.com

PhD Supervisor: Professor Ion Serbanoiu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

This research project aims to develop a comprehensive platform for promoting environmentally sustainable construction practices and minimizing the ecological footprint of highway development projects in Romania. The platform integrates advanced technologies, including soil mapping GIS, soil survey data, and the national land registration and cadastre system, to provide stakeholders with a holistic understanding of soil characteristics and land use patterns. The primary objective of this research is to demonstrate how the integration of soil mapping GIS, soil survey data, and the national land registration and cadastre system can facilitate informed decision-making processes during highway development projects. By leveraging advanced spatial analysis techniques and data integration, the platform will enable stakeholders to assess soil quality, identify environmentally sensitive areas, and optimize construction practices to minimize environmental impact.

The first component of the platform is the Soil Mapping GIS, alongside GIS analysis tools to create detailed soil maps along highway corridors. These maps visualize soil characteristics and variations, providing valuable insights for project planning and design. The integration of soil survey data into the platform enhances its capabilities by providing additional information on soil properties, fertility levels, and potential environmental risks.

The second component involves integrating data from the national land registration and cadastre system into the platform. This integration streamlines land use planning processes and ensures compliance with regulatory requirements. By incorporating information on land ownership, land use designations, and property boundaries, the platform enables stakeholders to make more informed decisions regarding highway development projects.

The third component of the platform is the development of decision support tools to assist stakeholders in optimizing construction practices and minimizing environmental impact. These tools leverage the integrated data sources to identify environmentally sensitive areas, assess the potential impact of construction activities, and recommend mitigation measures to minimize ecological disruption.

The anticipated outcomes of this research project include enhanced environmental sustainability in highway development projects, minimized ecological footprint of infrastructure development, and improved collaboration and communication among stakeholders. By empowering stakeholders with access to comprehensive data and decision support tools, the platform will enable more informed decision-making and promote environmentally sustainable construction practices for highways in Romania.

Keywords: sustainable highway construction, soil mapping, construction management, land management, environmental conservation, GIS

NUMERICAL AND PHYSICAL EXPERIMENTS ON THE BEHAVIOR OF THE PERFORATED STEEL CORE COMPONENT OF BUCKLING RESTRAINED BRACES

Cosmin-Petru Mocanu-Basalic, Septimiu George Luca, Petru Mihai, Irina Lungu, Elena Basalic Mocanu

1"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services, Bd. D. Mangeron 1, Iasi 700050, Romania
2"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Materials Science and Engineering, Bd. D. Mangeron 41, Iasi 700050, Romania

Corresponding author: Cosmin-Petru Mocanu-Basalic, cosmin-petru.mocanu-basalic@student.tuiasi.ro

PhD Supervisor: Professor Irina Lungu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The need to control the structural displacements of buildings has led to the development of new concepts and displacement control systems. One of these is the passive displacement control system, which has as its main dissipative elements, buckling restrained braces. In this study, a series of numerical experiments and physical tests were conducted for the particular case of buckling-restrained braces with a perforated core (PCBRB). The aim was to establish a connection between the slenderness ratio and the type of behavior regarding the plastic areas of the perforated core (ductile or brittle). For this, a series of test groups was created with elements composed of the same type of material, with the same characteristics and theoretical displacement control capabilities. All elements were analyzed using the same numerical load environment (loads, load cycles, maximum displacement). The type of behavior in the plastic area was monitored, as well as the methods and criteria of failure. Based on the data obtained and analyzed, the following conclusions were drawn: elements whose slenderness ratio is less than 1.75 present ductile behavior under tensile stress, but local stability problems are evident in their behavior; the elements whose slenderness ratio is greater than 5.5 show stable behavior in tension, do not present problems of local stability, but have brittle behavior in compression. To validate the obtained information, a series of physical models were designed from the same material considered in the numerical models, on a reduced scale, respecting the geometric conditions mentioned above. Some of these specimens were tested in tension to validate the failure modes of the material. In order to verify and certify the modes of behavior in compression, scale models will be tested in the hydraulic press. In these tests, the failure mode of the material will be monitored by validation of the plastic and transition zones, as well as the functioning of the buckling prevention mechanism.

Keywords: hysteretic dissipators, seismic dampers, displacement control

OPTIMIZATION METHODS FOR CIVIL ENGINEERING INVESTMENTS IN URBAN PROJECT AREAS

Andrei Bejusca[1], Ion Serbanoiu[1], Loredana Judele[1] and Daniel Lepadatu[1,2]

[1]"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Civil Engineering and Building Services
1 Mangeron Blvd., Iași 700050, Romania
[2]Technical University of Moldova, Faculty of Urban Planning and Architecture, 2028 Chisinau, Republic of Moldova

Corresponding author: Andrei Bejusca, andrei.bejusca@student.tuiasi.ro

PhD Supervisor, Professor Ion Serbanoiu,
Gh. Asachi Technical University of Iasi-Romania

Abstract:

Investments encompass a broad spectrum of material and intellectual resources allocated to various business activities and endeavours, aimed at generating profits or achieving specific social outcomes. An investment plan serves as a strategic framework for allocating capital to secure future income or realize other beneficial effects. The Investment Construction (IC) guide is a critical document that evaluates the economic feasibility and financial viability of investing capital in the reproduction of fixed assets.
Improving urban infrastructure can yield multifaceted benefits when it aligns with national objectives and undergoes funding through a comprehensive analysis that prioritizes projects with high potential for success. While many investors tend to favour projects in priority areas or those of significant interest, there are instances where investments depend on other factors for financing, which may not be easily quantifiable at first glance.
Therefore, optimizing investment methods requires a thorough understanding of this multi-criteria decision-making process to assist stakeholders in making informed choices. This paper aims to present a series of optimization methods for such investments, alongside a real-life example that confirms the project's profitability and underscores the necessity of its implementation. Such implementation often carries diverse and sometimes entirely different implications, highlighting the complexity and importance of investment decisions in urban development.

Key words: investments, optimisation, civil engineering, urban project area

A SURVEY ON THE SEISMIC RETROFIT OF A REINFORCED CONCRETE BUILDING

Alexandru-Nicolae Bizu, Dorina-Nicolina Isopescu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Alexandru-Nicolae Bizu, E-mail address: alexandru-nicolae.bizu@student.tuiasi.ro

PhD Supervisor: Professor Dorina-Nicolina Isopescu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The vulnerabilities and defects that are present today in existed built environment provide sufficient evidence to support the need for combined seismic and energy retrofit solutions of these buildings. In recent years, researchers have paid increasing attention to this problem, offering creative solutions to address this critical challenge; however, there is not one answer that is both distinctive and effective. By placing a reinforced concrete frame system on the exterior of an existing building, also made of reinforced concrete frames, the resulting system - the new structure connected to the existing structure, can increase the lateral load capacity of a building. This is achieved by increasing the stiffness of the building. So far, the designed solution has been used for some buildings in Japan only for seismic strengthening, but future integration with energy retrofit systems could further enhance its benefits.

The present study proposes an innovative strengthen solution of a reinforced concrete frame system, which is connected to the existing structure by means of horizontal reinforced concrete connection blades/plates. The connection between the existing structure and the newly created frame system is achieved by using adhesive anchoring systems. Thus, the study aims to provide an overview of the rehabilitation methods, for the category of buildings analysed, used so far worldwide. After this introduction, the study aims to present a method of strengthening such a building, without taking it out of use for a limited period. Subsequently, the theoretical results will be verified by experimental tests on a sample of representative elements characteristic of the newly created structure. The results will provide a new method of modernizing an existing large building, whether it is of permanent importance to society or intended for habitation, without creating social pressure by requiring it to be depopulated in order to modernize it. The decision-makers can thus have at their disposal efficient, energetic and economic solutions, to ensure the necessary security in the exploitation of the existing built environment.

Keywords: seismic retrofit, reinforced concrete, building, pendulum, mass-adjusted dampers

BIM DIMENSIONS APPLICATION FOR STRUCTURAL DESIGN

Bogdan Chelaru, Adrian Alexandru Șerbănoiu

”Gheorghe Asachi” Technical University of Iaşi, Faculty of Civil Engineering and Building Services,
1 Prof. D. Mangeron Blvd., 70050, Iaşi, Romania

Corresponding author: Bogdan Chelaru, bogdan-ionel.chelaru@student.tuiasi.ro

PhD Supervisor: Professor Adrian Alexandru Șerbănoiu
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

The integration of Building Information Modeling (BIM) in the architectural, engineering, and construction industry (AEC) has transformed the way projects are conceptualized, designed, and implemented. This research article partially investigates the utilization of Building Information Modeling (BIM) dimensions in structural design processes. With the growing complexity of construction projects, the integration of BIM technology provides significant potential for improving efficiency and accuracy in structural design. This study explores the practical implementation of incorporating BIM dimensions, covering from 3D to 7D data integration—in structural design workflows, applied to one single structural element. The research highlights the synergistic relationship between BIM dimensions and structural design, emphasizing their role in improving collaboration among stakeholders, streamlining decision-making processes, and enhancing project sustainability. Furthermore, the article addresses challenges and future directions for leveraging BIM dimensions effectively in structural design practices. Overall, this study contributes to advancing knowledge in the application of BIM technology within the realm of structural engineering, providing valuable insights for professionals, researchers, and educators alike.

This paper delineates two key methodological facets: firstly, the 3D modeling process and secondly, the process of mapping data to the BIM model elements derived from technical documentation. The 3D modeling was realized using the Autodesk Revit Student Version. This specific case study will focus on a structural component, a structural column. Utilizing both instance and type parameters, crucial data was incorporated to facilitate modeling, analysis, simulation, and management throughout different phases of the object lifecycle. Type and instance parameters in the context of BIM dimensions (3D, 4D, 5D, 6D, and 7D) refer to specific properties associated with building elements within a BIM model that can vary based on their type or individual instance. These parameters provide essential information for modeling, analysis, simulation, and management across various stages of the building lifecycle.

In conclusion, the application of BIM dimensions holds immense potential for transforming the structural design process. By leveraging the capabilities of BIM technology, practitioners can overcome traditional limitations and achieve greater efficiency, accuracy, and cost-effectiveness in their projects. However, successful implementation requires addressing challenges related to technology, workflow integration, and organizational culture. Moving forward, further research and industry initiatives are needed to advance the adoption and integration of BIM dimensions in structural design practices.

Keywords: BIM dimensions, BIM technology, structural design, structural engineering, 3D modelling, 3D, 4D,5D, 6D and 7D, construction industry

INNOVATIVE HYDROGEN PLASMA-ASSISTED CONVERSION TECHNOLOGY OF CONSTRUCTION WASTE INTO ENERGY

Iulian Cucoș[1], Dorina Isopescu[2], Irina Baran[2]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Hydrotechnics, Geodesy & Environmental Engineering, 65 Prof. D. Mangeron Blvd. 700050, Iasi, Romania
[2]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Construction and Installations, 1 Prof. D. Mangeron Blvd. 700050, Iasi, Romania

Corresponding author: Iulian Cucos, iulian.cucos@academic.tuiasi.ro

PhD Supervisor: Professor Dorina Isopescu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The field of civil and industrial constructions represents a basic pillar of the world economy, the resulting waste can represent a sustainable source of energy or raw materials that, according to the principles of the circular economy, can be reintroduced into the manufacturing flow.
The design process of a thermal gasification installation with hydrogen plasma of construction waste starts from the analysis of the composition of the waste, the establishment of the chemical reactions that are the basis of the gasification process, the realization of mass and thermal balances, the computer modeling of the thermo chemical process in the installation , the design and physical realization of the prototype of the installation followed by the functional testing of the various components so as to reach the technical parameters imposed by the technology implemented on the installation, the conversion technology is as follows:
- the plastic waste is introduced into the thermal gasification reactor equipped with hydrogen plasmas where the controlled gasification process takes place, at very high temperatures, in the absence of atmospheric air with a large supply of oxygen and reactive hydrogen produced in the reactor by the hydrogen plasma.
- the solid fraction is transformed in the thermal reactor and collected in a special equipment as an inert material without impact on the environment from where it is removed in order to obtain sub-products that can be used as raw material.
- the vapor phase is removed and transferred to a gas treatment unit also equipped with hydrogen plasmas, the composition and quality of the syngas obtained is continuously monitored in the event that they do not comply with the technical specifications required for use in a cogeneration equipment or do not comply with the environmental requirements for disposal in the atmosphere, are reintroduced through a command and control system based on different sensors into the gas treatment and conditioning chamber through a closed loop system, the final result is a syngas with a chemical composition and a purity corresponding to various industrial applications

Keywords: hazardous wastes recovery, plasma technology, thermal treatment, energy recovery, pyrolysis plant, finite element method

UTILIZATION OF SUSTAINABLE HYDROPHOBIC BIOMIMETIC MATERIALS TO REDUCE SEEPAGE IN FOUNDATION WORKS

Răducu-Mihai Geantău, Ancuța Rotaru, Traian-Dănuț Babor

[2]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Construction and Installations,
1 Prof. D. Mangeron Blvd. 700050, Iasi, Romania

Corresponding author: Răducu-Mihai Geantău, raducu-mihai.geantau@student.tuiasi.ro

PhD Supervisor: Professor Ancuţa ROTARU,
"Gheorghe Asachi" Technical University of Iași, Romania

Abstract:

Innovations in biomimetic materials represent a significant step in the development of sustainable technologies. The key principle of biomimesis is currently a source of inspiration in the development of new materials that have not been sufficiently researched in construction applications. Applications in the aerospace and automotive sectors could benefit from these materials to reduce maintenance needs and improve operational efficiency by reducing resistance caused by water and ice accumulations. However, a very few specific applications include treatments for building exteriors, roofs, bridges, and other structures exposed to the elements. They are also useful in urban drainage systems to prevent blockages and accumulations that can lead to flooding. Hence, hydrophobic biomimetic materials prove to be innovative solutions for many other of the current challenges in the construction and infrastructure sector. By mimicking nature, these materials provide an efficient method of preventing moisture accumulation and mould formation, which can structurally and aesthetically affect constructions.

Exploring and evaluating the performance of hydrophobic biomimetic materials inspired by natural phenomena such as the lotus effect for protecting foundations against water seepage that can compromise their durability and safety, the paper aims to identify and analyse these materials that not only repel water effectively but also offer increased durability under variable environmental conditions.

To effectively address the characteristics of hydrophobic biomimetic materials, the study involves a comparative evaluation of various types of materials, including silicon nanoparticles and modified polymers, which mimic the structure of lotus leaves. The methodology includes a detailed analysis of surface topography at the micro and nano levels through scanning electron microscopy (SEM) and atomic force microscopy (AFM). Contact angles are also measured to assess the hydrophobic properties of each material. This methodological approach allows not only the identification of superior hydrophobic materials but also an understanding of the underlying mechanisms that contribute to these properties.

The potential of hydrophobic biomimetic materials to revolutionize traditional approaches in moisture management and infrastructure protection could significantly extend the lifespan of constructions. Moreover, the use of these sustainable technologies aligns with global objectives to reduce negative environmental impacts, promoting greener and more durable constructions. In conclusion, the study paves the way for further innovations in material design to optimize building foundation performance.

Keywords: biomimetic materials; hydrophobic effect; lotus effect; environmental challenges; sustainable technologies; nanoparticles

ASSESSING CRITERIA FOR MEASURING NORMAL ROUNDABOUT PERFORMANCE BASED ON GEOMETRIC CHARACTERISTICS

Roozbeh Ebrahimi Golshanabadi

National University of Science and Technology "Politehnica" Bucharest, Faculty of Transportation, Bucharest, Romania.

Corresponding author: Roozbeh Ebrahimi Golshanabadi, Roozikkaa@gmail.com

PhD Supervisor: Professor Mihaela Popa
National University of Science and Technology "Politehnica" Bucharest, Romania

Abstract:

The significance of intersection design in urban planning and traffic management cannot be overstated, particularly when considering the role of roundabouts in promoting efficient and safe traffic flow. Roundabouts are a widely recognized solution for maintaining traffic efficiency; however, as traffic volume escalates, their effectiveness can be compromised by their physical dimensions and geometric design. To address this need, various infrastructures are meticulously designed and analyzed. Among these, roundabouts have been implemented within the road network to enhance the productivity of intersections by minimizing delays. Despite their widespread use, there is a notable absence of a robust pattern or model tailored to the traffic conditions in Iran for assessing roundabout performance. This research has delved into the intricacies of delay time and queue length as primary criteria for measuring efficiency. To achieve a comprehensive understanding, data about the geometric characteristics of roundabouts were meticulously collected. Subsequently, this data was subjected to rigorous analysis and simulation using VISSIM software. The study's approach was methodical, beginning with collecting geometric data from a diverse range of roundabouts across different traffic conditions in Iran. The simulations provided valuable insights into the factors that influence roundabout efficiency, including the impact of different geometric designs and the role of traffic volume in causing delays. By analyzing the simulation results, the study identified potential areas for improvement in roundabout design and operation, intending to reduce delay times and queue lengths, thereby enhancing the overall efficiency of the transportation network. In conclusion, the study offers a detailed examination of roundabout efficiency in Iran, contributing valuable knowledge to traffic management and infrastructure development. According to the results, the optimal diameter for the central island for the design of roundabouts is between 15 and 25 meters.

Keywords: performance measurement, normal roundabout, delay time, queue length, geometric characteristics

THE EVOLUTION AND INNOVATION OF INDUSTRIAL STEEL RACKING SYSTEMS: A STRUCTURAL AND FUNCTIONAL ANALYSIS

Șerban Iacob, George Țăranu, Nicolae Țăranu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services
1 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Șerban Iacob, serban.iacob@student.tuiasi.ro

PhD Supervisor: Professor Nicolae Țăranu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

This article reviews the literature on the design and experimental testing of steel rack structures for storage. The rise of e-commerce has led to a growing demand for steel storage racks, requiring flexible structures to meet the logistical needs of warehouses. The variability of these structures in terms of components and configurations, along with their construction from thin, cold-formed steel profiles, results in complex and unpredictable behaviour. The elements of steel racks—such as perforated uprights, beams, and braces—are susceptible to various forms of instability, including buckling, distortion-induced buckling, and lateral-torsional buckling. For these reasons, there is a clear need for experimental tests to understand the behaviour of these structures when in use. The article examines the technical guidelines and recommendations from the principal design codes around the world, as well as an overview of studies where tests were conducted on components, sub-assemblies, and full-scale structures. Even though experimental testing of steel storage racks has been ongoing for over 50 years, there are still significant gaps in our understanding of their behaviour, particularly in response to seismic activity. The article discusses various testing methodologies from standards and studies, focusing on beam-upright connections, upright-baseplate connections, bracing-upright connections, and full-scale testing, which includes both nonlinear dynamic and nonlinear static (pushover) tests. Additionally, the article presents results for base-isolated structures, which, according to existing studies, appear to be highly effective. The study concludes that there is a significant shortage of data on the behaviour of racks, indicating the need for additional research to broaden the knowledge base. Furthermore, the current design codes do not provide clear prescriptions for full-scale testing of these structures, even though full-scale experiments are generally accepted to yield the most accurate results. Therefore, further research and the development of robust testing standards are necessary to ensure the safety and reliability of storage racks.

Keywords: cold formed steel, beam-upright connection, upright-base plate connection, full-scale testing, base-isolated structures.

STAINED GLASS WINDOWS, CANOPIES AND AWNINGS FROM HERITAGE BUILDINGS IN DOBROGEA

Nicoleta Însurățelu, Costel Coroban, Ana Maria Grămescu

”Ovidius” University of Constanța, Faculty of History and Polytical Sciences,
1 Universității, Alley, Building A, Constanța, Romania

Corresponding author: Însurățelu Nicoleta , nicoletainsuratelu03@gmail.com

PhD Supervisor: Professor Costel Coroban
”Ovidius” University of Constanța, Romania

Abstract:

The problem of the present work refers to 3 of the elements of minor architecture, stained glass windows, canopies and awnings. Imposing, precious, beautiful and expensive stained glass windows are decorative compositions for windows, for skylights or for the parts above the doors. Stained glass are the most practical and at the same time, particularly elegant possibility to have natural light inside a building. Thus, beautiful and suggestive images can be created from pieces of colored, opaque or transparent glass. The pieces of glass use to be fix into the meshes of the lead mesh. Stained glass windows, especially large ones, effectively take the place of the wall. Not only that the pieces of glass must fit into the mesh of the lead grid but they must remain attached It is essential that the pieces of glass and the frame of the stained glass become and behave like one part. In the modern era and in Belle Époque, the elements of minor arhitecture completed the entrances in the buildings in a veritable ennoblement. The entrances in buildings use to be marked, and also decorated, with a beautiful and most of the time elegant assembly, composed of awning and door. In the time when the French language was the main source from which neologisms were borrowed, and Western architectural styles were the main sources of inspiration for the constructions of the time, the entrance in to a house, made in the form of a small room of wrought iron, built at the same time with the house, or added later, received his noble name „marquise”, from the distinguished French word „marquise”. Houses with „marchiză” are most often found in the southern part of Romania. So, also in Dobrogea area, especially Dobrogean families whit Olten origin built their houses with beautiful and very practical awnings.

