TUIASI doctoral

"GHEORGHE ASACHI" TECHNICAL UNIVERSITY OF IAŞI, ROMANIA

CSD INTERNATIONAL CONFERENCE OF THE DOCTORAL SCHOOL

6TH INTERNATIONAL CONFERENCE OF THE DOCTORAL SCHOOL

BOOK OF ABSTRACTS

MAY, 17-19, 2023

IASI, ROMANIA

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Excellence in Doctoral Studies through Innovation, Convergence and Interdisciplinarity

Welcome to CSD2023, wishing you a successful conference!

6th 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 17 – 19, 2023

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**)

Organizer's Message

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

At its sixth edition, the International Conference of the Doctoral School at the "Gheorghe Asachi" Technical University of Iasi (TUIASI) aims to provide PhD students of the Doctoral Schools from Technical Universities in Romania and abroad with a favourable framework for communicating the results of their research, exchanging ideas and initiating new collaborations, refine their theoretical and methodological approaches, encouraging presentation and continuous development of interdisciplinary research. The three days' conference (17th-19th of May, 2023) consist of five panel sessions, where PhD students can present and discuss their research papers. The program of the conference will also include a number of plenary presentations held by prestigious professors from universities with which TUIASI has close collaborations.

The conference aims to bring together miscellaneous oral presentations dealing with relevant problems associated to the thirteen doctoral fields at the university: Chemistry; Computers and information technology; Chemical engineering; Civil engineering and installations; Electrical engineering; Electronic engineering, telecommunications and information technologies; Energetic engineering; Industrial engineering; Materials engineering; Mechanical Engineering; Environmental engineering; Systems engineering; Engineering and management.

Bridging the scientific doctoral fields, encouraging the innovation through interdisciplinary collaboration, and the orientation towards internationalization, this event can offer an intellectual intersection between disciplines in which new ideas and progress in science would appear. This way the doctoral programs can be implemented with a focus on training PhD students for research and acquiring a set of core competencies that will allow for the immediate transfer to social institutions in search of a sustainable economy. For PhD students in the earlier stages of doctoral studies, the conference provides an opportunity to train for their first contributions to a certain scientific field, while for the PhD students in later stages, the communications held during conference can be seen as a scientific step towards the jobs market.
***Please visit* the conference website at: https://conferinta-csd.tuiasi.ro/**

Welcome to CSD2023, wishing you a successful conference!

Honorary President,

Professor **Dan CAȘCAVAL**
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- Lect.dr. **Andrei Donțu (Section 2)** (andrei-ionut.dontu@academic.tuiasi.ro)
- PhD Student **Iolanda Fusteș-Dămoc (Section 3)** (iolanda.fustes-damoc@student.tuiasi.ro)
- PhD Student **Cosmin-Ionuț Gosav (Section 4)** (cosmin-ionut.gosav@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.

SECTION 1.

Interdisciplinary studies

INDUSTRIAL COMMUNICATION WITHIN LOW VOLTAGE CIRCUIT BREAKERS

Silviu Marian Antohi, Maricel Adam, Alin Dragomir

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

Corresponding author: Silviu Marian Antohi, silviu-marian.antohi@student.tuiasi.ro

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

Abstract:

Electricity industry operators are looking for new ways to maximize their investment in communications networks while ensuring secure and reliable data transmission. Currently, there are various communications solutions, the two most common being wireless technology and cable options - such as copper cable and fiber optics. Both technologies cover applications in the utility market, for example distribution automation, but there is currently an increase in wireless technology. The paper presents a review of wireless communication networks within electrical equipment. Also are presented some comparative aspects of communication networks used in substation regarding electrical equipment. The current communication methods found within the electrical equipment are presented. Within the paper, are highlight the advantages and disadvantages of the current communication methods used within electrical equipment. The communication networks are various and suitable for particular cases. In the paper it was argued the choice of a certain type of communication used for monitoring electrical equipment. In the final part of the paper, some aspects regarding the temperature wireless monitoring of the electrical equipment are presented using sound acoustic waves (SAW) sensors, which aim to highlight the advantages of wireless monitoring of electrical equipment. Temperature monitoring by means of SAW devices are based on the principle of generating an acoustic surface wave caused by the appearance in the piezoelectric substrate of mechanical forces caused by the change in the temperature of the supervised element. Temperature measurements are obtained in real-time and can be used to configure alarms based on preset threshold values. By monitoring thermal stresses with SAW devices, operating personnel can obtain warnings of exceeding the permissible temperature values. The SAW-based temperature monitoring method offers unique advantages compared to traditional temperature measurement methods, namely: the sensors of SAW devices are passive (do not require a battery or power supply); SAW sensors communicate with the wireless reception unit (through acoustic waves); provides information continuously through one of the industrial communication protocols. Also, in the case study, it was assessed in what matter the influences on the wireless communication network can affect the operation of the electrical equipment.

Keywords: condition monitoring, network communication, power system, SAW sensor, Wi-Fi communication

ISLANDED OPERATION OF INDUSTRIAL POWER SYSTEMS FOR SAFE SHUTDOWN OF INDUSTRIAL PROCESSES

Florin-Constantin Băiceanu, Daniel Munteanu, Ovidiu Ivanov, Ciprian-Mircea Nemeș, Bogdan-Constantin Neagu

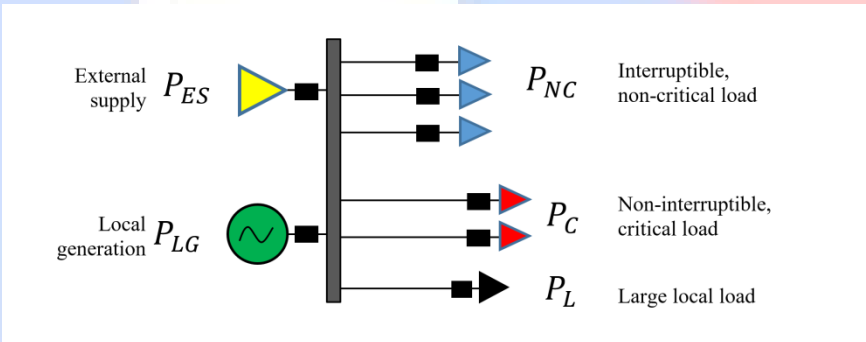
"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electrical Engineering, Energetics and Applied Informatics, 21-23 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Florin-Constantin Baiceanu, florin-constantin.baiceanu@academic.tuiasi.ro

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

Abstract:

Industrial processes rely on a continuous and reliable supply from the grid to achieve optimal operation and production. For large sites, local generation is also used to ensure continuous operation of critical equipment. Severe disturbances that occur in the grid, such as power outages and faults, can force the site to switch to islanded operation to keep critical equipment running as long as necessary to shut down safely.
This paper presents a load shedding approach based on heuristic algorithms such as PSO (Particle Swarm Optimization) applied to a large industrial site in Romania, used to manage the safe islanding of a set of critical consumers in the presence of local generation. The algorithm iteratively calculates over the next few seconds which consumers are required to be disconnected to maintain a balance between generated and consumed power so that the system remains in synchronism.



Starting from the required input data, we can keep the consumption in equilibrium for a sufficient time interval so that the critical consumers can be safely switched off in turn.
The algorithm besides generating several possible solutions, manages to optimize the solutions so that the difference between the production and consumption curves is as small as possible.