Keywords: stained glass windows, canopies, awnings, minor architecture, Belle Époque

SUSTAINABLE DEVELOPMENTS IN THE PORT OF CONSTANȚA ROMANIA

Alexandru-Cristian Ionescu, Romeo Ciortan

"Ovidius" University Constanța, Faculty of Civil Engineering,
22B Unirii street, 900500, Constanța, Romania

Corresponding author: Alexandru-Cristian Ionescu, ionescualex996@gmail.com

PhD Supervisor: Professor Romeo Ciortan
"Ovidius" University of Constanța, Romania

Abstract:

The evolution of commercial vessels towards larger capacities necessitates the development of new terminals with sufficient depth. One solution is to construct new port terminals where a sufficient depth can be easily attained through extensive dredging works and building of new quay walls. A more sustainable solution will be to increase the depth of the existing berths. Those existing terminals can be adapted through dredging works, but this deepening pose stability and resistance challenges for the existing quay walls. This study explores various solutions for increasing the depth of quay walls, with a case study in the Port of Constanta, Romania. Considerations include minimizing disruption to harbor activities, maintaining the water basin surface, and ensuring machinery compatibility. This paper discusses the used solution in the Work Harbor from Constanța, Romania. Furthermore, after the competition of this project a new project arose that had the same problem as the aforementioned one, an insufficient depth for an efficient operation of large bulk vessels. In this case a new deepening is required, but the challenges were different. First of all, different soil conditions were encountered and also different quay wall loads were present. The solution from the work harbor were adapted to face the new challenges. Analytical and finite element calculations were performed to ensure that the new solution keeps intact the old structure while it can fulfil the port operators desire to maximize their loading and unloading procedures.

Keywords: Harbor infrastructure, dredging, sustainable development

MANAGING URBAN PLANNING IN A MAJOR ROMANIAN CITY: INTEGRATING INDUSTRIAL HERITAGE FOR PUBLIC SPACE RECONFIGURATION - GROUND RULES AND KEY APPROACHES

Razvan Nicolae Ivanciu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Razvan Nicolae Ivanciu, razvan-nicolae.ivanciu@academic.tuiasi.ro

PhD Supervisor: Professor Adrian-Alexandru Şerbănoiu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The research aims to identify possible solutions to the deficiencies of the strategic planning process at the metropolitan level in Romania, with a focus on the dimension of industrial heritage reintegration, its humanization and the transition from peripheral enclaves with a sad memory connotation to social-cultural cores. Two directions of exploitation and transformation of this built heritage into essential social hubs within the community have been identified: exploitation as platforms/sports facilities and exploitation in the form of unconventional spaces for urban art manifestation, particularly graffiti art. The need for transformation has become acute, and it is evident that both the current metropolitan spatial planning documentation and the tools for their implementation are nearly non-existent at all levels: concept, strategies, administrative policies at the metropolitan level, appropriate urban plans for the medium and large-sized cities' metropolitan dimension, as well as the political context or institutional architecture related to metropolitan governance are currently inadequate for the development needs of cities and their peri-urban territories.

The practical component aims primarily to initiate a mapping process of a part of the Iasi industrial heritage within the metropolitan area and its contemporary valorization with adequate integration into the extended urban fabric. Known for their large dimensions, unique interior space characteristics, and the scenic potential of the often accompanying technological installations, industrial complexes also occupy strategic positions in the geography of metropolitan areas, often being included in recently expanded residential areas. The extensive surfaces occupied by industrial zones thus constitute true functional enclaves and, from an architectural language perspective, can be transformed into essential social-cultural nuclei for urban life, as Western experience has demonstrated. The theoretical component aims to establish and optimize a technical administrative service for a metropolitan area.

The process of revitalizing areas with industrial buildings represents an extremely important milestone in the sphere of contemporary urban development management in the context of prolonged transition - from a rigid system tributary to the communist regime - to a fabric that rises from the ashes of the old structures' dissolution, an adaptation that can fully exploit the lonely remaining buildings, like mammoth-ghosts in the daily landscape and transform them into true urban stages when skilled, complex and creative solutions are implemented.

Keywords: Management, metropolitan area, industrial heritage, reintegration, urban revitalisation

MECHANICAL PROPERTIES AND FROST-THAW BEHAVIOR IN ROAD CONCRETE

Bogdan Ionel Luca, Alexandru Panțiru, Marinela Bărbuță

"Gheorghe Asachi" Technical University of Iasi, Faculty of Civil Engineering and Building Services, 1 Prof. Dimitrie Mangeron Blv. 700050 Iassy, Romania
2Romanian Association of Earthquake Engineering

Corresponding author: Bogdan Ionel Luca, bogdan-ionel.luca@student.tuiasi.ro

PhD Supervisor: Professor Marinela Bărbuță
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

This study seeks to explore how waste materials impact the mechanical and durability aspects of road concrete. Specifically, steel slag was utilized to replace aggregates at various percentages, while silica fume replaced 10% of the cement. Experimental analyses were conducted to determine and assess mechanical characteristics such as flexural strength, split tensile strength, and compressive strength. Additionally, the resilience of the road concrete to frost-thaw cycles was investigated.

The results revealed that the mechanical strengths exhibited notable improvements when compared to the control mix (devoid of waste) particularly at lower percentages of aggregate replacement. This suggests that incorporating waste materials can enhance the overall performance of road concrete. Furthermore, the behavior of the concrete subjected to frost-thaw cycles showed better resilience when waste materials were included in the mix, as opposed to the control mix. This indicates that incorporating waste materials not only improves mechanical properties but also enhances durability, crucial for long-lasting road infrastructure.

Keywords: road concrete, frost-thaw, waste silica fume

COMPARATIVE STUDY OF THERMAL CONDUCTIVITY IN LIGHTWEIGHT CONCRETE WITH DIFFERENT WASTE MATERIALS

Radu Gabriel Mihai, Ștefănica Eliza Vizitiu, Gabriel Bejan, Dorin Avram, Marinela Bărbuță, Ligia Melinte, Mowaffak Tawfik

”Gheorghe Asachi” Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services, 1 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Radu Gabriel Mihai, radu-gabriel.mihai@student.tuiasi.ro

PhD Supervisor: Professor Marinela Bărbuță
”Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

This paper investigates the impact of waste content and temperature variations on the thermal properties of lightweight concrete. The adaptability of lightweight concrete has been explored through the use of shredded plastic, polystyrene, and sawdust as substitutes for traditional aggregates in a comprehensive central composite design study. This experimental approach involved the creation and testing of 14 different concrete mixes. One mix served as the control with no aggregate replacement, while the remaining 13 incorporated varying proportions of waste materials as partial aggregate substitutes. The analysis utilized nonlinear response surface methodologies to effectively evaluate the influence of each variable on thermal performance. The study found that the mix incorporating polystyrene granules as an aggregate substitute exhibited the lowest thermal conductivity coefficient, indicating superior insulative properties. Furthermore, specific thermal isolation performances were observed at high dosages: a 50% polystyrene mix achieved the maximum temperature difference (ΔT) under external temperatures of 55°C; a 70% shredded plastic mix showed maximum ΔT at 50°C; and a 50% sawdust mix was most effective at 40°C. Comparatively, 100% polystyrene mixes consistently outperformed other materials in terms of ΔT and had significantly lower thermal conductivity (λ), underscoring their effectiveness in high-temperature scenarios. The incorporation of waste materials as aggregates in all the mixes showed great potential for isothermal insulation, showing their suitability for construction purposes aimed at improving thermal efficiency. These findings not only underscore the utility of recycled materials in reducing the environmental impact of concrete production but also highlight their role in improving building energy efficiency. The use of waste materials as aggregate substitutes in lightweight concrete offers both environmental sustainability and enhanced insulation properties, providing a valuable reference for future research and practical applications in the field of sustainable construction materials. With the goal of minimizing environmental impact and promoting energy efficiency, this study encourages the wider adoption of eco-efficient opportunities in the building sector.

Keywords: lightweight Concrete, thermal insulation, sustainability, waste materials, thermal conductivity

CONSIDERATIONS ABOUT THE EFFICIENCY OF COMMONLY USED INSULATION MATERIALS AT EXTERNAL WALLS FOR HISTORIC BUILDINGS, USING NUMERICAL SIMULATION DATA AND FIELD MEASUREMENTS

Petru Cătălin Miltiade, Irina Baran, Laura Dumitrescu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services, 1 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Petru Cătălin Miltiade, petru-catalin.miltiade@student.tuiasi.ro

PhD Supervisor: Professor Irina Baran
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

In today's context, with energy efficiency a paramount concern, finding optimal solutions for insulating buildings is crucial. This involves considering:

- The high energy consumption during construction to produce materials.
- The substantial energy usage during operation to maintain quality indoor environments for comfort.

This article focuses on historical buildings still in use, such as schools or city halls, built at a time when energy efficiency wasn't a priority. These buildings often have architecturally significant facades that must be preserved, making external wall insulation challenging.
The solution is to insulate internally, but this poses a risk of interstitial condensation, potentially damaging the wall. To mitigate this risk, extensive numerical simulations and experimental measurements are necessary.
In our country, a commonly used solution for internal wall insulation is the MULTIPOR thermal insulation mineral plate. This article aims to evaluate its efficiency and compare it with other solutions to aid in designing insulation for historical building exteriors.
The focus on MULTIPOR arises from data collected from a school in Neamț County, a historical monument with beautiful but sensitive facades. The insulation was applied internally due to concerns about preserving the exterior.
The research goal is to assess the thermal insulation efficiency and prevention of interstitial humidity with MULTIPOR, comparing it to alternative materials on the market. This provides a basis for designers facing similar challenges.
Data collection involved various gadgets measuring humidity, temperature behind the insulation, internal and external temperature, and heat flow. Experimental results were compared with numerical modeling using specialized software.
While some results were expected, others were surprising, detailed in the article. Though similar studies exist comparing internal thermal insulation solutions, this article uniquely evaluates the efficiency of MULTIPOR, a widely used solution in Romania, when placed internally on external walls.

Keywords: insulation materials, historic buildings, Multipor thermal insulation

ANALYSIS OF THE TERRITORIAL EVOLUTION OF THE VALEA LUPULUI LOCALITY, IAȘI COUNTY, FOR THE PERIOD MARCH 2010 - MARCH 2024

Veronica Muraru, Florian Stătescu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Hidrotechnics, Geodesy and Environmental Engineering, 59A Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Veronica Muraru, veronica.nedelcu@student.tuiasi.ro

PhD Supervisor: Professor Florian Stătescu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The socio-economic development of the big cities in Romania involves an expansion of the area of the metropolitan areas that attract the increase in the number of the population through the creation of new jobs and the need to develop all services (housing space, transport, health, education, etc.) that improve the quality of life. This phenomenon of territorial development disrupts the functionality of metropolitan areas. The repercussions of this unplanned development require studies and analysis to take action and come up with viable solutions in the management of territorial organization.

The article aims to highlight the territorial changes that took place following the acceleration of the construction process in the rural area bordering the city of Iasi, studying the dynamics between the built-up and agricultural areas, the evolution of the number of constructions, the impact of the reduction of the agricultural area, the evolution of the Valea Lupului locality and the land fund, etc. For this purpose, the following cartographic materials were used: maps, orthophoto plans, graphic information from the Database of the Iași Cadastre and Real Estate Advertising Office, the Valea Lupului General Urban Plan, Google Earth images and statistical data from the National Institute of Statistics Iași.

Following the processing of graphic and numerical data using the AutoCAD Map program, maps emerged that highlight the territorial transformation of the built-up area from March 2010 to March 2024 with a percentage of over 50%. The connotations of this obtained result imply an adequate management from the local and municipal authorities regarding taking measures and finding solutions in solving new urban planning challenges.

Keywords: dynamics, evolution of the number of the constructions, urban planning, graphic information, territorial changes

STUDIES REGARDING THE STABILIZATION OF FOUNDATION SOILS THROUGH ALTERNATIVE METHODS

Marinela Scanghel

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil engineering and Installations,
1 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Marinela Scanghel, marinela.scanghel@student.tuiasi.ro

PhD Supervisor: Professor Adrian-Alexandru Serbanoiu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The objective of the research is to analyze the results obtained in the most unfavorable cases encountered in the stabilization of foundation soils by determining their characteristics before and after stabilization with binders, to study the technical-economic opportunity given their use as well as possible problems depending on the type of stabilized soil.
Stabilization with binders involves improving the physico-chemical and mechanical properties of the soils following chemical reactions and long or short-term physical processes produced on the structure of the stabilized soils, contributing to changing the resistance of the mixtures.
As a result of the studies carried out until now, it has not been possible to identify all the aspects related to the structural performance of the road sectors in which the road structure contains stabilized layers in relation to those made from classic structures.
Through the doctoral thesis, the particularities, advantages and limits of stabilization processes with enzymatic binders will be followed, especially from the point of view of the behavior during the action of the freeze-thaw phenomenon, aspects that can be used later in the calculation of road structures.
Both at the national and international level, there is quite little information about the behavior over time of soils stabilized with enzymatic binders and for this reason the first step of the research was to study the current conditions regarding stabilization products and their execution procedures, approved at national level/ with international applicability.
Even if stabilization with hydraulic binders leads to obtaining superior characteristics, it is possible that in certain terrain conditions they may not produce the expected effect. In this context, knowing the information about the behavior of other types of binders becomes an area of interest for a safe and efficient design of road structures that aims to ensure the technical requirements of strength, stability, safety and functionality.
The research involves laboratory testing of the samples taken for grain size composition, upper and lower limits of plasticity, specific density, proctor test, optimal moisture content and maximum dry density and derivatives such as plasticity index, soil type, non-uniformity coefficient will be determined.
The second part of the research is represented by performing laboratory analyzes by analyzing several working hypotheses, covering certain types of weak foundation soils and using several types of binders, so that we can obtain comparable results.
The samples made will be subjected to strength tests, respectively CBR (California Bearing Ratio) and compressive strength for different periods after treatment (at different time periods, respectively 7 days, 15 days, 30 days, 60 days, 90 days to had an overview of how binders act on local materials), resistance to freeze-thaw cycles.

Keywords: Soil stabilization, hydraulic binders, enzyme binders

SUSTAINABLE STONE MASONRY STRENGTHENING SYSTEM USING HEMP-BASED MATERIALS

Ionuț Alexandru Spiridon, Dorina Nicolina Isopescu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services,
1 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ionuț Alexandru Spiridon, ionut-alexandru.spiridon@student.tuiasi.ro

PhD Supervisor: Professor Dorina Nicolina Isopescu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Preserving heritage stone masonry structures while addressing sustainability concerns is a pressing issue in architectural and structural conservation. This study investigates the efficacy of a novel consolidation system employing hemp-based materials, aligning with global trends advocating for eco-friendly practices. Hemp, a versatile and renewable resource, is gaining attention for its myriad applications in various industries due to its durability, low environmental impact, and rapid growth cycle. In this innovative approach, hemp fabric reinforcements and chemically anchored hemp cord ties are utilized, thus leveraging the remarkable tensile strength and flexibility of hemp fibers to enhance the structural integrity of stone masonry. Additionally, this system incorporates lime-perlite mortar, a blend known for its compatibility with historic masonry and its insulating properties. Perlite, a volcanic glass material, is lightweight, fire-resistant, and offers remarkable thermal insulation, contributing to the overall energy efficiency of the structure. This combination of hemp-based materials and lime-perlite mortar not only ensures structural stability but also upholds environmental responsibility in architectural heritage preservation endeavors.

A significant advantage of this system is its ability to be applied unilaterally, making it particularly advantageous for monumental constructions where façade interventions are restricted. By focusing on a unilateral application, this approach addresses the complexities of historic preservation without compromising architectural integrity. This research demonstrates that this consolidation technique not only enhances structural resilience against seismic forces but also remarkably improves thermal performance, serving as an effective thermal insulation layer. Moreover, the incorporation of hemp and perlite contributes to the reduction of carbon footprint, aligning with sustainable development goals.

In conclusion, integrating sustainable materials like hemp and perlite into conservation practices not only ensures the longevity of historic structures but also contributes to a more environmentally conscious approach to architectural heritage preservation. By harnessing the potential of hemp-based materials and lime-perlite mortar, this study offers a promising avenue for the preservation and sustainable management of architectural heritage, safeguarding the legacy of past generations for future ones while mitigating environmental impact.

Keywords: stone masonry, strengthening system, hemp-based materials, sustainability, thermal performance

USE OF MODERN WATER LOSS DETECTION TECHNIQUES IN URBAN PIPE NETWORKS

Vasile Stavarachi, Mihail Luca

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Hydrotechnics, Geodesy and Environmental Engineering, Iasi, Romania, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Vasile Stavarachi, vasile.stavarachi@student.tuiasi.ro

PhD Supervisor: Professor Mihail Luca
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Study critically examines modern technology used to detect "water losses"in the pipeline networks used in Romania. The phenomenon of "water losses" occurs inall components of the water supply system and manifests itself with different intensities inpipelines, storage tanks, water treatment plants and pumping stations These losses in water supply systems are around 40% - 65% of the water distributed. In economically advanced countries, water losses in pipe networksurban water mains do not exceed 18 % - 25 %.

Water losses can be by size: a - visible or reported losses that are surface of the land; b - losses that aresurface and require special equipment to detect; c - background losses, in the form of droplets which cannot be detected. The development of modern technology in recent times has led to the development of equipment that can detect different types of water loss. In general, water losses are more easily detected at night in urban pipe networks through flow and pressure balance. This method is enhanced by the use of acoustic equipment. This equipment includes noise loggers with correlation and telemetry systems. Recorders canbe included in software for hydraulic modelling, satellite or geodetection etc.

Noise loggers have been used to detect water losses in the city of Iasi. By using this technique a subsectorisation of a DMA (District Metered Area) is performed with the help of which an accurate map of the losses is illustrated in the GIS (Geographic Information System) interface. The surveys were carried out on a section of a main pipeline of length 239 m long main pipeline, located in the Tătărași DMA, on which 6 noise loggers were installed to detect water losses. The data obtained were processed using the Permalog algorithm. The data processed for the period 23.02 - 05.03.2024 in the area of DMA Tătărași revealed the presence of a water leakage at a connection to the main pipe.

The water loss values recorded were in the range 18 - 22 m^3/h, which indicates the presence of damage on the pipeline. In the second stage, the damage was pre-localised using noise loggers. The exact location was determined using the Hydrolux HL 7000. In the third stage, the following were carried outfield investigation and remediation of the damage. Measurements carried out after completion of theshowed a lost flow value of 0.20 m3/h. The use of noise recording technology and equipment has the advantages of accurate and fast pre-location of the water emission point, fast data acquisition and processing, and data transmission via Wi-Fi. The main disadvantage is the high cost of the investigation equipment.

Keywords: DMA analysis; GIS; logger; pipeline degradation; water loss assessment.

REDUCING RESOURCE CONSUMPTION IN SUBSTRUCTURE WORKS BY REUSING WASTE

Stelian-Ioan Tudoriu, Decebal-Cristian Andrii, Ancuța Rotaru

"Gheorghe Asachi" Technical University of Iași, Faculty of Civil Engineering and Building Services,
1 Prof.dr.doc. Dimitrie Mangeron St., 700050, Iași, Romania

Corresponding author: Stelian-Ioan Tudoriu, stelian-ioan.tudoriu@academic.tuiasi.ro

PhD Supervisor: Professor Ancuța Rotaru,
"Gheorghe Asachi" Technical University of Iași, Romania

Abstract:

Reusing waste in infrastructure works may be a key solution to reducing resource consumption and protecting the environment for a more efficient substructure for our future. By identifying and implementing waste reuse practices in infrastructure projects, costs and environmental impact can be significantly reduced, a sustainable approach being crucial to the challenges of climate change and natural resource conservation. The paper explores methods and advantages of reducing resource consumption in substructure works by reusing waste by examining effective strategies for collecting, sorting, and processing waste into useful resources for sustainable and resource-efficient substructure. The benefits of adopting these practices are also analyzed.
By adopting an integrated and progressive approach it is possible to create a more resilient and sustainable substructure. The paper presents case studies and recommendations for integrating waste reuse practices into future infrastructure projects.