Keywords: industrial critical loads, load shedding, multistage algorithm, particle swarm optimization

SIMULATION AND CONTROL OF A NINE PHASE INDUCTION MACHINE USED IN PROPULSION SYSTEM FOR ELECTRIC AND HYBRID VEHICLES

Iulian Bălan, Alexandru-Iulian Timofte, Alexandru Sălceanu

"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: Iulian Balan, iulian.balan@student.tuiasi.ro

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

Abstract:

In these days, the automotive industry is providing a proper environment to develop and try new solutions for the electric traction systems and the electrical drives used in the vehicles. One of the ideas which arose in the last years relates to the usage of different electric machine designs for obtaining the optimal value when it comes to cost-performance criteria in a drive system. Fom this point of view, the attention was drawn by the multiphase induction machines (MIM) which promis to fulfil the already strict requirements of the traction motor but also to add a plus in value when it comes to reliability and efficiency. This paper provides an overview of a possible way of using such a MIM in a vehicle system with detailed results in the direction of field oriented control (FOC) modelled and tested with the help of Matlab Simulink. In an electric (EV) or hybrid vehicles (HEV), the traction system is in charge of providing the means of accelerating or decelerating the vehicle in an optimal way. In order to do so, there are several additional systems like the gearbox which are providing a smooth transition between the accelerating and cruising part of a drive cycle. Because the overall performance of the vehicle depends on the range of the constant torque area and the maximum available cruising speed, we already know how important the impact of the gearbox in the vehicle feeling is. MIM with the help of pole phase modulation techniques are trying to remove this subsystem from the vehicle by providing a high starting torque used for accelerating the vehicle from low speeds and a high power reserve when going beyond medium to high speeds without the needs of increasing the DC bus inverter voltage. This will be done by changing dinamicaly the MIM configuration (pole-phase modulation). We will discuss in the first part about a standard design metod of a multiphase induction machine which allows us to use the pole-phase modulation strategies and then in the second part we will model and simulate a classic FOC strategy applied to the designed MIM. The third part will be dedicated to design the pole-phase modulation strategy and trying different load cases while changing dynamically between the available configurations. We will be able to see how different strategies for switching between different configurations (9phase-4poles, 3phase-12poles) will impact the resulting mechanical characteristic which in the end will translate to a vehicle momentum.

Keywords: EV, FOC, HEV, multiphase induction machine, pole-phase modulation, traction system

MODEL BASED DESIGN USED IN TEACHING OF BLDC CONTROL

Iulian Balan, Alexandru-Iulian Timofte, Silvia-Nicoleta Plăcintă, Vasile Horga, Alexandru Sălceanu

"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: Iulian Balan, iulian.balan@student.tuiasi.ro

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

Abstract:

Nowadays, the complexity of the embedded systems which are used in different areas of industry is growing more and more. This complexity leads also to a change in the way we think about the means of programming those systems. Advanced control strategies like predictive, regressive or genetic algorithms are now considered to be used in small devices like System on Chip (SoC) despite their solid influence in the CPU load. The only difference we see now compared to the past is the rapid ascension of the microelectronic industry. This advance made it easier to integrate more powerfull controllers with less costs in small aplications controllers like the embedded systems. Despite all of this, there is also a drawback when it comes to the programming of such complex functions. Extensive and complicated programming codes should be written if there is a need of a new function in the system. That huge container of code (thousand to tens of thousands) is hard to handle, maintain, debug and change. In the last years a new way of handling the System and Software development came in the attention of the companies- Model Based Design Development (MbD). Most of the automotive companies are applying this approach for shortning the product development cycle by efficiently using the available resources, providing traceability between development areas and increasing the overall costs of the project. In this modus operandi, the engineers can use the MbD to cover all the V-Cycle stages by: defining models (architecture) based on refined requirements, describe the advance functions on a model component level and simulate the system behaviour, automatic code generation, software integration on SoC and testing the overall (or pinpointed) implementation in offline (MiL) or online (SiL) environments. In this paper we will discuss the idea of introducing the MbD viewpoint in the structure of the academic teaching plans. This will provide to students with an initial touch of the subject before they will enter the industry trials of understanding and using the MbD. The paper is evolving around the comparison between a classical way of software implementation and the new MbD perspective. In order to attract students's attention the initial requirements are given: *design a BLDC control alghoritm which uses a SoC for digital implementation of the control functions.*

Keywords: BLDC Control, classic programming, complex functions, control alghoritms, Model Based Design, SoC, V-cycle

NEURAL NETWORK CLASSIFIER BASED GAZE DETECTOR

Gabriel Bonteanu, Petronela Bonteanu, Arcadie Cracan, Radu Gabriel Bozomitu

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

Corresponding author: Gabriel Bonteanu, gabriel.bonteanu@academic.tuiasi.ro

PhD Supervisor: Professor Radu Gabriel Bozomitu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

This paper presents a gaze detection algorithm based on neural network AI technology implemented in python. The target application is a remote one, that is, the device that captures eye images is not head mounted but has a fixed position, capturing high-resolution images of the human subject. Thus, the eye image ends up having a modest resolution of 30x20 pixels. The technique used in image processing is that of a classifier.
The network has 4 layers of neurons: the first layer has 600 pixels that encode the light intensities of each pixel of the grayscale image, as well as the last layer of the network, the desired operation being the following: only that output neuron corresponding to the center of the pupil will be activated.
The network was trained using stochastic gradient descent on a set of 1324 images from three eye image databases, which were previously used by the research team in testing of 6 classical (non-ai) algorithms based on feature detection.
Thus, the first database contains 400 images captured using a device developed by the research team, the second database includes 400 images taken from the Casia Iris Lamp public database, while the third database includes 524 images used in testing of the state of the art EXCUSE algorithm.
The initial set of eye images was divided into 3 dedicated parts, training set (80%), validation set (10%) and test set (10%).
Several implementation possibilities were explored: sigmoid and ReLU neurons; quadratic and cross-entropy cost functions; 2 up to 5 hidden layers.
The results indicate an accuracy of more than 75% in the detection of the center of the pupil with an error of 0 pixels (euclidean distance) while the detection rate at 2 pixels is 100%. The flexible size of the network and the high processing speed allow edge processing, the new trend in information processing.

Keywords: AI, classifier, Eyetracking, gaze detection, neural network, pupil detection

CULTURAL AND CREATIVE INDUSTRIES IN THE NORTH-EASTERN REGION OF ROMANIA: AN ANALYSIS OF THE CREATIVE ECONOMY

Adriana Bujor

"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 Bujor, adriana.bujor@academic.tuiasi.ro

PhD Supervisor: Professor Silvia Avasilcăi,
Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The cultural and creative industries are an essential part of modern economies, increasingly recognized by governments, businesses, and the general public as sources of beauty and expression, as well as financial value and jobs. Scholars worldwide have focused on researching cultural and creative industries distributed across business and management, economics, geography, law, or studies of individual sectors or activities such as design or media. In Romania the emerging creative economy and the estimates regarding the cultural and creative industries' overall contribution demonstrate real growth potential, in trend with the EU statistics. Despite various controversies, researches in the field allow us to affirm that the importance of these industries is also growing in Romania. According to the National Institute for Cultural Research and Training (INCFC), Romania's cultural and creative sectors are researched and analyzed considering the cultural, social, and economic values they generate, emphasizing the relationship of interdependence between creativity, culture, economy, and society. The paper presents an analysis of the companies acting in the cultural and creative industries in the North-Eastern Region of Romania, based on the following criteria: creative activity type (code list according to statistical and narrative information published in public databases regarding the Romanian NACE), the date of their establishment, and the evolution of the turnover over the past five years. Considering the changes during the time span of the last five years, three important periods are included in the analysis: pre-pandemic, during the pandemic, and post-pandemic. In this context, the main aim was to identify the way in which the cultural and creative industries in the North-Eastern Region were influenced by and reacted to the Covid 19 crisis. Such an analysis will highlight the cultural and creative sectors most strongly affected by the pandemic, compared to those that managed to find the leverages to innovate, adapt and thrive.

Keywords: creative industries, entrepreneurship, innovation, reactivity, resilience

MECHANICAL BEHAVIOR OF CEMENT MORTAR MODIFIED WITH BENTONITE AND TITANIUM DIOXIDE NANOPARTICLES

Georgiana Bunea, Sergiu-Mihai Alexa-Stratulat, Ionuț-Ovidiu Toma, Petru Mihai

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

Corresponding author: Georgiana Bunea, georgiana.bunea@academic.tuiasi.ro

PhD Supervisor: Assoc.Professor Petru Mihai
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Modern civil engineering research has broadened its interest in the nanotechnology field. The most used construction material worldwide, i.e. concrete, was mixed with various types of nanomaterials for research purposes, e.g. carbon nano-tubes, nanosilica, etc. Each nanomaterial succeeded in improving certain physical and/or mechanical characteristics of concrete. Titanium dioxide TiO_2 particles proved to have a photocatalytic effect when added to the cementitious mix, combined with an increase in mechanical strength and durability to chloride and sulfate ions, as well as the resistance to freeze and thaw cycles. Bentonite B nanoparticles – a more economical solution – increases as well the mechanical strength and several properties related to the durability of cement composites, e.g. corrosion resistance.

The current paper focuses on determining the impact of adding both TiO_2 and B nanoparticles to cement mortar. These nanoparticles were selected based on the complementarity of some of their properties. Thus, combining the smaller non-reactive TiO_2 nanoparticles with the larger reactive B nanoparticles and adding them to the mortar mix, could provide better results in both strength and durability of cement mortar, compared to the control sample and also to the mortar modified with only one of the two nanomaterials.

The study considered four nanomaterial combinations added to the cement mortar mix. Three samples of each combination were cast. They were water cured for 28 days and then tested for flexural and compressive strengths. All modified mortar samples recorded an increase in flexural strength compared to the control sample. The best cement mortar mix for flexural strength comprised 1.5 wt% B and 0.75% TiO_2 nanoparticles. An increase in compressive strength compared to the control sample was obtained for the cement mortar mix modified with 1 wt% B and 0.75 wt% TiO_2. The hydration process is prolonged due to the higher specific surface area of the nanoparticles, for the mortar modified with B and TiO_2, compared to the control sample. Thus, the mechanical strengths are expected to increase at later ages. Finally, the study confirmed that the addition of both B and TiO_2 nanoparticles has a positive effect on cement mortar, especially on its flexural strength.

Keywords: bentonite, cement mortar, compressive strength, flexural strength, titanium dioxide

A COMPARATIVE STUDY FOR DC-DC CONVERTER OUTPUT CAPACITOR BANK'S GENERAL RELIABILITY EVALUATION USING MIL-HDBK-217F AND TELCORDIA SR-332 PREDICTION STANDARDS

Dan Butnicu

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

Corresponding author: Dan Butnicu, dbutnicu@etti.tuiasi.ro

PhD Supervisor: Professor Dorin O. Neacsu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

In the last decade a higher level of reliability became a compulsory demand when it comes of modern DC-DC converters. This work addresses the main reliability metrics: the failure rate _ and MTBF of an output capacitor bank used within a high current low voltage buck converter due to many studies had shown that the output capacitor bank was demonstrated being the most critical component within converter. Many authors treated this issue, usually by doing reliability predictions. The majority of the papers use only one specific Standard Prediction to solve the problem. Herein calculation was done using both the older standard MIL-HDBK-217 and the latest one Telcordia SR-332, providing a benchmark comparison between the two which is a helpful tool for the output capacitor selection in the early stage design. Military standard was well accepted for decades in order to reliability prediction even on industrial electronics and is still used today under critical manner because no more update after the latest version MIL-HDBK-217F - Notice 2 released in 1995. Since then, newer prediction standards had appeared on the electronics reliability market. Over the time, this standard was mostly used but it does not accurately model the reliability because lack of taking account of mission profile. The above-mentioned newer standard – Telcordia SR-332 (Issue 4, March 2016) is trying to compensate also the lack of the newest component technology in the older standard (which is the first standard released on the market) supplying useful design data for design engineers who use the so called ''design with the reliability in mind'' concept. Within the paper were established the environmental condition for the passive components by means of a PoL (Point of load) buck converter that is used for both calculation methods. Influence of temperature and several specific concepts like reference conditions, operating condition, ripple and internal self-heating were taking account in order to display the results. Temperature for the capacitor's capsule needed in πT stress factor calculation was derived by PSPICE simulation. High fidelity and dedicated SPICE models provided by manufacturer was used for MOSFETs, polymer electrolytic and MLCC capacitors that compose the converter.

Keywords: DC-DC converter, MIL-HDBK-217F, MLCC, polymer electrolytic capacitor, reliability, Telcordia SR-332

NUMERICAL STUDY ON PEG 400-BASED MATERIALS ENHANCED WITH OXIDE NANOPARTICLES

Elena Ionela Chereches, Alina Adriana Minea

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

Corresponding author: Elena Ionela Chereches, elena-ionela.chereches@academic.tuiasi.ro

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

Abstract:

Nanofluids are homogeneous mixtures of solids and liquids, with solid particles smaller than 100 nm uniformly and stably suspended in a fluid. Nanoparticles that have high thermal conductivity include metallic (Ag, Cu, Al, etc.) and non-metallic (TiO_2, Al_2O_3, ZnO, MgO, carbon nanotubes, etc.) particles and can be used as an additive for the preparation of nanofluids. There are several advantages in dispersing nanoparticles compared to millimeter-sized particles in working fluids, such as better nanoparticle stability in base fluids, lower viscosity, improved thermal conductivity and decreased corrosion. Thus, the preparation of nanofluids with good stability is the most crucial step in conducting experimental studies on their thermophysical properties and heat transfer. In this paper we have carried out a numerical study of the laminar flow of a fluid through a pipe, using the Ansys Fluent software. The simulation corresponds to the forced laminar flow and heat transfer for two oxides - PEG 400 nanofluids. To obtain nanofluids, MgO and TiO_2 nanoparticles in different mass concentrations were dispersed in the PEG 400 base liquid. The properties of nanofluids were determined experimentally (viscosity and specific heat) and theoretically (density and thermal conductivity). The numerical analysis was implemented for two Reynolds numbers, Re = 500 and Re = 1000. The velocity of the fluid entering the pipe is constant and was calculated based on the Reynolds number for each fluid. Concerns the results, the heat transfer performance of nanofluids was defined by the convective heat transfer coefficient. Numerical research that significantly contributes to the critical analysis of the new studied fluids. The general conclusion of the numerical studies was that it is absolutely necessary to first determine the thermophysical properties of the fluids and their variation with temperature, thus creating the premises for a correct numerical analysis.

Keywords: MgO nanoparticles, nanofluids, PEG 400, thermophysical properties,TiO_2 nanoparticles

ON THE IMPACT OF A CLASSIFICATION MODEL IN EEG FEATURE SELECTION FOR COGNITIVE LOAD ASSESSMENT

Corina Cîmpanu

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

Corresponding author: Corina Cîmpanu, corina.cimpanu@academic.tuiasi.ro

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

Abstract:

The performance of a Brain-Computer Interface system is associated with working memory activity and is directly related to the cognitive load level. Specific to humans, working memory refers to the ability to temporarily hold in mind a series of informational pieces when solving a problem. This executive memory process causes the activation of some specific brain regions. Electroencephalogram (EEG) data provide meaningful information about identifying and forecasting memory-related cycles. In EEG memory paradigm identification, data preprocessing and feature selection represent crucial steps that allow an unbiased interpretation of data. The EEG signals used in the experimental section of this study were acquired from 14 electrodes, a third of them located in the frontal and prefrontal regions during memory tests on some specific computational reasoning scenarios. The 14 resulting signals were decomposed on 4 frequency bands: Alpha, Beta, Gamma, and Theta.

The Genetic Algorithm (GA) based optimization procedures tackle minimizing a classifier's error rate, minimizing the length of the selected subset of features, and a linear combination of the two. However, regardless of the involved Single Objective Optimization (SOO) procedure, the major problem that arises here is related to the fact that EEG data consist of numerous samples of high dimension, expected to be noisy and highly redundant.

The SOO procedure is applied separately for the three objectives mentioned earlier, involving the training of different classifiers like Ada Boost, k Nearest Neighbors (KNN), Random Forest (RF), or Support Vector Machine (SVM), etc. This study aims to evaluate different approaches to assess and classify cognitive load and working memory activity to improve misclassification rates and execution time. To achieve this goal, we train different configurations of the above-listed classifiers. Various multiclass classifiers demonstrate their degree of confidence during the evolutionary selection of features and bring on their advantages or limitations. The results suggested that workload levels can be precisely indicated using even a limited set of electrodes and waveforms.

Keywords: classifier, cognitive load, EGG data, genetic algorithm, singleobjective optimization, working memory task

A COMPARISON OF RANKING METHODS USED IN MULTIOBJECTIVE OPTIMIZATION FOR FEATURE SELECTION IN EEG SIGNALS

Corina Cîmpanu

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

Corresponding author: Corina Cîmpanu, corina.cimpanu@academic.tuiasi.ro

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

Abstract:

Electroencephalogram (EEG) recordings provide insightful information concerning the diagnosis and prognosis of human thinking and memory-related processes, aiding researchers and physicians during Brain-Computer Interface systems development. In EEG, memory pattern identification, feature extraction, and feature selection are determining factors for an impartial data description and an accurate classification. The EEG signals analyzed in this study are collected from 16 electrodes split into 4 frequency bands during specific working memory-related tasks on different reasoning scenarios.