Keywords: reusing waste, sustainable substructures, collecting, sorting and processing waste

THE IMPORTANCE OF ACHIEVING ZERO EMISSION BUILDINGS (ZEB) FOR SUSTAINABLE DEVELOPMENT

Ioan Ursache, Andrei Burlacu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services,
1, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ioan Ursache, ursacheioan@yahoo.com

PhD Supervisor: Professor Andrei Burlacu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The article highlights the importance of implementing the concept of Zero Energy Building (ZEB) in order to achieve the objectives set by the EU regarding the energy performance of buildings.
The European Union (EU) has a well-defined policy framework regarding energy and climate change. This framework encompasses actions at the EU level, as well as collaboration and engagement in international agreements. The EU and its member states coordinate their efforts to address the challenges related to energy and climate change, in accordance with their respective competencies and responsibilities.
In the field of climate change, the European Union (EU) and its member states have played a leadership role in international agreements. The Paris Agreement of 2015 stands as a significant example, where the EU and its member states committed to reducing greenhouse gas emissions and taking measures to adapt to climate change. The EU has set ambitious goals, including reducing emissions by at least 40% by 2030 and achieving climate neutrality by 2050.

Keywords: Zero Energy Building, Energy Performance of Buildings, Climate Neutrality

LONG-TERM BEHAVIOUR OF THE STRUCTURES BUILT WITHIN THE 1950S-1960S TO CONSOLIDATE THE SHORES AND CLIFFS OF THE BLACK SEA COAST IN CONSTANȚA CITY, ROMANIA

Mădălin-Cornel Văleanu, Pavel Ionițoaiei, Ancuța Rotaru

"Gheorghe Asachi" Technical University of Iași, Faculty of Civil Engineering and Building Services,
1 Prof.dr.doc. Dimitrie Mangeron St., 700050, Iași, Romania

Corresponding author: Mădălin-Cornel Văleanu, madalinvaleanu@yahoo.com

PhD Supervisor: Professor Ancuța Rotaru
"Gheorghe Asachi" Technical University of Iași, Romania

Abstract:

The development of human settlement and habitat within the coastal area of the Black Sea inside the current territory of Romania required the development of the coastal area so that to be in agreement with the social and economic needs of the population. Since the 6th century BC, when the first Greek colonies created inside the coastal area of the Black Sea on the current territory of Romania, specific seaport structures were built aiming primarily to facilitate maritime trade, a trend that continued over the time of flourishing and development of Roman and Ottoman empires. As a result of the annexation of this region to Romania in 1878, the coastal area inside the edge of the city of Constanța experienced extensive development due to coherent government policies and openness to new technologies developed at the end of the 19th century. However, the level of technical knowledge concerning the advancement of port structures at the end of the 19th century and the first part of the 20th century combined with the uneven urban development and against the backdrop of a specific geological structure, led to soil instability phenomena affecting either port structures or those structures built to stabilize the seacliffs. Only after the end of the Second World War, a new stage in the development of this area began, including the expansion, design, and construction of port and coastal defence and consolidation structures of the seacliffs. However, even at this stage, incidents and technical accidents were not uncommon. The study aims to analyze in the form of a case study the long-term behaviour of certain coastal defence and consolidation works of the seacliffs inside the city of Constanța, designed by the remarkable professor and engineer Ioan Stănculescu (1919-2002) and executed between 1955 and 1958. Those over 65 years that have passed since the structure was put into operation in 1958 allow the authors to highlight specific aspects of the long-term behaviour of those important constructive coastline structures and also the causes that contributed to their degradation.

Keywords: Black Sea costal area, Constanța seaport, seacliffs, retaining structures

SECTION 5.
Mechanical engineering;
Industrial engineering;
Materials engineering;
Engineering and management

OPTIMIZATION OF PROTECTIVE THERMAL SHIELDS FOR TEG ENERGY RECOVERY DEVICES IN ICE SYSTEMS

George Achitei, Lamara Achitei, Aristotel Popescu

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Mechanical Engineering
61 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: George Achitei, george.achitei@academic.tuiasi.ro

PhD Supervisor: Professor Aristotel Popescu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Recovering the energy contained in waste heat from various activities is an important issue to increase efficiency of energy use. A thermoelectric generator (TEG) is a device that converts thermal energy into electricity using a system of semiconductor elements. This concept was first illustrated by the German physicist Thomas Seebeck in the 1920s. The operating principle of a TEG is based on the occurrence of an electric current in semiconductor n- and p-type elements, connected in series, stacked between two ceramic plates. When one ceramic plate is cooled and the other one is heated, a thermoelectric current occurs and electrical voltage is obtained. Although TEG technology can convert heat directly into electricity, the conversion efficiency is quite low. To reduce environmental pollution with waste heat and increase energy recovery, efforts are being made to optimize these systems (number, size, shape, positioning, etc.). This study focuses on processes within internal combustion engines and recovery methods based on TEG. The experimental setup used TEC1-12706 SR, that is a 12V 60W Peltier TEG, with 40 x 40 x 3.8mm dimensions and withstands temperature differences (for cooling or heating) up to 138 degrees Celsius. Since the exhaust gases from internal combustion engines is much higher and may destroy the TEGs, the latter should be protected by a material that should partially transfer thermal energy from exhaust system to TEGs. The aim of present research is to test different protective (yet conductive) materials to shield the TEG in the proposed device. The hot side is subjected to different temperatures from an open flame, while the cool side was considered at ambient temperature. During experiments, current and voltage output from the device were constantly measured, at certain time intervals, using two different meters that recorded in real time all the values. The temperature difference was measured using thermocouples mounted on ceramic sides of the TEG, and the values were read using a thermocouple scanner. While a stainless steel plate would ensure a higher thermal protection, the best conductivity and TEG energy output is obtained when a copper protective plate is used.

Keywords: thermoelectric generator, thermal management, waste energy, automotive, seebeck effect

PRELIMINARY RESULTS ON YSZ (HIGH Y_2O_3 CONTENT) CERAMIC LAYERS

Ionuț Adomniței[1*], Gheorghe Bădărău[1], Marian Luțcanu[2], Daniela Lucia Chicet[1], Nicanor Cimpoesu[1]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Materials Science and Engineering,
41 Prof. D. Mangeron Blvd., Iasi, 700050, Romania
[2]"Gheorghe Asachi" Technical University of Iasi-Romania, Department of Physics,
67 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ionuț Adomniței, ionut.adomnitei@student.tuiasi.ro

PhD Supervisor: Professor Nicanor Cimpoeșu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Ceramics materials, nowdays, are used in industry also as thermal barrier based on their great properties of high temperature resistance, wear, corrosion resistance and high mechanical strength. The ceramic coatings represent the ideal solution for metallic elements used in environments with high temperatures for their protective role keeping the metallic properties of the elements. Since it has a higher coverage area and a lower production cost, one method of deposition on metal substrate can be atmospheric plasma spraying (APS). A NiCr anchor layer was firstly deposited on the metallic substrate before the YSZ deposition (six layers with 90˚ orientation of each layer). For deposition process a robotic arm was used in a clean room. Analysing a deposited ceramic layer (37% Y2O3 with stabilized zirconia) through atmospheric plasma spraying (APS) we observe that it becomes chemically homogeneous, without cracks, pores or fissures of the layers on the surface. Pulverization plasma jet processes are widely used for large areas covers and the robotic arm is helpful for complicated geometrically shape substrates. Ceramic layer shows discontinuities with uncoated surfaces, as the substrate is almost in contact with the environment. Structural, morphological and chemical evaluation of the coatings (on top and in depth) were realized using optical microscopy (OM Zeiss + MotiCam digital camera), scanning electron microscopy (SEM VegaTescan LMH II, SE detector) and energy dispersive spectroscopy (EDS Bruker X-flash). The results reveal obtaining of compact ceramic layers with a reduced number of pores. Resistance to thermal shock was investigated with a solar concentrator (Promes Facility, France) by concentrating repetitively a high temperature on a small area using solar heat. Samples with anchor layer resists until extremelly high temperatures (near 2000˚C) without craking or evaporation confirming the role of thermal barrier of the ceramic layer that cover the metallic substrate. Near and in the heated area no cracks or defects were observed.

Keywords: ceramic coating, plasma coating, SEM, EDS

MODERN METHODS OF SEVERE PLASTIC DEFORMATION: A SHORT REVIEW

Ștefana Dochița-Agop, Ioan-Gabriel Sandu, Nicanor Cimpoeșu, Costică Bejinariu

"Gheorghe Asachi" Technical University of Iasi, Faculty of Materials Science and Engineering, 67 D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ștefana Dochița-Agop, stefana.agop@academic.tuiasi.ro

PhD Supervisor: Professor Costică Bejinariu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The study provides an overview of modern methods used in severe plastic deformation processes. Many plastic deformation techniques have gained significant attention for their ability to refine the grain structure and a property of the analyzed mechanical materials. Various contemporary methods, such as high-pressure twisting, equal-channel angular pressing, and accumulative role bonding, are analyzed in terms of their principles, advantages, and applications at the scientific level. The integration of severe plastic deformation techniques used in the field of implantology is a promising way improve the mechanical property and performance of dental work devices. By subjecting biocompatible materials to severe plastic deformation, it is possible to obtain refined microstructures, good strength and tailored mechanical properties suitable for implantology applications. The purpose of this studio is to highlight recent advances and key findings in the field of severe plastic deformation, providing insights into the evolving landscape of materials processing and development in implantology field.

Keywords: severe plastic deformation; mechanical property; biocompatible materials; implantology; performance

EXPLORING MOST USED METHODS OF EVALUATING HUMAN RESOURCE PERFORMANCE: IMPLICATIONS FOR ORGANIZATIONAL SUCCESS

Florentina Bîrlădeanu Eftincă, Silvia Avasilcăi, Adriana Bujor, Ana Maria Dobranici Dumitrescu

”Gheorghe Asachi” Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management, 29 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ana Maria Dumitrescu, ana-maria.dumitrescu@student.tuiasi.ro

PhD Supervisor: Professor Silvia Avasilcai
“Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Performance is understood, in most cases, as a subjective perception of reality, which has led to a multitude of criticisms, opinions, definitions on the concept itself, but also on the measurement tools. A really delicate problem in the management of an organization is represented by the evaluation of the professional performance of the human resource. Evaluation is part of the managerial function of control and provides a picture of the reality of the organization. The human resource performance evaluation process is an essential component of organizational performance management. Performance evaluation is one of the basic activities of human resource management, which determines the extent to which the organization's employees have completed their work tasks and responsibilities. Performance evaluation takes place to help management make decisions related to staff mobility within the organization and offers employees and managers the opportunity to identify training needs, in order to acquire new skills that in the future will lead to the improvement of the quality of the work performed by employees. Evaluation can also represent a motivational factor for certain employees, some organizations offering, in this sense, bonuses or rewards to employees who record better performances from one period to another. From the need to assess the human resources in an organization as objectively as possible, a multitude of methods and techniques for evaluating professional performance have emerged. The quality of assessment depends on the quality and complexity of assessment methods. Hence, the employee performance appraisal system is generally considered to be essential in organizations and is used for many different purposes such as: salary increases, improvement and training, transfers, compensation, counseling, promotion, employee recognition, termination etc. These purposes are legitimate reasons for using performance appraisal systems in organizations. The paper aims to present a comprehensive examination of the diverse approaches used to assess human resource performance accros various organizational settings. Employing an exploratory research approach, the study seeks to uncover and emphasize the preferred evaluation methods adopted by companies to gauge their employees' effectiveness and enhance overall human resource performance, thereby contributing positively to organizational outcomes.

Keywords: evaluation methods, human resources performance, management performance

IMPACT OF CHEMICAL CORROSION ON MECHANICAL CHARACTERISTICS OF MORTAR WITH NANOPARTICLES ADDITION

Elena Basalic Mocanu[1], Daniel Lepădatu[2], Cosmin Mocanu[2], Ramona Cimpoeșu[1], Loredana Judele[2], Nicanor Cimpoesu[1]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Materials Science and Engineering, 41 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Civil Engineering and Building Services, Bd. D. Mangeron 1, Iași 700050, Romania

Corresponding author: Elena Basalic Mocanu, elena.mocanu-basalic@student.tuiasi.ro

PhD Supervisor: Professor Nicanor Cimpoesu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

In recent years, cementitious materials have been strongly influenced by increasing varied additions of different types and structures, starting from a multitude of recyclable waste (such as fibers or dust) and going up to increasingly complex additions of nanoparticles of different shapes and structures, which can greatly change their behavior, but especially their microcrystalline structure. The corrosion of cementitious materials following the attack of various chemical agents represents a serious problem of their structural degradation and which can generate substantial losses of strength and mass. If there are no measures to prevent this phenomenon, either by treating their surfaces with varnishes or protective paints, or by incorporating protective additives into the concrete recipe, the latter is possible only where the working conditions of these materials are known in advance. In order to improve the mortar's corrosion behavior, we added four types of nanoparticles (silicon dioxide, graphene nanoplatelets, carbon nanofibers, and multi-walled carbon nanotubes) to its recipe. They are able to improve or slow down this degradation. We subjected the samples to corrosion with three types of chemical agents (acids) individually but also in a mixture (sulfuric acid, hydrochloric acid, and nitric acid, 1% concentration). Each exposure lasted about 90 days. It is not precisely known the percentage and type of nanoparticles that must be added to the mortar recipe so that it improves the characteristics desired by the user depending on his working environment. For this reason, in this research, the influences of these nanostructured additions on the physico-mechanical characteristics of the mortar subjected to the chemical corrosion attack with different acids will be highlighted in order to be able to identify the one that has the best possible behavior to the acid attack and, by optimizing percentage, determine its quantity. Of course, it will be possible to go further and try to couple the types of nanoparticles two by two and even three. Mass loss is also an important indicator for studying the influence of the corrosion phenomenon and was quantified with great precision (10^{-4}g) to be able to differentiate the effects on each mortar sample with the four types of nanoparticles.

Keywords: Nanoparticles, chemical corrosion, mortar, mechanical properties

THE EFFECT OF DIGITAL MARKETING STRATEGIES ON THE GROWTH OF THE COMPANY'S PERFORMANCE

Sebastian Birzu[1], Silvia Avasilcăi[2]

[1]”Gheorghe Asachi” Technical University of Iasi-Romania, Faculty of Mechanical Engineering, Blvd. Mangeron, No. 59A, 700050, Iasi, Romania
[2]”Gheorghe Asachi” Technical University of Iasi-Romania, Faculty of Mechanical Engineering, Blvd. Mangeron, No. 59A, 700050, Iasi, Romania

Corresponding author: Bîrzu Sebastian, sebastian.birzu@tuiasi.ro

PhD Supervisor: Professor Avasilcăi Silvia
“Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Digital marketing is essential to a company's performance-enhancing strategy in an increasingly digitized world. The primary purpose of this article is to show the effects of using digital marketing in increasing a company's performance and suggest to the top management that only by implementing digital marketing strategies can they remain at least on par with their competitors. This paper aims to explore the current state of knowledge in digital marketing and demonstrate its increasing importance in companies' digitalization in Romania and other countries. Through this research, we want to see the current state of knowledge regarding digital marketing and demonstrate that this marketing branch has become vital in the digitalization of companies in Romania and abroad. To achieve this goal, we will develop a framework structure that will highlight the main channels of online marketing and how they can influence a company's financial and non-financial performance.
The managers of the companies must understand that by adopting these models and strategies, they will contribute as much as possible to the fulfillment of the objectives they have set themselves and be one step ahead of the competition, perhaps even predicting their steps with the help of digitalization and mainly digital marketing. The companies that will choose to create their marketing departments and digital marketing departments will succeed in stepping headfirst into what we call the new stage of evolution, but also the economic challenges to which the companies will be subjected, the economic environment due to military conflicts and economic instabilities that will come.

Keywords: marketing, digital marketing, performance, technological progress, scientific research

HARNESSING HEAT FROM VEHICLE EXHAUST FOR AUTOMOTIVE APPLICATION

Robert-Marian Bleoțu, Cosmin Preda

Lucian Blaga University of Sibiu, Department of Industrial Machinery and Equipment,
Victoriei Street 10, 550024, Sibiu, Romania

Corresponding author: Cosmin Preda, cosmin.preda@ulbsibiu.ro

PhD Supervisor: Professor Pinca-Bretotean Camelia
Universitatea Politehnica Timişoara, Facultatea de Inginerie Hunedoara

Abstract:

Hybrid vehicles, with their dual power sources of internal combustion engines and electric motors, represent a pivotal step towards greener transportation solutions. To further augment their efficiency and reduce environmental footprint, integrating heat recovery systems into hybrid cars' exhaust systems has garnered considerable attention. This study explores the complex domain of electric energy generation through heat recovery, specifically designed for hybrid vehicle exhaust systems. The following research analyses the principle of harnessing wasted thermal energy from the exhaust system process and converting it into usable electric power. Through a comprehensive exploration of various heat recovery technologies, including thermoelectric generators (TEGs), this paper highlight mechanism, advantages, and challenges in the context of hybrid vehicles. TEGs, leveraging the Seebeck effect, offer direct conversion of heat differentials into electricity which is mainly used in different automotive systems for heat energy recovery, with high efficiency. The high potential of the use of this recovery technology is analyzed in this work, in which a constructive analysis for the regenerative system will be carried out, a CAD modeling will be approached, and later the integration of this system in the current component of a motor vehicle will be carried out. A thermal analysis will be performed for different operating parameters of the vehicle, which will generate different temperature values. These will be analyzed from an energetic point of view, when the thermal energy is transformed into electrical energy. The component of the thermo-electric generator will be selected according to the values and parameters obtained following the constructive analysis of the regenerative system, later the technical parameters of the regenerative component will be presented. Current research mainly focuses on enhancing the efficiency and integration of heat recovery technologies, and refining system integration strategies. In conclusion, heat recovery systems for hybrid vehicle exhausts represent a novel system towards sustainable transportation. These systems have the potential to significantly augment hybrid vehicle efficiency, extend driving range, and for environmental impact.

Keywords: heat recovery, electric energy generation, automotive exhaust, thermoelectric generators, electric vehicles

MANAGEMENT RISK MODELS. THEORETICAL APPROACH

Mihai-Doru Buliga, Ion Verzea

”Gheorghe Asachi” Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management
29 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Buliga Mihai-Doru, mihai-doru.buliga@student.tuiasi.ro

PhD Supervisor: Professor Ion Verzea
“Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Risk in literature is defined by terms like "the possibility to compromise or to lose an asset" or "the combination between the likelihood and the gravity of losses". The scientific subject of risk management is relatively new, being formed just in the previous 30 to 40 years. This period characterized the beginning of scientific journals, conferences, and publications that addressed the fundamental ideas and concepts of risk assessment and management. The majority of society, whether in the private sector or public administration, today uses risk analytical methodologies and procedures that have been developed into new and more advanced processes.
The main purpose of the study is to provide an short but comprehensive framework for several models of risk management (SWOT, VaR, Map Risk, Saftey Barrier) for creating a comparative analysis. To define the process we used as research methods: the system approach, formalisation, risk theory and modelling, analysis, and synthesis by examining existing literature and collecting data through a thematic review. As the main results in the framework, we highlighted, the main advantages and disadvantages of using the previously mentioned risk management models. The SWOT can be used by any person or stakeholder group and for any strategic goal, but does not give a straight solution or recommendation for developing a strategic plan. Var-models have a specific area – financial and investment and offer a high score fidelity but can be used only by experts. The purpose of Map-Risk is to describe the possible negative effects of a specific risk, however, a precise solution is not provided. In summary - to identify the perfect solution considering that risks are now able to happen anywhere and considering the theory of contingency continues to take on new dimensions - can be challenging. The positive aspect is that an optimal framework can be created by integrating various risk management methods.

Keywords: Risk Management, VaR, Map-Risk, SWOT, Saftey Barrier

SAFETY HELMETS RECYCLING AND SELECTION: A SHORT REVIEW

Cristian-Ștefan Bunduc, Leandru Gheorghe Bujoreanu, Ramona Cimpoeșu, Costică Bejinariu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Materials Science and Engineering,
67 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Cristian-Stefan Bunduc, cristian-stefan.bunduc@academic.tuiasi.ro

PhD Supervisor: Professor Costica Bejinariu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Safety helmets or hard hats are among the most important personal protective equipment (PPE), especially in the construction industry or any other industry that includes working at different heights or in areas where the risk of falling cannot be avoided. Currently, there are many types of safety helmets on the market; therefore, both the design and the type of materials used for their manufacturing are related to their areas of application. Among these, some of the most important are industrial safety helmets, due to the impossibility of eliminating the risks of head trauma in different working conditions. This category occupies a special place, especially when it comes to workplace safety. Nevertheless, usually the most serious and disruptive occupational injuries, i.e., work-related traumatic brain injuries, are due to the misuse or use of non-suitable helmets. However, in some cases, even if the type of helmet was chosen correctly, the failure of this PPE can be related to the material's durability since aging processes cannot be avoided. Therefore, before use, the safety helmets must be subjected to rigorous inspections to assure the safety of the operator. In practice, these tests are almost impossible since most of them can only be performed by specialized personnel or equipment and not by visual inspection of the operator. Consequently, to prevent any accidents, the users are forced to replace the hard hats after short periods of use. To assure sustainability in this sector, it is highly necessary to develop safety hats that use green materials for their manufacturing while finding eco-friendly methods of recycling the old ones. This study presents a short overview of the literature regarding the use and recycling of safety helmets, focusing on the shortcomings of each type of material that is used for their manufacturing. Therefore, it was observed that even though most of the hard hats are made of plastics (thermoplastics, ABS, polyethylene, etc.) or composites, their reuse is strongly limited due to the inevitable degradation of the materials used for the manufacturing of their shell.

Keywords: safety helmets; composite materials; personal protective equipment; hard hat; materials selection

IMPROVED PROPERTIES BY FFF BICOMPONENT 3D PRINTING OF POLYMERS – A REVIEW

Maria Catană, Simona-Nicoleta Mazurchevici, Dumitru Nedelcu

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Machine Manufacturing and Industrial Management
Prof. D. Mangeron Blvd., no. 53A, 700050, Iasi, Romania

Corresponding author: Maria Catana, maria.catana@student.tuiasi.ro

PhD Supervisor: Professor Dumitru Nedelcu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Multi-material 3D printing using Fused Filament Fabrication (FFF) deposition technology is considered promising because of the many advantages it offers. The most important of these are relatively low production costs, improved mechanical properties, wide range of materials, complexity and high functionality of the resulting parts. The aim of this work is to review the literature to see the possibilities of combining different materials, the affinity between them, optimization of input parameters so that mechanical properties are improved. The main challenge in combining two or more materials is the interface and how the layers adhere to each other. The order of the printed materials, the degree of filling and the printing temperature can influence the quality of the deposited layers. In order to achieve high performance parts it is necessary to take into account the properties of the materials and their compatibility. The main parameters that have an enormous influence on the quality of the finished part are the filling pattern, extrusion temperature, thickness of the deposited layer and printing speed. The major concern of researchers in the field has been to study the interface area generated by the two deposited materials. It was observed that this interface shows how different materials (PLA/TPU, PC/ABS, TPU/ABS, ABS/ PLA and PCL/ PLA interact with each other. Tests show that the strength of a joint depends much more on the geometry of the interface than on the chemical compatibility between materials. It was found that the T-shaped interface led to favorable results in terms of the mechanical characteristics of 3D printed parts. Another aspect observed is the drastic decrease in Young's Modulus and tensile strength when the two materials are not chemically compatible. Also, the way the materials are printed, the amount of filler and the printing temperature play an important role in achieving good adhesion between layers.Thus, according to the results obtained it was concluded that the mechanical performance of parts additively manufactured with multiple materials is usually better compared to parts printed from a single material.

Keywords: multi-material 3D printing, FFF technology, biodegradable polymers, interface geometries, input parameters

A DOCUMENTARY SYNTHESIS OF THE RESEARCH-DEVELOPMENT STAGE OF SOLID-STATE ORDER-DISORDER TRANSITION IN CU-BASED SHAPE MEMORY ALLOYS

Șerban Chimir, Leandru-Gheorghe Bujoreanu

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Materials Science and Engineering,
41 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Șerban Chimir, serban.chimir@student.tuiasi.ro

PhD Supervisor: Professor Leandru-Gheorghe Bujoreanu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Shape memory alloys (SMAs) are characterized by a reversible martensitic transformation which represents the microscopic mechanism of the Shape Memory Effect (SME). During this reverse martensitic transformation, the martensite retransforms to the parent phase (austenite), during heating or isothermal unloading, if the martensite phase was stress-induced. β-type SMAs are characterized by an austenitic phase with a body-centered cubic (bcc) crystalline structure and an electronic valence (number of valence electrons/number of atoms of the unit cell) of approx. 1.5. According to the solid sphere model, a bcc unit cell comprises a central atom surrounded by eight atoms that form the eight corners of a cube. When a second or third atomic species is involved, more ordered structures can be obtained. Most of the β-type SMAs experience a thermoelastic martensitic transformation, which is characterized by a continuous balance between the thermal and elastic effects. The most representative β-type SMAs are NiTi and Cu-based, the latter being represented by Cu-Zn-Al and Cu-Al-Ni(Mn) systems. In Cu-based SMAs, the crystalline structure of austenite is ordered. The first atomic ordering, when considering at least two atom species, involves an atom of the first species, for example A, to be surrounded by eight atoms of the second species, B. By simply imagining such a unit cell, one can easily observe that each atom of the B species is surrounded by eight atoms of A species. Since these eight atoms simultaneously belong to eight unit cells, the stoichiometric formula would be the equiatomic AB. This is the case of the intermetallic compound CuZn, from Cu-Zn-Al SMAs. On the other hand, at Cu-Al-based SMAs, the stoichiometric formula of austenite is Cu3Al. When adding the third alloying element, such as Ni or Mn, the unit cell becomes even more ordered since the first atomic species would be in the center of the unit cell, the second would occupy two unparallel diagonals of two parallel faces and the third atomic species would occupy the rest of the four remaining positions.

Keywords: Order-disorder solid state transition; shape memory alloys; crystallography; differential scanning calorimetry; cycling effects

DIABETIC FOOT COMPLICATIONS

Adriana Chirilă, Aura Mihai, Manuela-Lăcrămioara Avădanei, Mariana Costea, Alina Iovan-Dragomir

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management, 29 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Adriana Chirilă, adriana.chirila@student.tuiasi.ro

PhD Supervisor: Professor Manuela-Lăcrămioara Avădanei
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Diabetes mellitus is a complex chronic condition characterized by elevated blood glucose levels, disrupting glucose, protein, and lipid metabolism. The condition has profound effects on multiple organs and systems, significantly impacting the quality of life for affected individuals. Research indicates that people affected with diabetes experience a lower quality of life compared to the general population, affecting physical health, role fulfillment, and overall health perception [1]. In Europe, approximately 61 million people have diabetes, with increasing prevalence due to rising obesity rates, unhealthy diets, and physical inactivity. Romania has witnessed a rapid increase in diabetes cases among adults, with prevalence rising from 4.21% in 2011 [2] to 8.4% in 2021 [3].This article highlights foot complications that are prevalent among diabetic individuals mainly from sustained high glucose levels, with ulcers and amputations posing significant health and economic burdens. Research consistently reveals that foot ulcer risk can be reduced through the use of therapeutic footwear and orthopedic devices. Other components of importance are the specific design features for sole and insole construction that differentiate diabetic footwear from the conventional one. Cushioning emerges as an essential characteristic, serving to reduce pressure points and minimise the risk of skin damage and ulceration. This is particularly important given the diminished nerve capacity in the feet that many diabetic patients have due to peripheral neuropathy [4]. There are a number of therapeutic products in the diabetic footwear range that have demonstrated varied efficacy in the treatment and prevention of ulcers. Types of footwear may include fully customised footwear (e.g., customised insoles used in customised footwear), semi-customised footwear (e.g., customised insoles used in regular footwear) or non-customised footwear (prefabricated insoles used in regular shoes) [5]. Incorporating medical footwear into diabetic care plans is essential for improving patient quality of life and preventing severe complications associated with diabetes-related foot pathologies. By analysing the factors that influence the quality of life of these patients and researching the importance of technical, diabetic footwear, footwear designs can be developed that meet the specific requirements of this vulnerable patient's group.

Keywords: Diabetes, diabetic footwear, footwear, insoles, therapeutic footwear, foot, amputations

PERSPECTIVE ON PERFORMANCE MANAGEMENT FORMS

Rebecca Ana Maria Chiriţă, Cristina-Elena Ungureanu, Ioana-Alexandra Sbîrcea

University Politehnica of Bucharest, Doctoral School of Entrepreneurship, Business Engineering and Management, Splaiul Independenței no. 313, sector 6, 060042, Bucharest, Romania

Corresponding author: Rebecca Ana Maria Chiriţă, Chiritarebecca72@gmail.com

PhD Supervisor: Professor Elena Fleacă
University Politehnica of Bucharest, Romania

Abstract:

Workplace performance management represents a critically important and engaging field for organizational managers across various industries. This article aims to provide a systematic perspective on the significance of performance management within a company, drawing upon references from specialized literature. First and foremost, it is essential to define the concept of performance management within the organizational context. It encompasses a complex set of actions and processes designed to enhance the overall performance of the organization. It is a strategic approach that aims to align individual and team objectives with long-term organizational goals. A review of relevant literature indicates that performance management offers multiple benefits to organizations. Firstly, it serves as a driver of organizational evolution, ensuring that resources and efforts are directed towards achieving strategic objectives. Additionally, performance management continuously motivates employees, contributing to increased engagement and satisfaction within the company. An important aspect of performance management is the ongoing process of evaluation and feedback. This enables managers to monitor employee performance in real-time and identify opportunities for improvement. By integrating appropriate managerial interventions, the organization can enhance operational efficiency and promptly respond to changes in the business environment. Furthermore, performance management fosters a culture of continuous learning and development within the organization. By establishing clearly defined objectives and providing constructive feedback, this process contributes to the development of employees' skills and competencies over time. In summary, workplace performance management is a fundamental pillar of organizational success. Its future-oriented approaches and continuous evaluation processes enable companies to adapt and thrive in a constantly changing competitive environment. Through the effective implementation of performance management practices, organizations can achieve significant improvements in overall productivity and performance.

Keywords: Work Performance, Human Resources, Continuous improvement, Employee Motivation, Factors of Influence

3D PRINTING OF PARTS USING BIODEGRADABLE FILAMENTS REINFORCED WITH METALLIC PARTICLES

Lucian-Corneliu Dârlău

”Gheorghe Asachi” Technical University of Iasi-Romania, Faculty of Machine Manufacturing and Industrial Management
59A Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Lucian-Corneliu Dârlău, lucian-corneliu.darlau@student.tuiasi.ro

PhD Supervisor: Professor Dumitru Nedelcu
“Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Additive manufacturing (AM) has some indisputable advantages over conventional manufacturing processes (milling, cutting, turning, drilling etc.), such as: the possibility of obtaining parts with complex geometries, internal cavities, etc.; the materials used (polymers, composites, low-melting metal alloys) are very numerous, and new materials are constantly appearing and it is a simple and cost-effective manufacturing process (it does not require complex and customised tools and fixtures for each new part). Material extrusion (ME) (piston, filament or screw) is the most widely used AM technology. Filament extrusion is the most accessible variant of ME technology and will be used in this study. Basically, a 3D printer with a dual extruder will be used. For the last 5 years, 2018-2023 (at the beginning), I have identified only 11 studies aiming to obtain AM samples from polymers reinforced with micro/nanoparticles metal/ceramic, with first authors as follows: Gonzales-Gutierrez (2018); Abel; Thompson (2019); Gloeckle; Godec; Lu (2020); Naranjo (2021); Gonzales-Gutierrez; Riaz; Thompson (2022); Carrozza (2023). Certainly, the existing gap will be filled by future research. The paper focus on a comparative analysis to determine the physico-mechanical properties. Therefore, some composites with PLA matrices highly reinforced with metal particles will be studied. Inside of the papers will be study 3 types of filaments, copper reinforced, stainless steel and magnetic iron, produced by The Virtual Foundry (USA) and distributed in Europe by Filament2Print company. These filaments will be extruded in pairs, two by two. The second aim of the study is to improve/optimise the properties (such as stiffness) of the printed parts. AM technologies are advantageous (inexpensive equipment, with very low material losses) to obtain unique parts with complex geometries at low manufacturing costs, compared to traditional manufacturing processes. More and more new applications are emerging for materials previously used only in subtractive technologies, which are very costly for micro-production.

Keywords: additive manufacturing, 3D printing, material extrusion, highly-filled polymers, dual extruder 3D printer

LEAN SIX SIGMA 4.0: AN INNOVATIVE STRATEGY FOR A SUSTAINABLE MANUFACTURING ECOSYSTEM

Nicoleta-Mihaela Căsăneanu Dascălu, Marius Pîslaru

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management
29 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Nicoleta-Mihaela Căsăneanu Dascălu, nicoleta-mihaela.dascalu@student.tuiasi.ro

PhD Supervisor: Professor Marius Pîslaru
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The objective of companies that use the technology of Industry 4.0 is to achieve the synchronization of intelligent machines during an entire process from end to end. Also, the adoption of the Lean Six Sigma (LSS) approach has demonstrated significant achievements in improving manufacturing effectiveness and quality requirements. The combination of Industry 4.0 and Lean Six Sigma creates a powerful partnership for developing a sustainable innovation ecosystem in the manufacturing industry. This integration permits companies to completely and effectively utilize an array of interactions with consumers, partners in business, and employees, which can lead to many benefits. Therefore, it is essential to explore the integration of LSS powerful instruments and techniques with the practices of Industry 4.0,a field that focuses on technological innovation. Additionally, it examines whether LSS establishes a solid foundation to achieve the overall benefits of Industry 4.0 by developing a resilient, employee-friendly, and adaptable work system that effectively uses technological advances to improve people's well-being.This study aims to improve understanding of the synergy connection between Lean Six Sigma (LSS) and Industry 4.0 by examining existing literature and collecting data through a thematic review. The objective is to generate new frameworks and perspectives. An in-depth examination of a literature review highlights important questions. Q1: How does Industry 4.0 technologies, as well as Lean Six Sigma tools and techniques, achieve innovation and a sustainable manufacturing ecosystem? Q2:How does Industry 4.0 technologies and Lean Six Sigma tools and techniques integrated to support the manufacturing ecosystem? The goal is to propose a framework for a sustainable manufacturing ecosystem based on the significant factors that result from the issues raised in the questions. The sustainable manufacturing ecosystem highlights the integration of Lean Six Sigma methodologies with new technology,Industry 4.0,to optimize manufacturing processes. This integration improves transparency in supply chain activities and enables organizations to focus on customer satisfaction by delivering high-quality services. Additionally, employees have the opportunity to improve their skills and engage in more value-added tasks throughout the production process.

Keywords: LSS 4.0, resilience, tecnology, digital, conceptual model, industry

ROMANIAN PRE-UNIVERSITY EDUCATION INSTITUTIONS: SOCIAL OR BUSINESS ORGANIZATIONS?

Ana Maria Dobranici Dumitrescu, Silvia Avasilcăi, Adriana Bujor, Florentina Bîrlădeanu Eftincă

”Gheorghe Asachi” Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management,
29 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ana Maria Dumitrescu, ana-maria.dumitrescu@student.tuiasi.ro

PhD Supervisor: Professor Silvia Avasilcăi
“Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Society expects and demands the school to develop students’ abilities to integrate into it. Therefore, one of the investigation areas in the sociology of education is the school as a social system, due to the fact that there is a close relationship between the goals of the school and the expectations and values of society. Society affects the school education and the school education affects society through its results. In our current era, schools grapple with the informal education provided by mass media, coupled with a significant decline in student enrolment and alarmingly high dropout rates, reaching 18-20%, among the highest in Europe. When we factor in family issues that directly impact students' interest in education, we begin to grasp just a fraction of the complex context within which we strive to deliver quality education at national level. Education, serving as a vital link between society and its components, is not only influenced by but also shaped by these very factors. The school should be seen as an organization carrying out education and training activities in a competitive market for service providers. Its competitiveness lies in the ability and speed of adaptation to the needs of the economic and social environment. The products sold are skills. The services offered by a school can be considered of "quality" only to the extent that its products and processes meet the needs, requirements, and expectations of customers (businesses, organizations, students) and partners (state, community, local public administration, parents). The objective of this paper is to depict an educational institution as a functional organization and underscore the relevance of treating it similarly to profit-oriented enterprises. To gain a comprehensive understanding of this concept, a literature review will be conducted, drawing upon books, studies, and professional articles. Through exploratory research, the study will focus on examining how a pre-university educational institution in Romania exhibits organizational characteristics. This analysis will delve into the functions, structure, organization, and roles of these institutions to demonstrate their resemblance to typical organizations.

Keywords: education, organization, school, social environment

PILLARS OF THE INDUSTRY 5.0 USED IN INDUSTRIAL ENGINEERING

Florin-Daniel Edutanu, Mariana Ciorap

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Faculty of Machine Manufacturing and Industrial Management, 59A Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Florin-Daniel Edutanu, florin-daniel.edutanu@student.tuiasi.ro

PhD Supervisor: Professor Cătălin Gabriel Dumitraș
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The field of industrial engineering has consistently targeted to optimise industrial processes and complex systems through the development, improvement and implementation of integrated systems based on human resources, financial resources, information, technological equipment, raw materials and materials. The digital transformation of the business environment, which commenced at the end of the 20th century, has attracted the attention of numerous industrial and governmental organisations, who have concentrated their efforts on the study and research of the Industry 4.0 (I4.0) concept in all its phases (initiation, development, etc.). Their objective is to facilitate the exploitation of the I4.0 concept as a transition (transformation) to the next industrial revolution, generically designated as Industry 5.0 (I5.0). The concept I5.0 was first proposed by researchers and specialists some time ago. It suggests that the next phase of industrialisation will correct the limitations of I4.0. This will involve respecting the existing limits on production, while placing the welfare of the industrial worker at the centre of the production process. This will enable to rewrite the I5.0 concept, mainly through the human/value-centric dimension. This paper aims to highlight the development potential and impact of the I5.0 pillars: additive manufacturing, industrial robots, augmented reality, artificial intelligence, and their implications in industrial sectors affecting the manufacturing process. It examines the perspective through the lens of the three principles proposed by I5.0: human-centric, sustainability and resilience, which outline these new manufacturing technologies used to improve production processes in most fields, including industrial engineering. The pillars of the I5.0 concept identified in this paper will describe the amplification of this digital transformation and the more meaningful and effective collaboration between humans and machines and systems in their digital ecosystem. This collaboration will combine the accuracy and speed of industrial automation with the creativity, innovation and critical thinking skills of humans. It is therefore important to note that, regardless of how the I5.0 concept is defined, these pillars underpin a new industrial revolution and define a new level of organization and control over the future entire product life cycle value chain.

Keywords: Industry 4.0, Industry 5.0, Pillars, Additive Manufacturing, Industrial Robots, Augmented Reality, Artificial Intelligence

ASSESSMENT OF POLYCRYSTALLINE, MONOCRYSTALLINE, AND AMORPHOUS SOLAR PANELS UNDER DYNAMIC ENVIRONMENTAL CONDITIONS: PERFORMANCE INSIGHTS FOR RENEWABLE ENERGY APPLICATIONS

Eduard Enasel, Gheorghe Dumitrașcu

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Mechanical Engineering
Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Eduard Enasel, eduard.enasel@student.tuiasi.ro

PhD Supervisor: Professor . Gheorghe Dumitrașcu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Solar photovoltaic (PV) technology is rapidly expanding globally as a key renewable energy source. Understanding the long-term performance of different PV technologies under real-world conditions is crucial for their development and deployment. Since its inception in 1839 with Edmond Becquerel's demonstration of the photovoltaic effect, the field of solar PV has experienced remarkable progress. However, actual PV performance is influenced by external factors such as temperature, wind, and irradiance, along with operational constraints like shading and panel orientation. Elevated cell temperatures from absorbed sunlight can decrease performance by 8-15%, necessitating the use of cooling systems for optimization under non-optimal conditions. This study focuses on analyzing the behavior of three distinct types of PV panels - polycrystalline, monocrystalline, and amorphous (thin-film) - in response to changing solar radiation and temperature. By utilizing microcontroller-monitored sensors, including temperature gauges, voltage output meters, and a pyranometer for solar radiation measurement, the research aims to elucidate how these panels respond to dynamic environmental conditions. The study's objective is to provide insights into the performance characteristics of each panel type under varying irradiance levels and temperatures, thereby informing strategies for optimizing solar energy generation in real-world applications. Preliminary findings indicate that each PV panel type exhibits unique performance traits influenced by solar radiation and temperature fluctuations. Polycrystalline panels, characterized by their cost-effectiveness and suitability for high-temperature environments, demonstrate stable output under direct sunlight but exhibit reduced efficiency in low-light conditions. In contrast, monocrystalline panels, known for higher efficiency and space efficiency, excel in low-light scenarios but are susceptible to performance degradation at elevated temperatures. Amorphous (thin-film) panels, while less efficient overall, display resilience in varying light conditions and moderate temperature fluctuations. This comprehensive investigation into PV panel behavior under real-world conditions seeks to contribute valuable insights to the field of solar energy technology. By understanding how different panel types respond to environmental variables, this research aims to guide future advancements in solar panel design and deployment strategies, ultimately facilitating the widespread adoption of renewable energy sources for a sustainable energy future.