Although most Genetic Algorithm (GA) based optimization procedures tackle the minimization of a classifier's error rate and the number of selected features, they are independent of how feature selection procedures are configured, either in Single (SOO) or Multi-Objective Optimization (MOO) manners, the major problem is multidimensionality and quantity of redundant and noisy EEG recordings. In addition, the layout of objective values for some randomly generated populations of solutions motivates the use of both SOO and MOO methods. Finally, the SOO is applied separately for two objectives: the minimization of the misclassification rate and the minimization of the number of selected features. All these limited explorations ground the use of MOO procedures for better and sound results.

Regarding all MOO procedures, the compared Pareto ranking schemes are meant for the selection of parents and survivors in evolutionary MOO. Usually, Pareto methods use only the dominance analysis for providing the partial sorting of solutions without considering the specific strength of the conflict between them. Methods compared in this paper assign the ranks by combining the search and the decisional mechanism. The decision is implemented through adaptive grouping schemes meant to guide the search towards the middle of the first Pareto fronts, enabling the progressive rejection of profitless solutions. The population is split into several groups to preserve its diversity, or a supplementary objective is added to control the variety of the most valuable genetic information. Finally, the layout of the available solutions in the objective space is examined based on clustering procedures and by Pareto ranking of the resulting centers to counteract the inherent disadvantages of Pareto methods. All compared ranking schemes demonstrate their effectiveness during the evolutionary selection of features. Furthermore, various classifiers distinctively address the problem at hand, illustrating different decisional mechanisms.

Keywords: classifier, cognitive load, EGG data, genetic algorithm, ranking, multiobjective optimization

NANOFLUIDS: AN OVERVIEW ON THERMOPHYSICAL PROPERTIES

Nicoleta Cojocariu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Material Science and Engineering 41 Prof. 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:

The present study scrutinizes the enhancement of the thermophysical properties of nanofluids with potential in heat transfer applications. Nanofluids are a new class of fluids that have shown immense potential in recent years in applications such as heat exchangers, radiators, electronic cooling system, solar cells, thermal energy storage, nuclear reactors, automotive and biomedical applications. In general, a nanofluid consists of a base liquid in which a nanophase powder is dispersed. To fall into the class of nanopowders, the particles must have at least one of the three main dimensions between 1 and 100 nanometers. In general, all conventional materials such as metals, ceramics or polymers can be obtained at the nanometric scale, yet, the present study focuses on the investigation of different characteristics for nanofluids consisting of oxide nanoparticles (Al2O3, TiO2, SiO2) and/or MWCNT (Multi Walled Carbon Nanotubes) dispersed in mineral oils.

Base fluids like oil, water or ethylene glycol have poor thermal conductivity, therefore, by adding solid nanoparticles even in small concentrations, this property is significantly improved. The main explanation of this enhancement relys on the higher thermal conductivity of solid nanoparticle if compared to the base liquids. It can be concluded that the ability of a nanofluid to transmit heat is directly proportional to the amount of nanoparticles added, but this is not universally true because by adding nanoparticles both the thermal and rheological properties change. The concentration of nanoparticles strongly influences the viscosity as well as the flow regime of the fluid. In the laminar flow regime or turbulent flow respectively, the thermal properties vary according to different mechanisms and that is why the experimental results in the literature are sometimes contradictory. Besides the volumetric concentration, the particle size, the temperature as well as the long term stability strongly influence all the thermophysical properties, therefore, the development of highly efficient nanofluids for different application is directly influenced by these parameters.

Keywords: convection, nanofluids, thermal conductivity, thermophysical properties, viscosity

ELECTRICAL EQUIPMENT CONDITION MONITORING

Alin Dragomir, Maricel Adam, Silviu Marian Antohi

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

Corresponding author: Alin Dragomir, alin.dragomir@tuiasi.ro

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

Abstract:

The paper presents how is performed an investigation for vibration monitoring of electrical equipment. The article also illustrates how the mechanical fault detection devices can highlight a specific anomaly of the high-voltage circuit breaker due to comparing the good operation state as the reference. In the final part of the paper, an experiment was presented to present this monitoring method as appropriate for earlier identifying mechanical fault in electrical equipment. Vibrations are mostly measured using specified devices called vibrometers. The vibrometer is a device that controls and records the speed, acceleration, and amplitude of vibrations. The vibrometer also performs the function of recording the frequency of sinusoidal oscillations of various objects. Vibrometers are divided into several categories, and as mentioned above, the most used piezoelectric type. The operation of this type of instrument is based on the piezoelectric effect, [11]. In the composition of the vibrometer and, more specifically, in the housing, an inert body is suspended on elastic elements containing a piezoelectric material. The deformation of these plastic elements during the manifestation of vibrations is transformed into a measuring signal. The main disadvantage of this type of device is that it needs a direct contact of this device with the object to be measured. Another shortcoming, in addition to the essential one, is that this device has a narrow frequency range. A non-invasive direct ablation measurement method based on vibration signal analysis has been developed [3] for application on high-voltage circuit breakers. In this system, the delay in the time instant of the start of the arcing contact touch as it gets shorter due to ablation is monitored. The relative experiment environment is exhibited in Fig. 2, [8]. The proposed method consists of measuring the vibration signal from the circuit breaker's shell case using an accelerometer. The acquired data can be used in two ways. One consists of comparing the acquired vibration pattern with a reference record and quantifying the difference. The other is used to detect the time interval. When the sensors are attached near the arcing contact system, the three poles with different ablation levels manifest distinct vibration signals.

Keywords: Circuit breaker; high voltage; mechanical monitoring.

CAREER-MAKING, A MOTIVATION FACTOR IN PRIVATE ROMANIAN COMPANIES

Diana Geantimir, Luminița Mihaela Lupu

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

Corresponding author: Diana Geantimir, diana.geantimir@yahoo.com

PhD Supervisor: Professor Luminița Mihaela Lupu,
"Gheorghe Asachi" Technical University of Iaşi, Romania

Abstract:

The aim of this paper is to investigate the components of the management policy of four Romanian companies and their impact on the motivation, involvement, and productivity of workers. The study is based on a sample of 100 employees, and the results highlight the presence of a career management policy that includes clear skills development policies, employment policies, adequate working conditions, and a fair remuneration policy. However, the absence of participation policies in the life of the company was also noted.

The main function of any company is to create value and generate profits for its managers while also contributing to social welfare by creating jobs. However, there is an increasing recognition that sustainable business success cannot be achieved solely through short-term profit maximization, but through long-term profitable and socially responsible activity.

The findings of this study suggest that the presence of a well-defined career management policy can significantly impact employees' motivation, involvement, and productivity. Clear policies on skills development and employment opportunities, coupled with fair remuneration and adequate working conditions, can foster a positive work environment and contribute to the company's long-term success.

The absence of participation policies, however, can limit employees' sense of belonging and engagement in the company's mission and values, which may negatively affect their motivation and productivity. Therefore, it is essential for companies to create opportunities for employees to be involved in decision-making processes and to have a voice in shaping the company's future.

Overall, this paper highlights the importance of a comprehensive career management policy and its impact on employees' motivation and productivity. Furthermore, it underscores the need for companies to prioritize long-term sustainable activity that benefits both shareholders and society.

Keywords: employee development, HRM, promotion, skills, work conditions

DETECTION OF HIGH CH_4 CONCENTRATIONS AT NATURAL GAS END-USE DISTRIBUTION NETWORKS IN URBAN AREAS

Mustafa Hmoudah, Călin Baciu, Cristian Pop

Babeş-Bolyai University of Cluj-Napoca, Faculty of Environmental Science and Engineering, 30 Fantanele Street, 400294, Cluj-Napoca, Romania

Corresponding author: Mustafa Hmoudah, mustafa.hmoudah@gmail.com

PhD Supervisor: Professor Călin Baciu,
Babeş-Bolyai University of Cluj-Napoca, Romania

Abstract:

Since the industrial revolution, CH_4 emissions have increased by 150%. Urban Areas are responsible for approximately 60% of these emissions, mainly coming from anthropogenic activities. Besides, urbanization caused changes in land-use and reduced CH_4 sinks. The sources of CH_4 emissions in Urban Areas still have a high degree of uncertainty. Recent studies have stated that leaks from natural gas distribution networks are significant sources of CH_4 in the atmosphere, and they also represent a potential loss of energy resources. However, emissions from end-use natural gas networks are poorly explored in literature.