Keywords: Photovoltaic, panel performance, solar energy, PV panel types, solar irradiance

DIMENSIONS AND MODELS OF DIGITIZED MANAGEMENT OF ORGANIZATIONS

Dănuț-Constantin Filip, Nicoleta-Andreea Filip, Ion Verzea

”Gheorghe Asachi” Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Dănuț-Constantin Filip, danut-constantin.filip@student.tuiasi.ro

PhD Supervisor: Professor Ion Verzea
“Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Digitized management represents a transformative paradigm shift in organizational operations, driven by the integration of digital technologies, data-driven decision-making, and agile methodologies. The study explores the multifaceted dimensions of digitized management within organizations, highlighting its key components, benefits, challenges, and implications for organizational performance. At its core, digitized management involves the seamless integration of technology across all levels of the organization, from frontline operations to strategic decision-making. This includes the adoption of enterprise resource planning (ERP) systems, customer relationship management (CRM) software, data analytics tools, cloud computing platforms to automate processes, optimize resource allocation and enhance scalability. Furthermore, digitized management emphasizes data-driven decision-making, leveraging advanced analytics and business intelligence tools to derive actionable insights from vast volumes of data. By harnessing the power of data analytics, organizations can gain valuable insights into market trends, customer preferences, and emerging opportunities, enabling more informed strategic decision-making and proactive adaptation to market dynamics. The aim of the study follows the benefits of digitized management, ranging from improved efficiency and enhanced customer experience to greater agility and strategic insights. By streamlining processes, automating repetitive tasks, and personalizing customer interactions, organizations can reduce costs, enhance productivity, and foster long-term customer loyalty. In the research we used the qualitative research method, following how the digitalization of a company's management has an impact on the sustainability and structural development of the business compared to a sample of small and medium-sized enterprises. In this sense, we followed the way in which small and medium-sized enterprises implement digitization models of organization management and the effects generated by these implementations. As for the expected results, we set out to demonstrate that digitized management offers organizations a pathway to unlock new opportunities, drive innovation, and achieve sustainable growth in today's digital economy. By embracing technology, data-driven decision-making, and agile methodologies, organizations can navigate the complexities of digital transformation and position themselves for success in an increasingly digitized world.

Keywords: digitized management, technology integration, agile methodologies, data-driven decision-making, business model

DIMENSIONS AND MANAGEMENT MODELS OF ORGANIZATIONAL WELLBEING

Nicoleta-Andreea Filip[1], Dănuț-Constantin Filip[1], Ion Verzea[1], Rachid Chaib[2]

[1]"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management, Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]"Freres Mentouri" University of Constantine, Department of Engineering, Transport and Environment, RN79, Constantine, Algeria

Corresponding author: Nicoleta-Andreea Filip, nicoleta-andreea.filip@student.tuiasi.ro

PhD Supervisor: Professor Ion Verzea
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

In the current environment of the organization, in order to achieve success, it is important to observe what makes employees happy. Employee wellbeing is a concept which refers to the quality of work as experienced by the employee, having an overall feeling of happiness and health. For this concept to exist among employees, work should be evaluated as satisfying and positive emotions must be experienced more frequently than negative emotions. The involvement of employers in seeing what makes employees happy is essential for organizations striving to create a supportive and thriving work environment. By adopting an employee-centered management style as a strategic imperative, organizations can nurture a healthier, happier and more engaged workforce, leading to enhanced productivity, reduced absenteeism, and greater overall organizational success. Wellbeing management entails the strategic planning, implementation, and evaluation of initiatives aimed at promoting the physical, mental, and emotional welfare of employees. The aim of the article is to present a comparative analysis of six important management models aimed at enhancing wellbeing in organizations. The examined models are the PERMA Model, the Wellbeing Wheel Model, the Job Demands-Resources Model, the Wellbeing at Work Model, the Positive Organizational Scholarship Model and the Total Worker Health Model. Each model is evaluated based on its strengths and weaknesses, providing insights into their practical application within organizational contexts. The analysis highlights the diverse approaches to wellbeing management, offering organizational leaders and practitioners a nuanced understanding of the strategies available for fostering employee wellbeing. By leveraging the strengths of these models and addressing their limitations, organizations can create environments that support the wellbeing of their employees and also contributing to improved performance, engagement and organizational success. Each model highlights valuable insights into managing wellbeing in organizations, offering different dimensions and approaches. Finally, we reached the conclusion that organizations can create their own model that suits them best, integrating elements of the models to develop tailored, evidence-based strategies for promoting employee health, happiness and performance.

Keywords: employee wellbeing, organizational success, management, success, job satisfaction

DIMENSIONS AND MODELS OF DIGITIZED MANAGEMENT OF ORGANIZATIONS

Dănuț-Constantin Filip, Nicoleta-Andreea Filip, Ion Verzea

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Dănuț-Constantin Filip, danut-constantin.filip@student.tuiasi.ro

PhD Supervisor: Professor Ion Verzea
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Digitized management represents a transformative paradigm shift in organizational operations, driven by the integration of digital technologies, data-driven decision-making, and agile methodologies. The study explores the multifaceted dimensions of digitized management within organizations, highlighting its key components, benefits, challenges, and implications for organizational performance. At its core, digitized management involves the seamless integration of technology across all levels of the organization, from frontline operations to strategic decision-making. This includes the adoption of enterprise resource planning (ERP) systems, customer relationship management (CRM) software, data analytics tools, cloud computing platforms to automate processes, optimize resource allocation and enhance scalability. Furthermore, digitized management emphasizes data-driven decision-making, leveraging advanced analytics and business intelligence tools to derive actionable insights from vast volumes of data. By harnessing the power of data analytics, organizations can gain valuable insights into market trends, customer preferences, and emerging opportunities, enabling more informed strategic decision-making and proactive adaptation to market dynamics. The aim of the study follows the benefits of digitized management, ranging from improved efficiency and enhanced customer experience to greater agility and strategic insights. By streamlining processes, automating repetitive tasks, and personalizing customer interactions, organizations can reduce costs, enhance productivity, and foster long-term customer loyalty. In the research we used the qualitative research method, following how the digitalization of a company's management has an impact on the sustainability and structural development of the business compared to a sample of small and medium-sized enterprises. In this sense, we followed the way in which small and medium-sized enterprises implement digitization models of organization management and the effects generated by these implementations. As for the expected results, we set out to demonstrate that digitized management offers organizations a pathway to unlock new opportunities, drive innovation, and achieve sustainable growth in today's digital economy. By embracing technology, data-driven decision-making, and agile methodologies, organizations can navigate the complexities of digital transformation and position themselves for success in an increasingly digitized world.

Keywords: digitized management, technology integration, agile methodologies, data-driven decision-making, business model

THE STATE OF THE ART OF ADAPTIVE CLOTHING FOR PEOPLE WITH DISABILITIES

Valentina Frunze, Daniela Fărîmă

”Gheorghe Asachi” Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management, 29 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Valentina Frunze, valentina.frunze@student.tuiasi.ro

PhD Supervisor: Professor Daniela Fărîmă
“Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Improving the quality of life for people with special needs is a matter of international concern, necessitating the fashion industry's commitment to creating equal opportunities for persons with disabilities, preventing discrimination, and enhancing their standard of living as productive members of society. Throughout history, the field of adaptive clothes has shown resilience and progress, evolving from the functional necessities of the early 20th century to today's innovative technology. The general idea of adaptive clothing is to meet the needs for individuals with various physical limitations by incorporating different features to facilitate easier dressing and undressing, often without assistance. This factor also contributes to empowering individuals to actively participate in social activities. Through raising awareness and cultivating a strong collaboration among designers, researchers, and the disability community, adaptive clothing can become a prominent influence, promoting not just independence but also boosting self-confidence for individuals with disabilities. However, significant challenges remain. Limited research on user preferences and a lack of public awareness hinders wider adoption of adaptive clothing. Additionally, the cost of these garments can be a barrier for some individuals. Another issue that this field should be focused on is the lack of ergonomic mind that focuses also on comfort. To address these issues, this paper will delve into the current state of adaptive clothing, tracing its progression into a movement for independence and self-expression. The paper examines current design trends, analyzes the benefits for people with special needs, and explore the remaining obstacles that hinder full accessibility. By addressing these multifaceted challenges, the fashion industry can truly make a difference in the lives of individuals with disabilities. Through collaborative efforts, including research, design innovation, and advocacy, we can create a future where adaptive clothing is not just a niche market but a fundamental aspect of inclusivity and accessibility in fashion.

Keywords: adaptive clothings, innovations, state of the art, accessibility, disability

ENHANCING ORTHOPEDIC APPLICATIONS: A COMPARATIVE STUDY OF TIMOSI AND TI6AL4V ALLOYS FOR IMPROVED BIOCOMPATIBILITY AND MECHANICAL PROPERTIES

Ion Ghiculescu[1], Marius Albert Mazilu[1], Mihai Tofan[1], Andrei Victor Sandu[1,2], Madalina Simona Bălțatu[1], Petrică Vizureanu[1],

[1]"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Materials Science and Engineering, 41 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]Academy of Romanian Scientists, 3 Ilfov Street, Bucharest, Romania;
[3]Academy of Technical Sciences Romania, 26 Dacia Blvd., 030167 Bucharest, Romania

Corresponding author: Ion Ghiculescu, ion.ghiculescu@student.tuiasi.ro

PhD Supervisor: Professor Petrică Vizureanu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Biomaterials represent a very important point in the evolution of modern medicine, offering innovative solutions for the reconstruction and regeneration of damaged tissues. The history of biomaterials dates back thousands of years, starting with the use of the first natural materials for repairing and replacing human body tissues, such as the use of sutures made from natural fibers and primitive prostheses, and has made significant progress. Particularly, the integration of titanium alloys in orthopedic applications signifies a significant progress, due to their exceptional properties of biocompatibility, mechanical strength, and durability, making them essential in the development of high-performance orthopedic implants and devices. This study evaluates the biocompatibility and potential as implants of newly developed TiMoSi alloys, with a focus on enhancing TiMo alloys' performance by silicon addition. These additions aim at improving mechanical and technological properties while avoiding toxicity. The study developed and assessed four Ti15MoxSi alloys (x=0, 0.5, 0.75, 1.0 wt.%), analyzing their microstructure, mechanical, chemical, and biological behaviors. Results indicate that increasing Si content enhances mechanical properties. Cytocompatibility assessments on human osteoblasts and in vivo tests showed successful osseointegration and favorable bone formation without significant inflammation. Comparative analysis with the standard Ti6Al4V alloy, widely recognized for its medical application due to excellent biocompatibility and mechanical stability, indicates that TiMoSi alloys offer competitive or superior properties. The TiMoSi alloys' improved mechanical characteristics and successful biological integration, demonstrated through OSP expression and MMP2 and MMP9 overexpression, position them as promising candidates for orthopedic devices. This study underscores the potential of TiMoSi alloys as viable alternatives to Ti6Al4V, highlighting advancements in alloy development for enhanced medical applications. Therefore, the promising results regarding osseointegration and bone formation without significant inflammation elevate TiMoSi alloys as viable and potentially superior alternatives for orthopedic applications. This research not only contributes to the advancement of medical materials but also paves the way for future innovations in the development of safer and more effective orthopedic implants.

Keywords: Biocompatible elements, new alloys, titanium alloys, obtaining, characterization.

Acknowledgements: „This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS/CCCDI - UEFISCDI, project number ERANET-ERAMIN-3-Cool&SmartTit-1, contract no 8/024 within PNCDI IV"

OCCUPATIONAL SAFETY AND HEALTH WORK IN VIBRATION ENVIRONMENT

Cristina Grosu[1,2], Mirela Blaga[1]

[1]"Gheorghe Asachi" Technical University, Faculty of Industrial Desing and Business Management, 29 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]"National Research & Development Institute for Textiles and Leather", Lucretiu Patrascanu Street, 030508, Sector 3, Bucharest, Romania

Corresponding author: Cristina Grosu, cristina.grosu@student.tuiasi.ro

PhD Supervisor: Professor Mirela Blaga
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Since the first mention of instruments emitting vibrations in 1839 and up to the present day, the management of the risks associated with vibrations has been a complex issue from the point of view of the catastrophic effects that electric or pneumatic tools handled over a long period of time can have on the human body. At European level, the basic principles of worker protection in the field of occupational safety and health are laid down in the EU Framework Directive 89/391/EEC, which forms the legislative and legal framework for the adoption of the Special Directive 2002/44/EC of the European Parliament and of the Council and regulates the legal limits for the exposure of workers to vibrations in the territory of all EU Member States. In Romania, the special European Directive 2002/44/EC is implemented by Government Decision no. 1876/2005 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from vibrations, the scope of which covers all equipment and machinery that generate mechanical vibrations. Based on the risk assessment, each employer shall implement a set of measures aimed at minimizing exposure to mechanical vibration and the associated risks, such as: the choice of suitable work equipment, the limitation of the period and intensity of exposure and the proper maintenance of the work equipment. Personal protective equipment (PPE) represents the last barrier between the person and the risk, and anti-vibration gloves are included in the non-exhaustive list of the Government Decision 1048/2006 regarding the minimum health and safety requirements for the use by workers of personal protective equipment at the workplace. The EN ISO 13753 standard specifies that the resilient material used for producing anti-vibration gloves must be obtained predominantly of foam with elastic properties or rubber and occasionally of a textile material. Textile materials, in particular knitted structures, are increasingly being integrated into anti-vibration protective equipment as they offer obvious comfort benefits and mechanical performance obtained by adjusting various parameters during the knitting process or by finishing techniques. The aim of this article is to provide an overview of the main legislation regulating the protection of workers exposed to vibrations and to highlight the advantages of textile materials used for the manufacture of personal protective equipment.

Keywords: personal protective equipment, risk assessment, hazards, vibrations, textiles

SCRUTINIZING OF HEAT TRANSFER AND FLOW MECHANISM IN CIRCULAR BACKWARD-FACING STEP CONSIDERING FERROFLUID FLOW UNDER MAGNETIC FIELD EFFECT

Emrehan Gürsoy[1], Engin Gedik[2]

[1]Karabük University, Institute of Graduate Programs, Kılavuzlar, Neighborhood 413. Street No:7, 78050, Karabük, Türkiye
[2]Karabük University, Faculty of Engineering, Kılavuzlar, Neighborhood 413. Street No:7, 78050, Karabük, Türkiye

Corresponding author: Emrehan Gürsoy, emrehangursoy@gmail.com

PhD Supervisor: Professor Engin Gedik
Karabük University

Abstract:

Backward-facing step (BFS) includes especial rheological phenomenon such as reattachment and flow separation and also plays a considerable design role in the heat transfer applications particularly in heating and cooling system. Several parameters such as expansion ratio (ER), expansion angle (α), flow regime, and working fluid (WF) thermo-physical properties influence the heat transfer and flow mechanism in this geometry and a dead zone in terms of heat transfer occurs as far as the reattachment region. Based on this developable subject, a numerical investigation has been carried out on a circular cross-section BFS with ER=2.5 and α=90°. In the study, magnetizable ferrofluid (Fe3O4/water) with volume concentration of ϕ=1.0, 1.5, and 2.0% has been considered as WF and it flowed different laminar flow regimes (500≤Re≤2000). During expansion, WF has been exposed to a uniform magnetic field (MF) with a strength of B=0.3, 0.5, 0.7, and 1.0T and heated with a constant flux of q"=600 W/m2. The results show that ferrofluid with ϕ=1.0% performed the highest Nusselt number (Nu) and performance evaluation criterion (PEC). Furthermore, increment of Re causes an adverse effect on the PEC. Within the scope of Magnetohydrodynamics, Nu performed an increment with the help of B. Along with subjecting of the MF, flow mechanism at the expansion region exhibited a substantial variation due to Lorentz force. The highest PEC has been obtained from the B=0.5T at Re=500 for all cases and as further increase of B caused a negativity on the PEC. As Re increases, the B provided the highest performance exhibited a variation. For Re=2000, the highest PEC has been acquired from the B=0.3T. On the other hand, it has been concluded that B has a decisive effect on the reattachment phenomenon occurring in the sudden expansion region and on the recirculation that significantly affect heat transfer. However, it has been determined that this mechanism also considerable varies the reattachment phenomenon, which provides the highest convective heat transfer in the system, and the reattachment phenomenon is sloughed with the increase of B.

Keywords: Backward-facing step, Ferrofluid, Magnetic field, Performance evaluation criterion, Reattachment, Flow separation

ANALYSIS OF THE MAIN SOLICITATIONS OF MATERIALS FOR SALT WATER PUMPS

Magdalena-Gabriela Hutanu, Nicanor Cimpoesu, Liviu Andrusca, Vasile Manole, Mihai Axinte

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Materials Science and Engineering,
Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Magdalena-Gabriela Hutanu, magdalena-gabriela.hutanu@student.tuiasi.ro

PhD Supervisor: Professor Cimpoesu Nicanor
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Salt water pumps work in conditions of intense corrosion and erosion due to both the composition of the salty environment in which they operate and the dynamics of the liquid flow. Corrosion phenomena have their intensity influenced by the composition of sea or industrial water from the salt industry as well as by the physical and chemical characteristics such as viscosity, pH, the presence of vortex in the work area, the appearance of the cavitation phenomenon, etc. The rotor of the saline water pump bears the main erosive and corrosive attack, this being accentuated by the mechanical torsional and traction stresses to which the work piece is subjected. The working temperature has a great influence on the behavior of the materials of the active parts of the salt pumps because the pumps work on large thermal intervals between 5 and 50 °C. The studied material is stainless steel type 316 and it is used to make the elements that come into direct contact with the liquid with high salinity, respectively with the pump rotor and the shaft on which it is mounted. The functionality of the pump consists in absorbing liquid with a high concentration of salt and redirecting it. During operation, the rotor is subjected to torsional stresses combined with stretching, to dynamic erosive stresses, to chemical corrosion, all of this taking place at low temperatures in the case of salt mines in the range of 5 - 10°C or at high temperatures in the case of pumps working at desalination of water in warm areas of the globe then operating in the range of 30-50°C. The concentration of the studied saline solution varies between 10%-30%, the choice being made taking into account that salt dissolves at maximum of 36% in water. In the paper, I presented a synthesis of the main mechanical and physico-chemical demands encountered mainly in the case of salt water pumps.

Keywords: Salt water pumps, corrosive attack, erosion, rotors, physico-chemical demands

PROCESS PARAMETERS REGARDING INFILL, AVAILABLE IN THE ULTIMAKER CURA SOFTWARE

Alexandru-Ionuț Irimia, Vasile Ermolai, Răzvan Stavarache, Gheorghe Nagîț

„Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Machine Manufacturing and Industrial Management, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Alexandru-Ionuț Irimia, alexandru-ionut.irimia@student.tuiasi.ro

PhD Supervisor: Professor Gheorghe Nagîț
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

3D printing is an additive manufacturing process that has taken off both among researchers and especially among home users. This additive process is based on the deposition of thermoplastic material on a heated plate to produce a three-dimensional part. 3D printing technology is used in various fields to produce display parts as well as functional parts with the specification that the stresses be reduced, so that the parts do not deteriorate. This technology is known on the market as fused deposition modeling (FDM) and also as fusible filament forming (FFF). This article focuses on the main process parameters available in the UltiMaker Cura software. These process parameters have a real impact on the parts to be produced, meaning that they influence the quality of the finished parts, both in terms of mechanical strength and surface quality. At the same time, process parameters have a major role in the consumption of material, which affects production costs and also the environmental impact by reducing waste from residual plastics. The article discusses only process parameters, product parameters are not considered. The parameters that will be exposed and detailed are closely related to the infill level of 3D printed parts, we can mention some of them, such as: Infill density: the infill density defines the amount of thermoplastic material used during printing. A higher infill density means that there is more thermoplastic material inside the part, resulting in a more robust object; Distance between infill lines: instead of setting the infill density as a percentage, it is also possible to set the distance between lines. This determines the distance between each infill line, which has the same effect as changing the infill density; Infill pattern: Ultimaker Cura allows the user to change the infill pattern of the designed parts, which is beneficial in cases where an increase in the mechanical strength of the part is desired. Some of the internal structure types: grid, lines, triangles, tri-hexagon, cubic, octet, zig-zag, cross, 3D cross, gyroscopic fill and many more.

Keywords: 3D print, infill, Utimaker Cura, Process parametres, Fused Deposition Modeling, Infill pattern

REDUCING BUILDING SURFACE TEMPERATURE BY ADDING PCM LAYER INTO WALL CONFIGURATION

Fardin Jafari[1], Giovanni Semprini[2], Alessandra Bonoli[1]

[1]University of Bologna, Department of Civil, Chemical, Environmental and Materials Engineering, Via Terracini 28, Bologna, Italy
[2]University of Bologna, Faculty of Industrial Engineering, Viale Risorgimento 2, Bologna, Italy

Corresponding author: Fardin Jafari, Fardin.Jafari2@unibo.it

PhD Supervisor: Professor Alessandra Bonoli
University of Bologna, Italy

Abstract:

Growing energy demand in building sectors has accelerated the climate-changing crisis. Therefore, many European countries have applied some energy renovation practices, such as adding thermal insulation to reduce energy consumption. However, the thermal insulation layer can simultaneously increase building surface temperature and participate in the urban heat island. To tackle the issue, utilizing PCM can effectively increase wall thermal mass, benefiting from a higher latent heat capacity to reduce the wall surface temperature. PCM can absorb and release heat during melting and solidifying, effectively moderating the effects of outdoor temperature fluctuations. In this study, an experimental setup was designed to compare the surface temperature of 10cm EPS insulation with and without a PCM layer in four different compositions. The experiment contains a main enclosure and constant heat resource powered by 1200 watts. The temperature data was collected by thermocouple type T from both sides of the walls. The results demonstrated that embedding a layer of PCM can reduce the surface temperature by about 25% with composition A. Meanwhile, scenario D recorded the minimum interior surface temperature almost 18% lower than the reference wall. Integrating PCM with the wall offers a promising solution to reach a sustainable practice in providing indoor thermal comfort and decreasing the urban heat island phenomenon.

Keywords: PCM integration, insulation, wall, surface temperature

METHODS AND TOOLS IN A STEP BY STEP APPROACH FOR CAPABILITY ANALYSIS WITH A CASE STUDY FOR THE IMPROVEMENT OF A GRINDING PROCESS WITHIN AN AUTOMATED UNIT

Laurențiu Larco

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Faculty of
Machine Manufacturing and Industrial Management, 59A Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Laurentiu Larco, laurentiularco@yahoo.com

PhD Supervisor: Professor Petru Dușa
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Since the first mention of instruments emitting vibrations in 1839 and up to the present day, the management of the risks associated with vibrations has been a complex issue from the point of view of the catastrophic effects that electric or pneumatic tools handled over a long period of time can have on the human body. At European level, the basic principles of worker protection in the field of occupational safety and health are laid down in the EU Framework Directive 89/391/EEC, which forms the legislative and legal framework for the adoption of the Special Directive 2002/44/EC of the European Parliament and of the Council and regulates the legal limits for the exposure of workers to vibrations in the territory of all EU Member States. In Romania, the special European Directive 2002/44/EC is implemented by Government Decision no. 1876/2005 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from vibrations, the scope of which covers all equipment and machinery that generate mechanical vibrations. Based on the risk assessment, each employer shall implement a set of measures aimed at minimizing exposure to mechanical vibration and the associated risks, such as: the choice of suitable work equipment, the limitation of the period and intensity of exposure and the proper maintenance of the work equipment. Personal protective equipment (PPE) represents the last barrier between the person and the risk, and anti-vibration gloves are included in the non-exhaustive list of the Government Decision 1048/2006 regarding the minimum health and safety requirements for the use by workers of personal protective equipment at the workplace. The EN ISO 13753 standard specifies that the resilient material used for producing anti-vibration gloves must be obtained predominantly of foam with elastic properties or rubber and occasionally of a textile material. Textile materials, in particular knitted structures, are increasingly being integrated into anti-vibration protective equipment as they offer obvious comfort benefits and mechanical performance obtained by adjusting various parameters during the knitting process or by finishing techniques. The aim of this article is to provide an overview of the main legislation regulating the protection of workers exposed to vibrations and to highlight the advantages of textile materials used for the manufacture of personal protective equipment.

Keywords: process capability, control chart, SPC, repeatability, reproducibility, conforming product

THE ROUTE OF THE MATERIALS AND THE RETURN OF THE MATERIALS FROM THE TEXTILE INDUSTRY TO THE CIRCUIT OF NATURE

Lazăr Cezara Patrisia[1,2], Antonela Curteza

[1"]Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management, Bd. Prof. Dr. Doc. Dimitrie Mangeron, Nr. 29, Iasi, Iasi, Romania
[2"]Stefan cel Mare" University of Suceava, Faculty of Electrical Engineering and Computer Science, 13 Universității Street, Suceava 720229, Romania

Corresponding author: Antonela Curteza, antonela.curteza@academic.tuiasi.ro

PhD Supervisor: Professor Antonela Curteza
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

If we don't think about the environment in all the actions we do, we will find that,some day, because of the piles of garbage, we will no longer be able to leave our own house, we will no longer be able to breathe clean air. Imagine a world in which we will use flying cars not only to avoid congestion, but to be able to move from one building to another. We will have to relocate our living space because of the pollution we produce in the area where we live, or we will build buildings as high as possible so that the apartment we live in is not close to the polluted, harmful soil. The problem of environmental protection has been discussed since past times. A good reference to this is "Inul si camesa"("Linen and shirt") by Ion Creanga, story first published in the "Învățătorul copiilor" ("Children's Teacher"), ed. III, Iasi, 1874. The story shows us how, from a plant, you can make a beautiful shirt, and the fact that from a raw material you reach a finished product respecting a technological process, But, nevertheless, a finished product, once its duration of life ends, can become raw material for a new product. This literary work can also be called "the diary of a weed" or "the unknown diary of the linen shirt". The character of the circular economy in the story is highlighted in the paragraph: "Wait, I'm not done yet. From a shirt or clothes, in a little while you'll make a handkerchief, from which fluff is made for the sick in hospitals and for the wounded soldiers in battle. Then they look for you, like a medicinal herb, to turn you into paper at the factory."

Keywords: Circular economy, Sustainability, Industrial ecology, Systematic literature review, Circular business model

ADVANCED COMPOSITE MATERIALS USED IN THE AUTOMOTIVE INDUSTRY

Codrin-Dumitru Cîrlan, Edmund Levardă, Marius Petcu, Ștefan Lucian Toma

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Materials Science and Engineering, Materials Engineering and Industrial Safty Department, No 67, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Edmund Levărdă, levarda.edmund@gmail.com

PhD Supervisor: Professor Stefan Lucian Toma
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

This paper emphasizes the benefits of using composite materials in manufacturing automobile components instead of conventional metal. Some unknown and unorganized information on the multifunctional phenomena of composite materials is guided by relevance for manufacturing. Researchers enhance the variation of composites to achieve better performance in every sector as well as the vehicle industry. Due to high durability, strength, lightweight, and corrosion tolerance, ballistic performance composites are used. Some other features, like fire and lightning protection behaviour, can be imposed within a very easy and economical fabrication process. Chassis, braking-related components, steering systems, battery and charging-related objects, and differential and suspension systems depend adequately on composite materials. Composite materials may look complex, but their overall significance is very lucrative for introducing new types of materials. Composites are already considered the new turning point of material science. Very shortly, it will provide a variety of scopes, like natural fibre used for ensuring biodegradability. Huge limitations of using composites are characterized in automobile components. Overall output is consistently developing modern technology and safety for both the environment and mankind. The price of manufacturing is quite high for different components and different features of metal. Even then, composite reduces overall cost than other traditional materials which improving opportunities for vehicle manufacturers. Some other new perspective like piezoelectricity, magneto strictive properties, self-healing capability electromagnetic sheilding can be accelerate this field in long term future whichare discussed in this review paper.

Keywords: advanced composites materials, automotive industry

SOLUTION FOR ONLINE MARKETING – VIRTUAL TESTING ROOM

Alice Mătășel, Maria Carmen Loghin, Andreea Talpă

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Alice Mătășel, matasel.alice@yahoo.com

PhD Supervisor: Professor Maria Carmen Loghin
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

In today's digital age, IT applications have become indispensable tools for addressing a myriad of challenges, spanning from personal shopping to professional endeavors and communication. The efficiency of online platforms, particularly virtual stores, in facilitating rapid decision-making processes through comprehensive analyses of various offers and deals is undeniable. However, despite the convenience afforded by online shopping, the issue of product returns persists, particularly concerning items such as clothing and footwear. Common reasons for returns include discrepancies between the product's online presentation and its real-life appearance, functional issues, and fit-related concerns. Recent technological advancements have revolutionized garment fitting procedures, introducing virtual fitting environments that promise to enhance the apparel supply chain socially, economically, and environmentally. Key to ensuring end-user satisfaction in the apparel industry are factors such as 3D body measurements, garment sizes, and ease allowances. Nevertheless, designers face the daunting task of discerning customers' motivations and emotions regarding their desired fit, as well as determining appropriate ease allowances within virtual environments. Fit-related problems often arise due to factors such as incorrect sizing choices, limited size availability for certain models, or variations in individual body shapes. To mitigate these challenges and reduce return rates, providing customers with the ability to virtually try on selected items during the purchasing process holds significant promise. By offering customization options tailored to individual body shapes and preferences, customer satisfaction can be greatly enhanced, leading to decreased return rates and increased sales. This article proposes an integrated solution aimed at enhancing the online marketing of customized clothing products, particularly for medium or small companies.

Keywords: Virtual fitting room, garments, avatar, body shape, body size

POLYMER COMPOSITES THERMISTORS USED AS HEAT FIRE DETECTORS: A SHORT REVIEW

Cristian-Andrei Micu, Petrică Vizureanu, Alin-Marian Cazac, Costică Bejinariu

"Gheorghe Asachi" Technical University of Iasi, Faculty of Materials Science and Engineering, D. Mangeron 67 Blvd., 700050, Iasi, Romania

Corresponding author: Cristian-Andrei Micu, cristian-andrei.micu@academic.tuiasi.ro

PhD Supervisor: Professor Costica Bejinariu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Fast fire detection is crucial in assuring fire safety for the occupants in buildings, so they have enough time for egress, assure a fast fire response and limit casualties and the gravity / damages caused by the fire. The most used fire detection system use punctual detectors, but at these, the detection time is determined by the time required for the fire effluents (e.g. smoke, gas, heat) to reach the detectors (being influenced by the room height, air movement, the number of detectors and their location). A method for reducing detection time is to use a fire detector that can be put directly on the equipments that present the highest fire hazard (e.g.: electrical batteries), being so able to detect the onset of a fire even before ignition of combustible materials. This study presents a short overview of the literature regarding polymer composites thermistors that can be used as heat fire detectors. The most important characteristic of these materials is the change in electrical resistivity that occurs with the increase of temperature. A better performer material can be considered the one that has a higher electrical resistivity gradient in a specified temperature range (that can be the ingnition temperature of the protected material).

Keywords: fire detector; thermistor; composite materials;fire safety;electrical resistivity;temperature

EVALUATION OF SUSTAINABILITY IN THE PHARMACEUTICAL INDUSTRY VIA PERFORMANCE INDICATORS

Laura-Crina Miraute Coca, Marius Pîslaru

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management
Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Laura-Crina Miraute Coca, laura-crina.miraute@student.tuiasi.ro

PhD Supervisor: Professor Marius Pîslaru
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Any company that manufactures medicines should have a measurement tool that can calculate all specific parameters using performance indicators. A performance indicator is a measure that demonstrates how well a company achieves its objectives. This was then converted into a number that could be measured using appropriate evaluation metrics. In this paper, it is researched in the literature which are the most used indicators of sustainability in the pharmaceutical industry relevant to achieving sustainability objectives. The Publish or Perish tool was used to search the Google Scholar database for papers dealing with this topic during the period 2015–2023. The search engine used the following keywords: sustainability indicators in the pharmaceutical industry. The purpose of this study is to identify the most relevant sustainability indicators which a pharmaceutical company can use to measure its performance in this direction. At the same time, researchers' interest in capitalizing on this research directive is highlighted. The search was limited to 500 papers that addressed this topic, from which the most cited papers were extracted and an analysis of the most commonly used sustainability indicators in the pharmaceutical industry was carried out, which are then presented in this paper. Metrics are defined as the most important performance indicators to better outline the evaluation of this sustainability concept in a pharmaceutical company. The results of the study show that there is interest in the academic literature regarding the concept of sustainability and the indicators that can be used to quantify its performance; however, a well-defined model that uses a fixed and concrete number of indicators cannot be identified. However, common proposals for sustainability indicators were found in the pharmaceutical industry so that the most relevant elements that contribute to achieving the sustainability of a pharmaceutical company can be tracked. Our research can be extended to several scientific databases and, at the same time, over a longer period of time.

Keywords: Sustainability, indicators, metrics, pharmaceutical industry, Publish or Perish

THE PROCESS OF MAKING COMPOSITE MATERIALS WITH CARBON FIBER, BASALT OR FLAX

Ionut Mititelu, Paul Doru Barsanescu

[1]"Gheorghe Asachi" Technical University of Iasi-Romania, Mechanical Engineering,
43 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ionut Mititelu1, ionut.mititelu@student.tuiasi.ro

PhD Supervisor: Professor Paul-Doru Bârsănescu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Composite materials have become an essential component in the production of modern 21st-century industrial products, which are in a state of constant evolution. Used since antiquity, they go through a continuous development process, with efforts to recycle certain materials for energy and economic sustainability in the medium and long term. The reduction in weight has a significant impact on energy consumption efficiency, which is why industries demand advanced materials with excellent strength and stiffness properties, such as composites, which are experiencing a widespread upward trend in high-end industries. The autoclave manufacturing method is commonly employed for producing high-quality components utilized in aeronautics, sports equipment, automotive parts, and military and space applications. The purpose of the research was to contribute to the improvement of the process of making composite materials by analyzing the manufacturing method using different types of fibers such as: carbon, basalt or flax through the autoclave manufacturing method and analysis of the process for its efficiency and the resources used. Shortening the duration of the curing process for making plates with basalt fibers in the autoclave was followed. This was achieved by heating the composite material plates in the preparation phase and keeping them at a constant temperature of 40 ° C under vacuum for 16 h. In addition, the epoxy resin mixture used was also heated to a close temperature favoring the mixing between the epoxy resin and fibers, avoiding the creation of air gaps.Thus, following the analysis of the duration of the curing process, it was found that the enclosure required a shorter heating time up to the T1 temperature of 40° C, favoring a faster transition to the step 1 (t1), where the constant temperature will be maintained for 10 h, then go to step 2 (t2) at a temperature of 82 ° C for 6 hours. The duration of each step and curing temperatures depending on the composite material made and will influence the characteristics of the obtained material. In conclusion, in the production process, every minute counts. To enhance efficiency and reduce manufacturing costs, various solutions can be implemented without compromising the quality of the materials obtained: heating the materials and keeping them at a constant temperature for several hours, along with preheating the autoclave enclosure and the air introduced to increase the pressure inside.

Keywords: composite materials, autoclave, basalt, epoxy resin, manufacturing

RESEARCH AND CONTRIBUTIONS REGARDING THE ROLE OF THE IN- FORMATION SYSTEM IN ORGANIZATIONAL SUSTAINABILITY MANAGEMENT

Ștefana-Cătălina Pohonțu-Dragomir, Ionuț-Viorel Herghiligiu

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Industrial Design and Business ManagementProf. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ștefana-Cătălina Pohonțu-Dragomir, stefana-catalina.pohontu-dragomir@student.tuiasi.ro

PhD Supervisor: Assoc.Professor Ionuț-Viorel Herghiligiu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The rapid advancement of technology presents a significant challenge to literature focused on sustainable development. Information systems and technology play a crucial role in this progress, widely acknowledged as key contributors to sustainable development. This research aims to explore the role of information systems in fulfilling organizational objectives related to sustainable development. To achieve this, it is essential to first grasp the con- ceptual underpinnings of both human and sustainable development. With this foundational understanding, we can then analyze the present landscape and identify areas for improvement to attain more favorable outcomes in sus- tainable development going forward. This research seeks to fill a notable gap in the specialized literature concerning the Information Systems approach, offering both specialized insights and broader multidisciplinary academic value. By elucidating the determinants of this approach, we can enrich the research field and elucidate the role of information systems in advancing sustainable development. The intended research endeavors to elucidate the framework surrounding the dynamics of the information system and its potential to foster organizational sustainability. Simultaneously, this research approach seeks to enhance our comprehension of the various perspectives found in specialized literature concerning Information Systems and their interplay with organizational sustainability. Based on the literature review, various models exist for evaluating the success of Information Systems (IS), with the D&M Model being the most utilized thus far. The primary motivation behind the D&M Model is twofold: to enhance IS research and to improve IS practice. DeLone and McLean have consistently underscored the necessity for numerous studies in this research domain to establish the correlation between IS success and organizational outcomes. Hence, this research endeavors to respond to this imperative, aiming to contribute by assessing the evidence regarding the connection between IS success and organizational sustainability.

Keywords: DeLone & McLean model, Information system, Success model, Organizational innovation, Net benefits

EXPLORING THE HYPERELASTIC BEHAVIOR OF EPDM RUBBER SPRINGS: A COMPREHENSIVE ANALYSIS

George Popa[1,2], Dragoș Luca[2], Viorel Paleu[1,2]

[1]"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Mechanical Engineering
43 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]Continental Automotive Romania, 6 Poitiers Blvd., Iași 700671, România.

Corresponding author: George Popa, george.2.popa@continental-corporation.com

PhD Supervisor: Professor Viorel Paleu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The widespread adoption of EPDM rubber material in diverse industrial applications is largely attributed to its inherent hyperelasticity and viscoelastic properties. This versatile material finds utility across a spectrum of components, including but not limited to bushings, dampers, and rubber springs. In such applications, precise characterization and modeling of EPDM's hyperelastic behavior become imperative. This is particularly true for critical systems like brake mechanisms and sealing assemblies, where the material's performance directly impacts safety and functionality. This study endeavors to delve into the hyperelastic behavior and subsequent modeling of EPDM rubber. Through a combination of finite element analysis (FEA) utilizing ANSYS software and empirical data obtained from traction tests, material parameters governing EPDM's behavior are elucidated.
By leveraging FEA simulations and experimental findings, this research aims to provide comprehensive insights into the behavior of EPDM rubber under compression. Moreover, the study aims to establish a validated modeling approach that can accurately predict the material's response in complex assemblies subjected to compression forces. Through rigorous experimentation and analytical techniques, this study seeks to contribute to the broader understanding of EPDM's mechanical properties and enhance the design and optimization of EPDM-based components in various industrial applications.