The main contributors in the Romanian CH_4 budget are the agriculture and the energy sectors. Over the period 1989 – 2000, methane emissions rate decreased by 34% due to the sectoral changes in agriculture and fossil fuels. Nevertheless, the Romanian national inventory doesn't report CH_4 emissions from Urban Areas.

This study investigates CH_4 concentration from end-use natural gas network in Cluj-Napoca, the second largest city in Romania in terms of population. These points can be identified as part of the natural gas distribution networks that serve natural gas to end users for gas consumption. The detected points were pipelines junctions and natural gas meters.

The estimation of CH_4 concentration in the atmosphere was carried out based on a laser CH_4 sensors Tunable Diode Laser Absorption Spectroscopy (TDLAS) with high measuring accuracy of 0.1 ppmv. This CH_4 concentration detection was performed from December 2022 to January 2023 at 74 natural gas end-use points. The determination of either representing leaks or not was quite after estimated the background level in the city and comparing the obtained concentrations with this background.

This study has revealed that 76% of the detected end-use natural gas distribution points have gas leaks and represent continuous contributors in CH_4 annual budget.

However, this contribution in the annual budget should be estimated. Moreover, the results of this study indicate that the presence of high leaks from natural gas end-use points in Urban Areas. They suggest in-depth investigating and allocating of all natural gas leaks at the end-use points, in order to take certain reduction measures regarding CH_4 mitigation.

Keywords: atmosphere, gas leaks, Greenhouse Gas (GHG), Methane (CH_4), natural gas end-use networks, urban areas

COALITIONAL CONTROL BASED ON OPTIMAL FEEDBACK GAIN MATRIX STRATEGY FOR VEHICLE PLATOONING

Anca Maxim, Ovidiu Pauca, Constantin-Florin Căruntu

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

Corresponding author: Anca Maxim, anca.maxim@academic.tuiasi.ro

PhD Supervisor: Professor Constantin-Florin Caruntu,
"Gheorghe Asachi" Technical University of Iasi-Romania

Abstract:

Nowadays, there is an increased interest in traffic management, thus ensuring an efficient usage of public roads (by avoiding traffic jams). Vehicle platooning is one of the simplest methods of organization among different vehicles, which travel on the same road, at the same time. A vehicle platoon implies an ad-hoc or intended grouping of vehicles, which collaborate to achieve a common goal. The first vehicle from the platoon is the leader vehicle, which imposes the velocity of the entire group, whereas the remaining vehicles are the follower vehicles, which must travel with the speed imposed by the leader and must keep a desired distance with respect to the vehicle directly in front.

The purpose of this research is to investigate the usefulness of the coalitional control strategy in a vehicle platooning application. The main idea is to introduce the usage of a flexible communication network within the platoon. The flexibility consists of the possibility to enable and disable communication links, depending on the local communication necessities. Moreover, when a communication link is activated between two vehicles, the local information becomes common knowledge between the two participants, thus forming a cooperative group or a coalition, which is considered a single entity from the control point of view. If more information is needed, more vehicles can be incrementally added to the coalition.

The proposed coalitional control strategy for a vehicle platooning application is derived using the optimal feedback gain matrix control methodology, which is one of the fundamental strategies suitable for state-space process models. Let us assume a fully activated communication architecture, i.e., all the vehicles are inside a single coalition. This means that all communication links are activated, which translates into a feedback gain matrix without zero elements. Within the proposed methodology, all communication topologies are considered, which results in several feedback gain matrices, with nonzero elements on different positions.

The methodology was successfully tested in simulation on a heterogeneous vehicle platoon, and the results show that the stability of the platoon increases with the number of activated links.

Keywords: coalitional control, feedback gain matrix, flexible communication, network, string stability, vehicle platoon

COMPARISON OF DIFFERENT CONTINUOUS WAVELET TRANSFORM FAMILIES FOR EEG-BASED EMOTION RECOGNITION AND CLASSIFICATION

Betina-Mihaela Melinte, Liviu Goraș

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

Corresponding author: Betina-Mihaela Melinte, betina-mihaela.melinte@student.tuiasi.ro

PhD Supervisor: Professor Liviu Goraș,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Emotions play a significant role in daily human interactions and decision-making processes, which are crucial for comprehending human behavior. Due to the advancement of signal acquisition equipment, the recognition and classification of human emotions from recorded physiological signals, particularly from electroencephalography (EEG), has garnered growing attention in the field of affective science worldwide. EEG-based emotion recognition is a challenging research field alongside wavelet analysis, which has been used to process biomedical signals for describing time-localized events, feature extraction, compression, and denoising applications. Despite the vast number of published articles meant to improve the accuracy of emotion classification and detection rate from EEG signals, none of the current approaches have studied nor compared different wavelet functions frequently used in other EEG study areas (such as epilepsy, sleep disorders, etc.). This paper aimed to identify the most effective wavelet function for analyzing EEG signals using the Continuous Wavelet Transform (CWT) and to determine whether the functions normally used in other fields of brainwave study are as good as those used in emotion analysis. Theta features were selected to be classified into emotions since they are linked to human emotions. The wavelet entropy was computed using different wavelet functions from the Daubechies, Biorthogonal, Fejér-Korovkin, and Coiflet wavelet families in order to identify and extract the features of interest from the EEG signals that can best discriminate emotions. The principal component analysis (PCA) feature selection method is adopted, and the efficacy of the features is validated by modeling and training a cross-validation Support Vector Machine (SVM) type classifier. The experiments are conducted on DEAP dataset, a well-known database to analyze music-induced affective states in humans, classifying those states into positive and negative emotions. Results show that among the wavelet functions taken into consideration in this study, *bior1.5* achieved the best classification rate of 82.76%, thus demonstrating the utility of other wavelet families that haven't been used before in the emotion detection field.

Keywords: continuous wavelet transform (CWT), EEG, emotion classification, entropy, principle component analysis (PCA), Support Vector Machine (SVM)

TEXTILE WASTE DECONTAMINATION IN THE RECYCLING PROCESS

Alexandra Bodoga, Andreea Nistorac

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

Corresponding author: Andreea Nistorac, andreea.nistorac@student.tuiasi.ro

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

Abstract:

Textiles are essential materials in many industries, including healthcare and food service, where cleanliness is essential to prevent the spread of infection. However, textiles can easily be contaminated with bacteria, viruses or other harmful microorganisms that can cause disease. Reducing the risk of transmission of micro-organisms has become one of the greatest modern concerns, especially in a post-pandemic context. Therefore, it is necessary to implement effective decontamination methods to ensure health safety. Several methods of textile decontamination can be discussed, including chemical, thermal, and physical techniques and their effectiveness in eliminating microorganisms. In recent years, textile and footwear recycling has become a priority for the fashion industry due to the negative impact they have on the environment. Before being recycled, these products should be decontaminated to avoid the spread of bacteria and other harmful substances. The purpose of this research is to shift the attention from assuring the end-result of the recycling process to be decontaminated and safe for being (re)used, to an equal crucial decontamination step at the beginning of the process that should be discussed to maintain safety during the recycling process from both the facility cross-contamination and the human resource perspective. As pathogens are microorganisms that can cause disease in humans and can often be transmitted through direct or indirect contact with contaminated people or objects, a first step in recycling as textile waste decontamination can prevent professional diseases by making the working environment safer. Different challenges can be further discussed regarding the aspect that in many cases, decontamination requires the use of strong chemicals that can also damage the material being cleaned. Therefore, it is important to identify substances with decontamination properties that do not affect textile fibres. This paper also reviews the available literature on substances that can effectively decontaminate surfaces while maintaining the quality and integrity of textile fibres. Further research should assess the issue of textile fibres that interact with various chemicals and substances during their life cycle, leading to changes in their physical and chemical properties.