Keywords: Hyperelasticity, EPDM rubber, compression, FEA modelling, ANSYS

DIGITAL TOOLS FOR DEVELOPING SUSTAINABLE SHAPES OF CLOTHING PRODUCTS FOR CUSTOMERS WITH SPECIAL NEEDS

Mălina-Ioana Roșca, Ana-Diana Vatră, Manuela Lăcrămioara Avădanei

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Mălina Ioana ROȘCA, malina-ioana.rosca@student.tuiasi.ro

PhD Supervisor: Professor Manuela Lăcrămioara Avădanei
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Fashion brings numerous challenges, both for textile manufacturers and consumers. Manufacturers are looking for quick solutions to develop new collections, and consumers are looking for variety in the customisation of products to meet their needs better. There is a problem between the willingness of producers to bring a wide variety of products to the market, which entails different cost categories and production times, and the wishes of consumers (variety, reasonable price); this problem can be solved by manufacturing products according to market demand. Communication between producers and consumers is important: consumers can provide information about what they need and want (as input), and producers can implement this information in developing new products (output). Consumers buy these products because they meet their requirements, and in this way, the cycle is closed. In addition to the challenges posed by consumer preferences, the fashion and textile industry must find methods and principles for sustainable manufacturing of clothing products, as raw material supplies are increasingly scarce, pollution is high, production costs are high, and so on. This industry can become sustainable if it changes its entire production process: using digital technologies to develop new products, launching new collections in the virtual space (digital platform accessible to a large number of customers), virtual testing of new designs by the customer and manufacturing those that are in demand. Digital technologies enable the customisation of the designing process of clothing products, which is essential for consumers with special needs (physical disabilities). In recent years, interest in clothing collections adapted to this market segment has increased significantly, and digitalisation has become a key element. Despite the limited availability of information about these products, the importance of recognising the needs of this consumer group and developing products that ensure psycho-sensory comfort, health, aesthetics, durability, and an appropriate fit has been recognised. The article presents a personalisation method of clothing products for people with special needs (physical disabilities) from the design stage. This approach promotes inclusivity, innovation and sustainability in the fashion industry and enables people with disabilities to enjoy products tailored to their needs to perform various tasks and activities.

Keywords: people with special needs, personalisation, sustainability, digital tools

THEORETICAL RESEARCH INTO SUSTAINABLE SUPPLY CHAIN MANAGEMENT

Ioana-Alexandra Sbîrcea, Rebecca Ana Maria Chiriţă, Cristina-Elena Ungureanu

University Politehnica of Bucharest, Doctoral School of Entrepreneurship, Business Engineering and Management, Splaiul Independenței no. 313, sector 6, 060042, Bucharest, Romania

Corresponding author: Ioana-Alexandra Sbîrcea, ioanaalexandrasbircea@gmail.com

PhD Supervisor: Professor Elena Fleacă
University Politehnica of Bucharest

Abstract:

Furious competition in today 's worldwide markets, the presentation of items with brief lifecycles, and the increased desires of clients have constrained commerce ventures to contribute to, and centre consideration on, the connections with clients and providers (Smich-Levi et al., 2000). Supply Chain Administration (SCM) has become part of the senior administration motivation since the 1990s. Administrators are getting to be mindful that the effective coordination, integration, and administration of key commerce forms over individuals in the supply chain will decide the extreme victory of the single endeavour (Van der Vorst, 2000). According to Christopher (1998), businesses now do not compete as exclusively independent substances, but maybe as supply chains. The expanded intrigue in SCM has been impelled by improvements in the Sustainable Supply chain that empower the visiting trade of tremendous sums of data for coordination purposes. Subsequently, there's a requirement and an opportunity for a joint approach of chain accomplices towards the foundation of more successful and effective supply chains. Supply chain administration (SCM) has been talked about by analysts and trade professionals for more than two decades presently, but still shockingly small of this reasoning can be seen in today 's trade hones. One vital enabler for taking the SCM logic from hypothesis into hone that's frequently said, but not examined in-depth, is beat administration bolster. The part best administration plays in a company's SCM hones may be an important piece of inquiry that's not however put within the huge SCM confusion. The reason for this thesis is hence to depict and clarify the part of beat administration in a company's supply chain administration hones. The reason is approached with the aid of two things, where the moment is incompletely built upon the discoveries from the primary. The primary consideration is an explorative, wide survey aimed at exploring how a company's hones, here restricted to incorporate a central company's coordination 's collaboration with providers and clients, are performed. Within the moment consider, which is an explanative, different case think about, the part of best administration is explored more in detail.

Keywords: Supply Chain, Supply Chain Management, Sustainable Supply Chain, Supply Chain KPIs

PHYSICAL-MECHANICAL PROPERTIES OF COSMETOTEXTILES WITH ANTI-ACNE EFFECT

Lucia-Oana Secareanu[1,2], Mirela Blaga[1], Alexandra-Gabriela Ene[2]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Industrial Design and Business Management, 59 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2] The National Research and Development Institute for Textiles and Leather, 16th Lucretiu Patrascanu Street, 030508, Bucharest, Romania

Corresponding author: Lucia-Oana Secareanu, lucia-oana.secareanu@student.tuiasi.ro

PhD Supervisor: Professor Mirela Blaga
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Functionalized fabrics used for cosmetic applications represent a specialized category that is undergoing rapid development. This research focuses on examining the physical-mechanical properties of two functionalized textiles, made of 100% polyester and a 100% cotton, treated with two different dispersions. The dispersions used are a blend of lyophilized plant extracts (propolis, aloe vera, calendula, plantain) and blue clay. The main difference between the two dispersions is that nano-halloysite was added to the second dispersion in order to better evaluate the influence of the blue clay. After treatment, the physical-mechanical properties of the samples were evaluated by determining the density and weight, resistance to acid and alkaline perspiration and resistance to artificial light - determination of the whiteness and yellowing index. Only in the case of polyester samples, changes in fabric densities are observed in both directions of the fabric. The increase in specific mass observed in all cases is due both to the chemical products deposited on the material and to the increase in material densities. Secondly, after the samples were exposed to acid and alkaline sweat, a SEM was used in conjunction with an EDS to show that there was no effect on the elemental concentration of the major constituents. This suggests that the surface treatment applied is resistant to these solutions. Finally, both cotton and polyester textile materials appear yellower and with a lower whiteness index after treatment, however in both cases, the differences are insignificant compared to the untreated sample. This article reports some results of new functionalized textiles with improved antimicrobial properties, which should increase the effectiveness of the treatment of certain types of acne.

Keywords: cosmeto-textiles, acne, blue clay, functionalized textile, dispersion

EASILY FORMABLE PARAFFIN-BASED COMPOSITES INCORPORATING IRON NANOPARTICLES WITH BOTH HYDROPHILIC AND HYDROPHOBIC CARBON SHELLS AS GAMMA-RAY SHIELD

Jolanta Sobczak[1], Gaweł Żyła[2]

[1]Doctoral School of the Rzeszów University of Technology, Rzeszów University of Technology, 35-959 Rzeszów, Poland
[2]Department of Physics and Medical Engineering, Rzeszów University of Technology, 35-959 Rzeszów, Poland

Corresponding author: Jolanta Sobczak, d569@stud.prz.edu.pl

PhD Supervisor: Professor Gaweł Żyła
Rzeszów University of Technology, Rzeszów, Poland

Abstract:

It is commonly practiced to utilize heavy metals as shields against gamma radiation, and the most frequently used metal is lead. Despite their effectiveness it should be remarked, that lead-base shields are heavy, impractical, and are harmful to the human body, therefore next to the traditional absorbers the new class of materials has been developed – nano- and microcomposites. Such solution allows for extensive options in terms of matrix and filler selection, where, besides fundamental shielding property the composites would be characterized by other desirable physicochemical properties adapted to specific requirements taking into account the working conditions. Analyzing literature data, it could be noticed, that some experimental studies apart from pure nano- and microparticles, include particles that possess functionalized surface, for instance in the form of core-shell microcapsules. These capsules could enhance shielding properties, for instance by including heavy elements as a core compound, and improve thoroughly dispersion in matrix with appropriately selected shell. Therefore, in the following study proposed composite based on paraffin where the addition were iron nanoparticles, with hydrophilic and hydrophobic carbon shells. Bearing in mind variety of working conditions (pH, humidity level, etc.) the presence of carbon shells could contribute to reduce the susceptibility to corrosion of iron nanoparticles, which might help maintain the durability and stability not only the nanoparticles itself, but also the entire composite. The developed manufacturing procedure included stages such as weighing individual ingredients on the analytical balance, placing the sample in a vacuum dryer and finally cold mixing using a hand press. The composite samples were simple in terms of composition, as it combined paraffin as the matrix, and iron particles as the filler (10 wt.%). The prepared composites were easily formable with the heat and force of bare hands at room temperature, thus opening limitless shape options. The shielding properties of composites was determined using 60Co with Geiger-Müller counter as a detector. Based on the collected data it was confirmed, that the shell of iron particles had an insignificant effect on the gamma-ray shielding properties.

Keywords: paraffin, particles, gamma-ray, composite, shielding, iron

REINFORCING INFILL STRUCTURE FOR MATERIAL EXTRUSION ADDITIVE MANUFACTURING

Răzvan Cosmin Stavarache, Vasile Ermolai, Alexandru Ionuț Irimia

"Gheorghe Asachi" Technical University of Iași, Department of Machine Manufacturing Technology, Blvd. D. Mangeron, 59A, 700050 Iasi, Romania

Corresponding author: Răzvan Cosmin Stavarache, stavarache.razvan.cosmin@student.tuiasi.ro

PhD Supervisor: Professor Oana Dodun Des Perrieres
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Fused Filament Fabrication (FFF) is an additive manufacturing technology that uses filaments to shape thermoplastic material to build parts layer-wise. Multiple factors influence the mechanical properties of parts made via FFF, such as the parts, decision-making, process parametrization, feedstock, and manufacturing process. Multiple studies focused on the materials and process parameters to understand their effects and interactions and improve the mechanical properties of FFF-made parts. Although FFF delivers parts with reasonable quality, the load capacity is limited due to the parts' anisotropy. Although multiple process parameters influence the mechanical properties of FFF-made parts, it is challenging to account for all of them in a single printing process. For this reason, it is important to study the influence of various process parameters on the mechanical properties of FFF parts and improve their strength by adjusting the printing process to promote filament fuse. According to the literature review, the most common process parameters in the FFF process include extrusion temperature, layer height, nozzle diameter, extrusion width, air gap, build orientation, raster angle, filling pattern, and infill degree. These parameters can significantly influence the tensile properties of the resulting parts. Printing parts with high infill degrees is the most common solution for obtaining high-strength parts. On the one hand, large- sized products can significantly increase the manufacturing time and material use. On the other hand, in terms of tensile strength, improved behaviour is obtained when the number of outer shells is increased. This paper proposes a convenient solution of locally reinforcing the samples using mesh or volume modifiers to tune the parts' core structure to reduce printing time and material usage without reducing the part's strength. In this regard, five parameters were used to control the infill structure of the resulting parts. These variables are mesh modifier shape, width, infill pattern, degree and filament width. A total of 16 parameter configurations were tested using a half-factorial design of the experiment plan with two levels of variation. The results show a significant strain improvement.

Keywords: Fused Filament Fabrication, mesh modifier, local reinforcement, infill pattern, tensile properties

IN VITRO INVESTIGATION OF BIODEGRADABLE ZNTI ALLOYS ON CORROSION BEHAVIOUR IN A PHYSIOLOGICAL FLUID

Alexandra-Tamara Șutic, Romeu Chelariu, Nicanor Cimpoeșu, Ramona Cimpoeșu, Mihai Axinte, Ana-Maria Roman, Gheorghe Bădărău

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Materials Science and Engineering,
41 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Alexandra-Tamara Șutic, alexandra-tamara.sutic@student.tuiasi.ro

PhD Supervisor: Professor Nicanor Cimpoeșu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Various studies have investigated the degradation behavior of Zn alloys in simulated body environments, highlighting their corrosion resistance and ability to maintain structural integrity during degradation. These results indicate that Zn alloys exhibit favorable biocompatibility, minimal cytotoxicity, and the potential for controlled degradation in physiological environments. Mechanical testing, including compression tests and microhardness evaluations, has demonstrated the mechanical stability and strength of Zn-based materials, which are essential for load-bearing applications in orthopedic and dental implants. Furthermore, the osteogenic potential of Zn alloys has been studied, demonstrating their ability to promote bone growth and tissue regeneration. In this study, the degradation behavior of pure Zn and Zn-xTi alloys was evaluated. Surface analysis techniques such as optical microscopy (OM), scanning electron microscopy (SEM), X-ray diffraction (XRD), and energy-dispersive X-ray spectroscopy (EDS) have been employed to characterize the microstructure and chemical composition of pure Zn and Zn-xTi biodegradable materials. Samples were immersed in NaCl solution for different timescales, and the pH values of the solution were recorded from minute to minute for the first 72 h. No significant variation was observed; it increased during the first 1000 min and then stabilized until the end of the test period. Degradation rates (µm/y) were determined by the gravimetric method and based on electrocorrosion resistance tests (linear and cyclic potentiometry). Corrosion compounds resulting from extended contact of the samples with the biodegradation medium were investigated by chemical analysis (EDS) and electron microscopy (SEM). The corrosion products formed in NaCl arise from the interactions between the alloy and the solution, ion exchange, and the corrosion potential of the constituent phases. Within the corrosion layer, compounds containing carbonate, salt, and chloride have been detected. The experimental results showed a slight influence of the intermetallic TiZn16 phase on the corrosion rates. On the basis of the obtained results, Zn-xTi biodegradable alloys showed a moderate degradation rate and can be considered as promising biodegradable materials for medical applications.

Keywords: ZnTi alloy, biodegradable Zn, degradation rate, corrosion

TAILORED FIBER PLACEMENT APPLICATIONS

Andreea Talpă, Maria Carmen Loghin, Alice Mătăşel

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Andreea Talpă, andreea.talpa@academic.tuiasi.ro

PhD Supervisor: Professor Maria Carmen Loghin
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The integration of traditional embroidery methods with cutting-edge technology in the Tailored Fibre Placement (TFP) process marks a significant advancement in composite manufacturing. This innovative approach combines the artistry of intricate fibre manipulation with the precision of Computer-Aided Design (CAD). By digitally mapping fibre pathways and translating them into instructions for embroidery machines, TFP achieves unparalleled control over fibre angles (ranging from 0° to 360°) and allows for precise deposition onto substrate materials, thereby enabling localized thickness adjustments. TFP's streamlined development process not only enhances efficiency but also reduces both time and costs associated with pattern generation. This accessibility democratizes advanced composite manufacturing, making it feasible for a broader range of applications. Moreover, the process's near-net-shape production minimizes material waste and maximizes fibre utilization, aligning seamlessly with sustainable manufacturing principles. The versatility of tailored fibre placement extends to its ability to produce customized preforms tailored to specific composite components or reinforcements. Its applications are diverse, encompassing the creation of lightweight parts for industrial robots, compressor blades, aircraft components, motor suit parts, automotive structures, and bicycle components. This versatility underscores TFP's adaptability across various industries, where precision and efficiency are paramount. The TFP's capability to accommodate various types of fibres enhances its versatility in meeting the specific requirements of different applications. Whether employing carbon fibres for high-strength applications, glass fibres for enhanced impact resistance, or aramid fibres for lightweight yet robust solutions, the tailored fibre placement adapts seamlessly to diverse material demands, expanding its utility across industries. In summary, the tailored fibre placement exemplifies the harmonious fusion of tradition and innovation in engineering. By leveraging the time-honored craftsmanship of embroidery techniques alongside the efficiency of modern CAD technology, TFP revolutionizes composite fabrication. It offers unparalleled control, efficiency, and sustainability in the production of complex composite components, setting a new standard for the industry.

Keywords: Embroidery, fibre placement, TFP, sustainability, new technology

HYDRAULIC MANIFOLDS BLOCKS – OPTIMIZATIONS, SIMULATIONS AND TESTING METHODS. A REVIEW

Narcis Ioan Țica

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Faculty of Machine Manufacturing and Industrial Management, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Narcis Ioan Țica, narcis-ioan.tica@student.tuiasi.ro

PhD Supervisor: Professor Daniela Popescu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The hydraulic manifold blocks (HMB) are the main components of the hydraulic systems. The conventional HMB are machined to obtain routings, necessary for the circulation of the fluid under pressure and for the installation of the components used for the control and the guideness of the flow, by using a compact design for the circuit layout. The main problem in conventional hydraulic blocks is the high loss of hydraulic energy, which might be as high as 50% for some applications. Moreover, the weight of such devices is high. The scientific literature mentions two research pathways, to solve such issues. The first focuses on different configurations of connections to link the holes by machining process, and the topics can cover investigation on the pressure, on the fluid flow, on the energy losses. The most significant investigations have in view the expansion connections, the contraction connections, the offset connections of holes, the V elbows with different angles, the U shape, the reversed S shape and the twisted S shape. Satisfactory results were obtained for the expansion connections. Regarding the offset connection of holes, if the flow passage created by two holes get smaller, then the pressure loss increases. For V elbows the optimal distance between holes is 3d and 5d (d-diameter of holes) and higher the angle is, lower pressure loss is obtained. A comparison between U shape, Reversed S shape and Twisted S shape shown that the U shape generates lowest pressure loss. The second type of research works focuse on how to reduce the weight and the energy loss by using additive manufacturing (AM) or laminated blocks (LB). The technologies are recommended to obtain special geometries for interfaces and routing holes. The most common additive manufacturing processes are selective laser melting, selective laser sintering, direct metal laser sintering and fused deposition modeling. The research works are often based on Finite Element Analysis (FEA) methodology, validated by experimental tests. The results reveal that the weight reduction obtained by AM can be 90%, while for LB it can be 80%. Concerning the pressure losses, the AM technology can lead to a reduction by 35% comparing to LB.

Keywords: Hydraulic manifold, optimization, pressure loss, weight reduction

ASSESSMENT OF HARMFUL EMISSIONS BY COMBUSTION PROCESSES OF NATURAL GAS AND HYDROGEN MIXTURES, AT PRESCRIBED COMBUSTION TEMPERATURE AND PRESSURE

Ovidiu C. Trofin[1], Mihaela Boțu[1], Gheprghe Dumitrașcu[2]

[1]National Research and Development Institute for Gas Turbines, COMOTI, Bucharest, Romania
220D Iuliu Maniu Blvd, Bucharest, 061126, Romania
[2]"Gheorghe Asachi" Technical University of Iași, Romania, Faculty of Mechanics, Department of Mechanical and Automotive Engineering, Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Trofin Ovidiu, ovidiu.trofin@comoti.ro

PhD Supervisor: Professor Gheorghe Dumitrașcu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The ever-increasing stringent regulations on harmful gases emissions, notably carbon dioxide (CO2) and carbon monoxide (CO), as well as the minimization on NOx emissions, should impel to design new thermal systems, particularly their combustion systems. For instance, lean premixed combustion of natural gas, the most common fuel used in gas turbines, has been developed and successfully applied during the last few decades to achieve low CO2 emissions with minimal cycle efficiency penalties. Alternative methods of lowering CO2 include fuel staging, inert species dilution as well as exhaust gas clean-up in a non-premixed combustion system. In this paper, the evaluation of harmful emissions by flue gases resulting from combustion with temperature and pressure imposed for natural gas/hydrogen mixtures was carried out through a chemical modeling of combustion. The modeling correlated the principles of conservation of energy and mass with the chemical equilibrium equations for selected chemical reactions. The modeling imposed combustion temperatures and pressures usually met in actual gas turbine. The excess oxygen required by the imposed restrictive conditions, the composition of the flue gases and the values of harmful emissions (CO and NOx) were evaluated in the two flue gases flow sections of the gas turbine, i.e. the inlet and the outlet one. The chemical model of combustion imposed the values of temperature and pressure, from current turbo engines, respectively temperatures of 800 and 1000 C for flue gases entering the gas turbine and pressures of 15 and 30 bar for the whole combustion process. The numerical results revealed all features regarding the flue gases composition function of temperature and pressure. The other harmful emissions show a dependence both on the temperature of the gases and on their pressure.