Keywords: Biological load, disinfectant substances, pathogens in textiles, recycling steps, textile life cycle

ANALYSIS OF BIODEGRADABLE ZnMgY ALLOY AS POTENTIAL IMPLANT MATERIAL FOR NECESARY MEDIUM PERIOD HEALING TIME

Cătălin Panaghie, Nicanor Cimpoesu

"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Materials Science and Engineering, 41 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: nicanor.cimpoesu@academic.tuiasi.ro

PhD Supervisor: Prof. Nicanor Cimpoesu

Abstract:

Beside Mg and Fe based alloys as biodegradable metal materials, Zn has attracted a great interest, and its properties related to bio-applications have been studied since the beginning of the century. Zinc is very important for biological functions in the human body because it is involved in various aspects of cellular metabolism [1]. Biodegradable materials are able to degrade in the human body to produce non-toxic compounds that can be easily eliminated. Zn based alloys are promising candidates for biodegradable implants because it has good strength, high corrosion resistance, low hydrogen release rate and good biocompatibility in animal tissues [2]. Rolling is the most important metal forming process. In the rolling process, permanent deformation is achieved by subjecting the material to high compressive pressure, allowing the material to pass through the gap between two rotating cylindrical rolls. In this work insigths of Zn–Mg alloys obtaining with addition of ytrium containing 3 wt.% Mg were studied. The structure, mechanical properties and corrosion behavior of these alloys in laminated state were investigated. A new alloy was obtained from high purity zinc (99,995%) and MgY (70-30 wt%) master alloy using an induction furnace under Ar atmosphere. The materials were melted for 10 minutes at 480 ˚C in a standard induction furnace with gas (Argon)(~0.75 atm), Induct-Ro, Iasi, Romania. In the first phase, the master alloy 70%Mg30%Y was introduced in the amount of 2.5g in the crucible, (granules approximately equal to cca.3mm^2) and pure Mg 1.5g. Pieces of pure Zn were gradually added to the hot crucible, total composition 110g ZnMgY. It was continuously mixed to obtain the best possible homogeneity and to control the melting of the MgY prealloy by dilution in the molten zinc bath. Loss of zinc by volatilization was avoided by maintaining a low melting temperature and by improving the dissolution of the element in the metal bath. The samples were remelted five times to achieve adequate chemical and structural homogeneity and to reduce voids and microcracks resulting from the melting process. The cast material was poured into the mold. After cooling, the obtained ingots were taken out and subjected to mechanical turning, cutting and grinding, obtaining test samples to be studied further.

Keywords: biodegradable materials, DSC, EDS, mechanical properties, SEM, XRD, ZnMgY alloy

THE INTRUSION OF THE MYTHICAL AND THE FANTASTIC IN DUMITRU RADU POPESCU'S PROSE

Georgiana Elisabeta Panait (Baciu)

„Dunărea de Jos" University of Galați, Faculty of Letters, 111 Domnească Street, Galați, 800201, Romania

Corresponding author: Georgiana Elisabeta Panait, panait_elisabeta_2010@yahoo.com

PhD Supervisor: Professor Simona Antofi,
„Dunărea de Jos" University of Galați, Romania

Abstract:

I focused my attention on the concept of myth and the symbols found in Dumitru Radu Popescu's works. The issues addressed by this writer relate to fundamental human values, which makes literary works of particular importance in the modern world, which is going through a deep spiritual crisis.Dumitru Radu Popescu probes for the unusualness of mythical symbols, for an ineffable world. Myth is present in literature not only as an initial historical source, but also as a historical generator of creativity, endowing it with certain mythological attitudes.The stability of myths in art exists both at the level of content and at the level of form. Literature uses not only the images of myth, but approaches structurally.The tragedy of the Romanian village caught in the demented fever of the socialist society, with the terror of arrests and the cruelty of the newcomers to power, mimicking the belief in a future paradisiacal world, demolishing centuries-old values in favor of an existential utopia. Making culture and literature an annex of the propaganda of the proletarian ideology, the communist leaders and cultural watchers opened a pernicious gap between the important pre-war creations and the "new literature", putting great writers on the index, abandoning the formal and thematic requirements of the works, the diversity motives, complexity and deep exploration of the human soul. A problematic character, victim not only of the accident due to the rescue from death of a flawed man, he blames himself, without finding a solution that would help him not to definitively lose the meaning of his own existence. Only, he still imagines a utopian world, dreaming of the island of paradise happiness. The writer, like other colleagues from the guild: Marin Preda, Augustin Buzura, Fănuș Neagu, Constantin Țoiu, needed the courage and will to move away from the control and demands of the power favorable to some ideological dogmas, in order to create an innovative literature, with a high percentage of originality.

Keywords: critical attitude, dreamlike, fantastic, mythical, prose modernization, realism

STUDY OF THE LOW FREQUENCY MAGNETIC FIELD GENERATED BY THE TRANSFORMER STATIONS IN THE RESIDENTIAL ENVIRONMENT

Ionel Pavel, Valeriu David

"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: Ionel Pavel, ionel.pavel@academic.tuiasi.ro

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

Abstract:

In this paper we present the measurements results of the magnetic field in five zones with power transformer station from residential area for determine the human exposure to the low frequency magnetic field. To determine the spatial variation of the magnetic field strength we used a commercial instrument made by EXTEC with a frequency band between 30 Hz and 300 Hz with ±4% basic accuracy and for determining the temporal variability of the field we used an automatic instrument made in our laboratory. This type of measurement system implemented, realized and calibrated by us, made an automatic measurement of the magnetic induction B, some seconds apart, memorizing and processing the results of this automatic survey in the frequency band up to 100 kHz, having a measurement uncertainty below 5%.

The measurements were carried out at 1 meter high from the ground and at a distance of 1 meter between the measurement points. The obtained results were presented in the form of magnetic field maps exemplifying the spatial variation of the low frequency magnetic field. Following the measurements made by the spot measurement method, we identified, for each area studied, some points where the field was higher and we performed automatic survey. Following the records obtained, in order to determine the temporal variability of the field generated by the existing sources, we made graphic representations, both in the time and the frequency domain and respectively a statistical processing using the automatic survey instrument. The maximum value of the magnetic field collected near power transformer station, identified in Zone 4, was under 32 µT. Compared to the maximum values allowed by International Commission on Non-Ionizing Radiation Protection (ICNIRP), this value is less than 3.2 %, however in all five investigated areas we recorded the values exceed 0.4 µT, which carry health risk, especially for children.

Keywords: automatic survey, human exposure, Low frequency magnetic field, power transformer station, spot measurement

UPCYCLING IN FASHION – A LITERATURE REVIEW

Lavinia Maria Popa, Antonela Curteza

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

Corresponding author: Lavinia Maria Popa, lavinia-maria.popa@student.tuiasi.ro

PhD Supervisor: Professor Antonela Curteza,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The concept of upcycling is an integral part of modern fashion. It involves reusing clothing products that are no longer useful or have reached the end of their life cycle by converting them into new, value-added products. Because of its potential to improve environmental efficiency, the concept has attracted widespread attention from business and academic communities. Over the years, the number of articles on upcycling has increased. The expanding number of articles on upcycling in various fields has shown that academic and business communities progressively acknowledge the concept. Unfortunately, the volume of literature on the subject has remained relatively low. It is essential for the fashion industry to thoroughly review the literature on how it incorporates upcycling into its business models. This study will enable it to identify the factors influencing its sustainability and make informed decisions about its operations.

This study highlights how academic research has been conducted on this topic. The methodology was developed through a systematic literature review and data analysis from the last ten years (2013-2023). A systematic review involves collecting qualitative data from quality sources such as journal articles. This review was undertaken to identify and critically appraise the most relevant academic research. The study explored various aspects of the fashion industry in the field of upcycling, including fast fashion and slow fashion. It also covered this sector's main barriers, benefits, trends, and factors that will affect it. This study will help academics and researchers expand the scientific literature's scope.

As a result, more than one hundred papers were obtained from various sources such as conferences and journals. The scope of this paper is to review the literature on this topic and to examine how it is disseminated in the digital age. It also examines how data is collected and used to improve the competitive environment for businesses.

The study focused on qualitative research to develop the concept of upcycling at least until mid-2023. It also sought to define the movement of the term and its holistic perspective.

Keywords: design, fashion industry, review, sustainability, upcycling

REVIEW OF VIBROACOUSTIC METHODS USED IN THE DIAGNOSIS OF KNEE JOINT ARTHROSIS

Denisa Șmadici, Viorel Paleu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Mechanical Engineering, 63 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Denisa Șmadici, denisa.smadici@student.tuiasi.ro

PhD Supervisor: Professor Viorel Paleu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Arthrosis is a degenerative pathology characterised by progressive degradation of the articular cartilage that can lead to its complete failure. The progressive degradation can be seen at the level of all anatomical structures involved in a joint (bones, cartilage, ligaments, menisci, synovial tissues) and can be considered one of the most prevalent joint affections, because it affects the joint as a whole, leading to disabling disorders. It is one of the pathologies with a big incidence and its risk factors consist of older age, sex, obesity, and certain bone deformities. The pathology is often diagnosed in its later stages when clinical manifestasions appear: pain, swelling, modified range of joint movements, stiffness and tightness in the morning, joint deformity, and coarse crepitus. Currently, the methods used to diagnose this pathology are mainly arthroscopy, radiography, and biochemical laboratory analysis. The usual diagnostic methods are, in their vast majority, currently invasive methods, which is not an ideal approach in health care. Also, the diagnosis of arthrosis is performed, most of the time, in fairly advanced stages of the affection. Novel methods of evaluation and diagnosis of the affected cartilage, in the earliest possible phases and more importantly, completely non-invasively, may represent the future in fighting against this pathology.

One of these methods could consist of the use of vibroacoustic signals to detect the pathology, using new, standardized and completely non-invasive techniques. Vibroarthography is a method considered inexpensive and it is radiation free. It can be used to assess different affections of the knee cartilage during movements, by recording knee vibration during knee's principal movements (flexion and extension), using special equipment placed on the articular surfaces, in contact with the skin and then, processing the recorded signals. The most important advantage of this method remains the non-invasive nature.

This paper aims to review the state of art on the use of this non-invasive technique in diagnosing knee osteoarthrosis.

Keywords: diagnosis, knee joint, non-invasive, osteoarthrosis, vibroacoustic signal

ANALYSIS OF THE APPLICATION OF ENVIRONMENTAL CERTIFICATION IN THE TOURISM INDUSTRY IN DEVELOPING COUNTRIES

Raluca-Maria Țâbuleac, Maria Gavrilescu

”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
Academy of Romanian Scientists, 3 Ilfov Street, Bucharest, Romania

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

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

Abstract:

Tourism and the hospitality industry play an important role in the major change required to create a sustainable society. Sustainable tourism focuses not only on the protection of natural resources, but also on the economic and social balance of the environment in which it takes place. A sustainable tourism industry takes responsibility for the current and future economic, social and environmental impacts of tourism by addressing the needs of visitors, businesses, the environment and local communities. Constructive advantages are observed by residents in the form of support for education as well as medical services, greater access to drinking water, and support for local initiatives. These beneficial consequences are enormous, particularly in developing countries. Traditional mass tourism threatens numerous natural regions across the world. It can place a huge strain on a region, causing soil degradation, higher levels of pollution, releases into the sea, loss of natural ecosystems, greater pressure on endangered species, and increased vulnerability to forest fires. This frequently pressures water resources and may lead local populations to keep up for resources that are vital.
In this study we aim to provide a perspective on the viability and importance of certification and accreditation in the tourism industry as a tool for sustainable development, by applying a cost-benefit analysis of certification as a tool for sustainable development, with a particular focus on developing countries. It has been found that when a destination is certified or has certified services, it influences, engages and inspires others towards a positive sustainable development of the tourism industry. At the same time, there are some disadvantages in the implementation of certification in developing countries, such as insufficiently developed technology, management, or marketing skills.
In conclusion, cost-benefit analysis can help decision-making by quantifying the impact of proposed certification schemes on different tourism regions. Cost-benefit analysis in evaluating the implementation of different certifications in the tourism industry would be useful and guidelines for its implementation at national and regional level are recommended.

Keywords: costs, eco-label, environmental certification, sustainability, tourism

TRANSIENT CFD SIMULATION OF PATIENT BREATHING IN THE OPERATING ROOM

Florin-Emilian Turcanu

"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-Emilian Țurcanu, florin-emilian.turcanu@academic.tuiasi.ro

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

Abstract:

This research explores the application of transient Computational Fluid Dynamics (CFD) simulations to analyze patient breathing patterns in the operating room (OR). The goal is to better understand the impact of these patterns on the environment, surgical procedures, and potential infection risks. CFD is a numerical method used to analyze fluid flow, heat transfer, and chemical reactions. It is increasingly being utilized in various industries, including healthcare, to optimize processes and improve safety. The study begins by creating a 3D digital model of an OR, accounting for all essential components such as ventilation systems, surgical equipment, and patient positioning. The model incorporates real-life data from various sources, including measurements of air velocity, temperature, and humidity, to ensure accuracy. Next, transient CFD simulations are conducted to analyze the airflow patterns generated by the patient's breathing. Transient simulations capture time-dependent phenomena, allowing researchers to examine the changes in airflow and associated variables over time. This is crucial, as patient breathing is a dynamic process with complex interactions between the patient's respiratory system, the OR's ventilation system, and other factors. The simulation results provide valuable insights into the transport and distribution of exhaled air and potential airborne contaminants in the OR. These findings have significant implications for surgical procedures and infection control. For instance, the study identifies areas where exhaled air accumulates or stagnates, increasing the risk of contamination. This information can be used to design more effective OR layouts and ventilation strategies, minimizing infection risks and enhancing overall patient safety. Furthermore, the research highlights the importance of considering individual patient factors such as age, body mass index (BMI), and underlying health conditions when analyzing OR airflow patterns. These factors can greatly influence breathing patterns, exhalation strength, and the dispersion of airborne particles. In conclusion, this research successfully demonstrates the utility of transient CFD simulations in analyzing patient breathing patterns in the OR. The findings have practical applications in enhancing surgical safety, optimizing OR layouts, and developing more effective infection control strategies. This innovative approach has the potential to significantly improve patient outcomes and pave the way for further advancements in healthcare engineering.

Keywords: Computational Fluid Dynamics (CFD), Infection control, Operating room (OR), Patient breathing patterns, Ventilation strategies

REVOLUTIONIZING HEAT TRANSFER: EXPLORING THE LATEST ADVANCES IN GRAPHENE NANOFLUIDS RESEARCH

Liviu-Ioan Zupcu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Material Science and Engineering,
41 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Liviu-Ioan Zupcu, liviu-ioan.zupcu@student.tuiasi.ro

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

Abstract:

Nanofluids are a promising new technique for improving heat transfer, and significant research has been dedicated to their development. In recent years, scientists have been particularly interested in graphene-based nanofluids, which have the potential to significantly enhance the thermal performance of fluid flow systems. Nanofluids are formed by adding solid nanoparticles of highly thermally conductive materials to a fluid. Among nanoparticle materials, graphene has shown great potential due to its high thermal conductivity, which can reach up to 5000 W/m.K.

Most research in this area has focused on using water as the preferred base fluid, and a two-stage preparation method has been widely accepted. To increase the stability of nanofluids, physical techniques such as agitation, mechanical stirring, and ultrasonic vibration are commonly employed.

Experimental studies have demonstrated that the rheological behavior of graphene nanofluids has to be analyzed at different temperatures and shear rates. Results have shown that the absolute viscosity increases due to changes in the viscosity of the base fluid. Graphene-water nanofluids exhibit Newtonian behavior for particle mass fractions below 1.0% and shear thinning behavior at higher concentrations.

However, experimental investigations of both the thermal and rheological behavior of graphene nanofluids are ongoing. Conductivity is observed to improve with increasing concentration, and the heat transfer performance of graphene in the base fluid has been experimentally analyzed, showing improvements in heat transfer capacity compared to the base fluid.

These results demonstrate remarkable potential for using graphene nanofluids as suitable replacements for conventional fluids in heat exchange applications. Further research is needed to highlight both the advantages and disadvantages of graphene-based nanofluids.