The simulation suggested that minor harmful emissions have the following characteristics:

- obviously, CO_2 mole fraction is drastically decreasing as the percentage of H2 is increasing;
- the CO mole fraction is directly proportional to flame temperature, slightly decrease with combustion pressure and it is inversely proportional to hydrogen content in fuel;
- the NO_2 mole fraction is decreasing when the combustion pressure is increasing, is very slightly modified by hydrogen mole fraction in the fuel and has a maximum around 1800 K;
- the NO mole fraction is directly proportional to the flame temperature, marginally affected by hydrogen content in the fuel and the combustion pressure

Keywords: Isobaric combustion, GN/H2 mixture, Combustion gas composition, Harmful emissions

CRITICAL SUCCESS FACTORS FOR THE ADOPTION OF AGILE MATURITY MODELS IN MULTINATIONAL ORGANISATIONS

Cristina-Elena Ungureanu, Alina-Elena Ancu Ioana-Alexandra Sbîrcea, Rebecca Ana Maria Chiriţă

National University of Science and Technology POLITEHNICA Bucharest, Doctoral School of Entrepreneurship, Business Engineering and Management, Splaiul Independenței no. 313, sector 6, 060042, Bucharest, Romania

Corresponding author: Cristina – Elena Ungureanu, cristina.elena.u@gmail.com

PhD Supervisor: Professor Elena Fleacă
University Politehnica of Bucharest, Romania

Abstract:

The purpose of this research paper is to investigate the critical success factors which influence the adoption of Agile maturity models in multinational organisations. The study seeks to address and get a better understanding of the growing importance of Agile methodologies in enhancing organisational flexibility and responsiveness, particularly within diverse global contexts. The purpose of this research is to identify key drivers, challenges, and success factors associated with the adoption of Agile maturity models such as DSDM, Kanban, SAFe, SCRUM, etc. The research methodology involves a comprehensive survey distributed among professionals who hold various roles within multinational organisations and are practitioners of Agile methodologies. The questionnaire covers demographic information, organisational context, adoption drivers, challenges, implementation strategies, perceived success factors, observed impacts, measurement practices, and future outlook regarding Agile maturity and continuous improvement. The research underscores the impacts observed post-adoption, such as: increased productivity, product quality, and customer satisfaction. Measurement and evaluation analysed include: regular assessments practices, KPIs, stakeholder feedback, and continuous improvement initiatives based on retrospective meetings. As a result, this research contributes to the field of organisational management and stakeholder relationship management by increasing the valuable insights into the adoption and effectiveness of Agile maturity models in multinational settings, shedding light on essential success factors and best practices for organisations embarking on efforts surrounding Agile transformations. The findings provide actionable recommendations to enhance Agile maturity and continuous improvement initiatives within diverse multinational environments.

Keywords: Agile maturity models, Agile transformation, continuous improvement, critical success factors, organisational management, stakeholder relationship management

DESIGN ANALYSIS OF GEAR WITH THE USAGE OF THE ADVANCED COMPUTER PROGRAM

Nikola Veleski, Ljupco Trajcevski

University „St. Kliment Ohridski" Bitola, Faculty of Technical Sciences, Bitola, North Macedonia

Corresponding author: Nikola Veleski, Veleski.nikola@gmail.com

PhD Supervisor: Professor Ljupco Trajcevski
Faculty of Technical Sciences - Bitola

Abstract:

Mechanical engineering is an indispensable part of today's technology development. Mechanical engineering includes a large field, such as: energy engineering, structural engineering, production engineering, etc. Each of these branches has a great influence in technical development, but one of the fundamental branches in mechanical engineering is design and calculations. All parts that are an integral part of certain machines or assemblies must be accurately calculated and selected. Gears are an essential part of a large number of machines. Gears, like all other assembly elements, are loaded with certain forces or stresses. Therefore, in order to be able to make the correct selection of gears, it is necessary to make correct calculations and dimensioning, in order to avoid further problems during the operation of the elements. The design and calculation of a gear transmission, one of the often-performed mechanical engineering tasks, requires a lot of long and complicated tedious computations. With today's modern technology that process that could be easily simplified by the use of the computer. However, the result for successful work of the computer programmer will be only as good as the accuracy of data of the input information as well as the procedure of calculation, provided by mechanical engineering science. In this paper, is developed the algorithm for design of the gear which includes typical steps of analysis and stress calculation of the main components, such as gears, shafts and bearings. Same different calculations, resulting from the special requirements and conditions of the application's exploitations can be also included in mechanical modeling procedure, as a choice. Computer program writing in a Visual C++ was also made. The computer program simplifying standard procedure of tedious mechanical computations is also provided. The advantage of the time shortening for complicate reiterations and decreasing of the routine mistakes due to use of computer program is evaluated.

Keywords: gear, shaft, model, calculation, computer, program

OVERVIEW ON VEHICLE - BRIDGE COUPLED VIBRATIONS

Adi-Mihăiță Velniciuc

”Gheorghe Asachi” Technical University of Iasi-Romania, Faculty of Mechanical Engineering,
Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Adi-Mihăiță Velniciuc, adi-mihaita.velniciuc@student.tuiasi.ro

PhD Supervisor: Professor Carmen Bujoreanu
“Gheorghe Asachi” Technical University of Iasi, Romania

Abstract:

Bridges are critical components of transportation infrastructure, facilitating the seamless movement of vehicles and goods across diverse cities and countries. However, the interaction between vehicles and bridges can induce vibrations that may compromise structural integrity and raise safety concerns. This article provides a comprehensive review of existing studies focusing on vehicle-bridge-coupled vibrations, synthesizing insights from diverse methodologies and findings presented by various researchers. The phenomenon of vehicle-bridge-coupled vibrations has received significant attention in structural engineering due to its potential implications for bridge performance and safety. Researchers used analytical, numerical, and experimental approaches to investigate this complex interaction, exploring factors such as vehicle speed, vehicle mass, bridge span, and environmental variables. Our study conducts a thorough examination of the existing literature, providing a comprehensive summary of the methodologies and discoveries made by other authors. It offers valuable insights into the complex dynamics of vehicle-bridge interactions. The synthesis of existing research serves as a precursor to future analyses focused on bridges in Romania regarding vehicle mass and vehicle speed according to Romanian regulations. The main goal is to identify crucial areas of bridges vulnerable to dynamic loading and suggest specific measures to improve structural safety and durability. Using advanced computational tools and different mathematical methods, these assessments aim to offer practical insights for constructors and bridge engineers. This enables well-informed decisions making and taking proactive efforts to manage risks. In conclusion, this article underscores the significance of studying vehicle-bridge-coupled vibrations in safeguarding the resilience and safety of bridge infrastructure. Through a review of current research and the establishment of a foundation for future analyses of Romanian bridges, this study aims to progress bridge engineering practices and strengthen transportation networks' resilience. Future articles will be developed into detailed assessments of Romanian bridges, identifying risky sections, and proposing effective measures to improve structural safety.

Keywords: vehicle mass, vehicle speed, bridge vibrations, coupled bridge-vehicle system, bridge safety

RESEARCH ON PREDICTIVE MANAGEMENT SYSTEMS AND ANTICIPATORY MAINTENANCE TECHNOLOGIES OF PIPELINE TRANSPORT INFRASTRUCTURES

Elena Cristina Anghel Vlădescu

University of Petrosani, Doctoral School, Petrosani, 20 University Street, Romania

Corresponding author: Elena Cristina Anghel Vlădescu, cristina.vladescu@conpet.ro

PhD Supervisor: Professor Cătălin Nicolae Popescu
Petrol Gas University Ploiesti

Abstract:

The aim of the paper is to analyze the current state of research on predictive management systems and technologies for anticipatory maintenance of pipeline transport infrastructures. The prevention of oil spills in operations or generated by sabotage or natural hazards and the management and remediation of spills resulting from an incident represents, preserving an important part of the profit, as such events significantly affect all stakeholders, with major concerns related to the potential negative associated with hydrocarbon losses.
Therefore, it is absolutely necessary to introduce techniques to determine the integrity of the pipelines, so that technical accidents are limited to a minimum. In the petroleum pipeline industry, risk is analyzed in terms of threats that can cause the process to suffer. However, we can also associate risk with a positive component, in the sense that reducing risk to the minimum possible induces new opportunities for development, as a means of achieving this goal. This reduction can be achieved through effective management and the development of appropriate strategies. Establishing the level of risk considered unacceptable for society depends on the assessment carried out in relation to the particular circumstances of each case, the severity of the impact of the occurrence of a risk on public health, security and the environment, including the implications of possible negative effects, persistence, reversibility or possible delayed effects of these damages. In the research we assessed the current situation, the factors influencing the effectiveness of maintenance management, the factors influencing the technological risk and analyzed the risk using the MADS technique. In this context, it follows that the strategy to be adopted in order to draw up maintenance programs must include the following stages: determining the technical condition of the pipeline through periodic checks, adopting modern techniques for the maintenance and rehabilitation of pipelines and technological installations, restoring the capacity to transport flow, modern corrosion prevention technologies, professional inspection equipment, resource economy, but also integrated environmental management - prevention of incidents, accidents and disasters caused by corrosion.

Keywords: predictive management, anticipatory maintenance, risk analysis, pipeline integrity

WORKSHOP

Applications of artificial intelligence in the industrial domains

ARTIFICIAL INTELLIGENCE SYSTEMS IN ELECTRICAL SWITCHBOARDS

Silviu Marian Antohi, Maricel Adam, Alin Dragomir

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management
53 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Silviu Marian Antohi, silviu-marian.antohi@student.tuiasi.ro

Abstract:

During the maintenance activities of the electrical panels, problems related to high temperatures in their contact areas were often found, namely, oxidized electrical contacts, insufficient tightening of the connection terminals, damage to contacts due to high erosion. These problems cause the allowable temperatures to be exceeded, therefore increasing thermal stress. This leads to thermal overload of contact areas, respectively to exceeding temperature thresholds for security of electricity supply.
By applying artificial intelligence, an automatic assistance of maintenance decisions is achieved, through a device for monitoring and diagnosing electrical switchboards, has a high degree of flexibility both at hardware and software level, with multiple communication possibilities that will allow real-time knowledge of the evolution of the monitored parameters, i.e. warning against exceeding threshold values.
The Intelligent System is able to locally display and transmit to an external computing unit via a USB module, the following alarms: exceeding a maximum temperature value for each of the monitored areas of interest, values correlated with the current charge level of the conductive paths; exceeding the value of the maximum permissible current intensity through the current paths of the switchboards; decrease of the supply voltage below a minimum required voltage value; indication of areas with contact resistances above permissible limits requiring maintenance activities. The beneficiaries of the device are: technical academic environment in the field of energy (energy); research and development units in the field; production facilities for monitoring and diagnostic devices; production, marketing and management units of power cells and switchboards. Potential energy users will directly benefit from the results of the device. Beneficiaries in the energy industry through the possibility of including in the portfolio of devices a new product made in the field of monitoring and diagnosis of cells and power switchboards. Companies in the field of electricity generation, transmission and distribution, as well as any industrial consumer who manages electrical equipment, are suitable for the use of such intelligent systems.

Keywords: AI application, electrical equipment, fault detection, temperature measurement

ENHANCING VEHICLE ASSEMBLY WITH AI-DRIVEN GAZE DETECTION IN AUGMENTED REALITY SYSTEMS

Petronela Bonteanu, Gabriel Bonteanu

”Gheorghe Asachi” Technical University of Iasi, Faculty of Electronics, Telecommunications and Information Technology, Iasi, Romania

Corresponding author: Petronela Bonteanu, petronela.bonteanu@student.tuiasi.ro

Abstract:

The integration of artificial intelligence (AI) technologies with augmented reality (AR) systems has revolutionized the vehicle assembly process in the automotive industry. This paper explores the significance of AI implementations, particularly focusing on gaze detection within AR frameworks for enhancing efficiency and precision in vehicle construction. Augmented reality has emerged as a transformative tool for vehicle assembly, enabling real-time visualization of assembly instructions and component placements directly within the manufacturing environment. AI plays a pivotal role in this context, facilitating seamless interaction between human operators and machine systems. One of the critical aspects highlighted is the establishment of a robust man-machine network empowered by gaze detection mechanisms. Gaze detection, as a fundamental component of this network, involves tracking and interpreting the direction of a user's gaze using AI algorithms. The effectiveness of such technology lies in its ability to intuitively understand where an operator is looking, thereby enabling context-sensitive AR overlays and intuitive control interfaces. This capability significantly enhances the precision and speed of assembly tasks while reducing errors and cognitive load on the human operator.

A proposed implementation for gaze direction detection involves the utilization of two Convolutional Neural Network (CNN) classifiers dedicated to independently detecting pupil center coordinates. This approach leverages the power of deep learning to accurately predict the gaze direction based on the position of the pupils within the eye images captured by sensors or cameras. The results obtained on 320 pixel by 240 pixels eye images indicate an accuracy of more than 65% in the detection of the center of the pupil with an error of 0 pixels (euclidean distance) while the detection rate at 5 pixels is 96%.

Keywords: eyetracking, gaze detection, augmented reality, AI, classifier, neural network

EVALUATION OF POST-SEISMIC EVACUATION USING ARTIFICIAL MULTIAGENT SYSTEMS – CASE STUDY

Georgiana Bunea[1], Florin Leon[2]

[1"] Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Civil Engineering and Building Services, 1 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2"] Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Automatic Control and Computer Engineering, 27 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Georgiana Bunea, georgiana.bunea@tuiasi.ro

Abstract:

Earthquakes are known to be one of the most destructive natural events that cause important damage to the anthropic environment. Iasi, a municipality in northeastern Romania, is among the country's most seismically vulnerable cities. The old urban infrastructure, and the lack of specific and well-thought-out analyzed seismic mitigation plans, as well as the unpreparedness of city inhabitants, may lead to a significant number of fatalities following the next earthquake. The evacuation of impacted persons and their safety thereafter is one of the main issues that arise in emergency scenarios following a high magnitude earthquake.

The research focuses on the simulation of human post-seismic evacuation using intelligent multiagent systems, considering the Iasi municipality region as the base environment. The agents are groups of people that start their movement from the vulnerable areas, i.e. damaged building districts, and, depending on their condition, have the common purpose of reaching hospitals or shelters. The movement can be done by walking, by car, or by ambulance (for injured citizens). Each origin node has set, from the beginning, the number of people of a certain kind. Bahlui River, which divides the city into two areas, and the corresponding main bridges were added to the multiagent system environment. The emergency scenarios considered that certain bridges or roads have a specific degree of damage and disrupt the human evacuation process. Thus, the agents were forced to look for alternative routes, that could take them to their destination.

The result of the multiagent simulation highlights the importance of a certain bridge or road in the evacuation process. Practically, the optimum solutions for a post-disaster evacuation scheme are obtained by using the multiagent system for the considered locations. It can be subsequently used in the post-emergency situation management, to diminish the number of life losses, decrease costs and improve the evacuation process in general.

Keywords: multiagent simulation, post-seismic human evacuation, vulnerable areas, emergency scenarios, damaged urban road areas

IMPROVING INFRARED THERMOGRAPHIC INSPECTIONS OF ELECTRICAL INSTALLATIONS THROUGH THE CONTRIBUTION OF ARTIFICIAL INTELLIGENCE

Alin Dragomir, Maricel Adam, Silviu Marian Antohi

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management
53 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Alin Dragomir, alin.dragomir@academic.tuiasi.ro

Abstract:

The aim of this paper is to develop a method for correcting infrared thermographic images captured by means of specific devices, which automatically assists the human decision on the degree of thermal stresses by correcting them by taking into account the coating of reflective surfaces with dust.
Dust deposited on current-conducting paths will emit an infrared temperature closer to the real one compared to an uncovered surface. During switchboard maintenance activities, problems were often found with exceeding permissible temperatures, namely, oxidized electrical contacts, insufficient tightening of fixed connection contacts and high wear of the main contacts of existing switching equipment in electrical panels. This leads to thermal overloading of the electrical contact areas inside them, thus generating thermal anomalies that cause deterioration of the technical condition. These problems exceed permissible temperatures, thereby increasing thermal stresses. This leads to thermal overload of contact areas, respectively to exceeding temperature thresholds for security of power supply, which leads to high losses. Currently, the most current method of investigating hot spots is the use of infrared technology. Scientific research wants to improve this monitoring procedure by taking into account the degree of scattering of electrical installations, consequently correcting the thermographic image through the contribution brought by artificial intelligence.
Moreover, the research focuses on the analysis of infrared thermographic images captured from electrical installations, for their correction with the help of artificial intelligence consisting of a neural network that will train a defined number of known cases regarding the thickness of the dust substrate deposited on the monitored areas and which will frame the new image added in the case closest to the reference. This will constitute an input size for IR image correction, which based on a mathematical formula will do this. In this context, laboratory experiments have been developed to measure and teach a neural network with at least 100 existing possible situations for monitoring and diagnosing hot spots in electrical installations, to remove deficiencies in highly reflective surfaces existing in electrical installations. IR thermographic inspection of electrical installations in order to detect overheated points involves the following steps: scheduling scans, performing scans, complete processing of field information and elaboration of thermographic measurement report.

Keywords: digitization technology, infrared investigation, technical condition, electrical equipment, decision assistance

FUZZY SYSTEM WITH NEURAL NETWORK - GENERATED RULES IN AN ARTIFICIAL INTELLIGENCE APPLICATION FOR EVALUATING TECHNICAL RESILIENCE

Adrian Vîlcu, Mădălina Laura Velești

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Industrial Design and Business Management
53 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Adrian Vîlcu, adrian.vilcu@academic.tuiasi.ro

Abstract:

The research presents the methodology of integrating a neural network into the generation of rules for a fuzzy system, which typically involves using the neural network to learn from data and then using that learned information to form the basis of the rules within a fuzzy system. Here is a general approach to how this integration can be accomplished, based on typical practices in the field of artificial intelligence: *data collection and preparation* - collection and preparation of the necessary data that the neural network will learn from; *neural network training* - train a neural network using the collected data. This involves feeding the data into the network and adjusting its weights and biases based on the error between the predicted and actual outputs; *rule generation* - after the neural network is properly trained, it extracts the knowledge it has learned in the form of rules. These rules are derived from the patterns the network has identified in the data; *integration into the fuzzy system* - incorporate these rules into a fuzzy system. This involves defining fuzzy sets and the corresponding membership functions influenced by the rules extracted from the neural network; *testing and refinement* - once the fuzzy rules are integrated, the system is tested to ensure that it behaves as expected. The performance of the fuzzy system can be evaluated against new data, and adjustments can be made to the rules or membership functions to optimize performance; *implementation* - finally, implement the neuro-fuzzy system within the desired application. This might require additional integration steps depending on the specific hardware or software environment where the system will operate.

This approach capitalizes the learning capabilities of neural networks to handle complex and nonlinear data, and the interpretability and ease of use of fuzzy systems. This powerful combination can be particularly beneficial in scenarios where human-like reasoning is required, offering a promising avenue for advancing the field of artificial intelligence.

Keywords: fuzzy system, AI application, neural network, technical resilience, MTTR, MTBF

THE IMPACT OF TRANSCRANIAL ELECTRICAL STIMULATION ON NEUROPSYCHOLOGICAL PROCESSES IN FEAR MEMORY

Alexandru Buzamat

"Gheorghe Asachi" Technical University of Iasi, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Alexandru Buzamat, alexandru.buzamat@student.tuiasi.ro

PhD Supervisor: Professor Marian Poboroniuc
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Millions of individuals worldwide are affected by Post-Traumatic Stress Disorder (PTSD) and anxiety disorders, causing profound disruptions to their quality of life and imposing substantial burdens on healthcare systems. Despite advancements in psychotherapy and pharmacotherapy, there remains a significant rate of partial response to current treatments, especially because of the renewal effect - a phenomenon where a previously extinguished fear reaction reappears in different contexts. The project aims to address a gap in current research by examining the effects of transcranial direct current stimulation (tDCS) on the renewal effect. Paradigms must be appropriately designed as well. Fear responses through EEG (e.g. recorded by means of performant g.Nautilus / g.USBamp systems and analyzed within g.BSanalyze application, g.tec medical engineering GmbH, Austria) and behavioral measurements in healthy subjects will be recorded in a 3-day context dependent conditioning paradigm, tDCS being applied during the extinction phase only for the experimental group. In addition to the engineering team responsible for configuring BCI systems and recording data, bioengineers and psychology specialists are also involved. If tDCS is found to be effective in reducing the renewal effect, these findings could then be applied to patients with PTSD and various anxiety disorders, potentially improving the outcomes of desensitization therapies.

Keywords: PTSD, Anxiety Disorder, tDCS, EEG, BCI

SOME KEY FIGURES:

- ✓ 178 papers
- ✓ participants from 10 countries (authors and co-authors)
- ✓ 16 Romanian universities, 15 foreign universities
- ✓ Romanian Academy and 2 branch Romanian Academies
- ✓ 6 research and development Romanian institutes and agencies, 3 foreign research and development institutes and agencies
- ✓ 2 companies
- ✓ 1 secondary school

THANK YOU FOR ATTENDING CSD2024!

You are welcome to the 8th Edition of the International Conference of the Doctoral School - "Gheorghe Asachi" Technical University of Iaşi, România, in May, 2025!

"GHEORGHE ASACHI" TECHNICAL UNIVERSITY OF IAȘI, ROMANIA

CSD INTERNATIONAL CONFERENCE OF THE DOCTORAL SCHOOL

TUIASI doctoral

MAY 15-17, 2024

IASI, ROMANIA

Excellence in Doctoral Studies through Innovation, Convergence and Interdisciplinarity

WWW.CONFERINTA-CSD.TUIASI.RO