The goal of the research performed during doctoral thesis is to design new graphene nanofluids and study their thermophysical properties, as well as evaluate their numerical and experimental behavior in a heat transfer application (heat exchanger).The thesis will focus on designing a graphene nanofluid and studying its thermophysical and electrical properties, as well as conducting numerical and experimental research on its application in specific heat transfer scenarios.

Keywords: graphene, heat transfer, nanofluid, rheology, thermal conductivity

SECTION 2.

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

A SHORT SURVEY OF MACHINE LEARNING TECHNIQUES FOR PHISHING WEBSITES DETECTION

Codruț-Georgian Artene, Florin Leon

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

Corresponding author: Codruț-Georgian Artene, codrut-georgian.artene@academic.tuiasi.ro

PhD Supervisor: Professor Florin Leon
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Phishing is a malicious cyber-attack that utilizes fraudulent emails, messages, or websites to deceive individuals into revealing their sensitive information, such as login credentials, credit card details, or other personal information. Phishing websites are created to resemble legitimate websites and are aimed at tricking users into sharing their sensitive information. Once the victim has submitted their information on the phishing website, cybercriminals can utilize it for malicious purposes, such as financial fraud, identity theft, or even more phishing attacks. Phishing websites pose a serious threat to internet security, and machine learning has emerged as a promising solution to this problem. In this survey, we review the latest developments in machine learning techniques for phishing website detection. We begin with a detailed description of the phishing cyber attack and an analysis of the various types of phishing websites. We classify the reviewed methods into several taxonomies based on the underlying machine learning algorithms and the features extracted from webpages that these methods use as input. We analyse the advantages and disadvantages of the studied methods regarding their performance in terms of accuracy, scalability, robustness, and generalizability. We also discuss the challenges of developing effective phishing detection models, including imbalanced datasets, evolving attack strategies, and adversarial attacks. Furthermore, we highlight the limitations of the existing methods and the gaps in the literature that may represent good starting points for future research. This survey's findings can prove valuable to researchers, practitioners, and policymakers who seek to gain insight into the current state of the art of machine learning for detecting phishing websites. By identifying limitations in the existing methods and highlighting opportunities for enhancing the development of effective phishing website detection models, this survey can contribute to the advancement of the field and the overall improvement of internet security.

Keywords: classification, cybersecurity, deep learning, machine learning, phishing detection, phishing website

A NOVEL METHOD FOR VEHICLE POSITIONING BASED ON CAMERA AND GPS INFORMATION EXCHANGE

Iosif-Alin Beti, Paul-Corneliu Herghelegiu, Constantin-Florin Căruntu

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

Corresponding author: Iosif-Alin Beti, iosif-alin.beti@student.tuiasi.ro

PhD Supervisor: Professor Constantin-Florin Căruntu,
"Gheorghe Asachi" Technical University of Iasi-Romania

Abstract:

The number of vehicles overwhelms currently the available infrastructure, which leads to increased accident rates, fuel consumption, pollution, travel time, and driving stress. However, intelligent vehicles may lead to a solution to this problem, because they use sensors that enable them to comprehend their surroundings and determine both their own position and that of other traffic participants. Moreover, the use of communication networks enables the exchange of information regarding potential hazards and obstacles on their route, as well as their travel intentions and positioning. To advance the efficiency of road traffic, the idea of grouping autonomous vehicles into platoons has been proposed. Vehicles should consider all available lanes on a given road sector when forming a group and travel at high speeds with minimal distances between them. However, this is possible only if a vehicle can determine its precise position w.r.t. the other traffic participants. Thus, this paper presents a method for positioning vehicles on the current road sector, using the information from onboard cameras and the global positioning systems (GPS) they are equipped with, and is based on the communication between them. As such, each vehicle examines the video stream from its own camera frame by frame using the Oriented FAST and Rotated BRIEF (ORB) detector, which identifies keypoints for each image. These keypoints are then used to construct descriptors using the Boosted Efficient Binary Local Image Descriptor (BEBLID). Then, the data from the GPS are extracted and every piece of information related to the current frame is serialized, which is further broadcast to other vehicles. Each vehicle decodes the messages it has received, extracts the keypoints and descriptors, and then uses a matching algorithm to compare the information it has extracted from the environment with that of the other vehicles. It calculates the homography matrix, which is used to determine if a car is on the left or right, and with the help of the timestamp can determine if a car is in front or behind. Due to shorter processing times and less data transmitted through the network, this method is much faster than the machine learning-based approaches.

Keywords: computer vision, descriptors, positioning, traffic optimization, V2X

A SHORT COMPARISON OF THE TWO-STAGE AND SINGLE-STAGE OBJECT DETECTORS ALGORITHMS IN COMPUTER VISION

Constantin Catargiu

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

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

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

Abstract:

Object detection is one of the essential subjects in computer vision because a significant part of computer vision problems involve detecting different object categories like persons, faces, cars, buses, animals, etc from an image or input video. This field is not limited to academic exploration and research and has potential real-world business use cases in domains like video surveillance, healthcare, autonomous driving, etc. Most use cases, especially autonomous driving, require high accuracy and real-time inference speed, so choosing an object detector that can fit with speed and accuracy is essential.
Object detection involves both classification and localization tasks, therefore not only tells us what is in the image but also where the object is via the bounding box. So, object detection is a two-step process: the first step is finding the locations of objects, and the second step is classifying those bounding boxes into different classes. Therefore, we can distinguish three types of algorithms in object detection: the first one is based on traditional computer vision (Viola Jones Detectors, HOG, and DPM), the second one is a two-stage deep learning-based algorithm (R-CNN, SPPNet, Fast R-CNN, Faster R-CNN) and finally, the third one are single stage deep learning based algorithms (YOLO, SSD).
In this paper we compared the performance of the two-stage and single-stage object detectors based on deep learning algorithms. First, I start with a brief history of object detectors developed in the past decades and summarize the two eras of this domain. Forwards, I present the models (architecture, performance, evolution) based on two-stage detection together with some results obtained for the inference process using architectures based on regions proposals (using sliding window and image pyramid to extract the ROIs or using Selective search to extract the ROIs, method used for R-CNN) and bounding box regression to predict the ROIs (Faster R-CNN). Next, I present and compare the YOLO (You Only Look Once) family object detector architecture and performance, together with some experimental results that I obtained for the training and inference process using different versions of this model. Finally, the paper ends with conclusions about the speed and accuracy of the training and inference process using the R-CNN family and YOLO family models.

Keywords: computer vision, deep learning, inference, object detection, selective search

ENHANCING CYBERSECURITY READINESS THROUGH RED AND BLUE TEAM COMPETITION

Cristian Chindruș, Constantin-Florin Căruntu

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 Chindrus, cristian.chindrus@student.tuiasi.ro

PhD Supervisor: Professor Constantin-Florin Căruntu,
"Gheorghe Asachi" Technical University of Iasi-Romania

Abstract:

Cybersecurity threats are evolving at an unprecedented pace, making it more important than ever for organizations to have an effective cybersecurity strategy in place. One of the most effective ways to achieve this is through red and blue team training. Red and blue team training is a type of cybersecurity training that simulates real-world attack scenarios to identify and mitigate vulnerabilities in an organization's digital infrastructure. In this training, the red team represents the attackers, and the blue team represents the defenders. The red team's goal is to penetrate the organization's defenses, while the blue team's goal is to identify and respond to these attacks. The benefits of red and blue team training are numerous. It provides a realistic simulation of an attack, helping organizations identify vulnerabilities in their digital infrastructure that they may not have been aware of. Additionally, it allows organizations to train their employees to respond effectively to security incidents, reducing the risk of a successful attack, and promoting a culture of continuous improvement. Adding competition to red and blue team training can further enhance the benefits of this type of training. Competition provides motivation for participants to perform at their best and stay current with evolving threats and best practices. It also encourages participants to think creatively and outside the box as they try to outsmart their opponents. In our study, we proposed a combined red and blue team approach to enhance communication and understanding between the two teams. By employing this approach, each participant was able to gain insight into the differing roles performed by the red and blue teams. Our findings suggest that this approach can lead to an increase in capabilities for reacting to a real attack. Specifically, by fostering a better understanding between the teams, participants were able to identify and mitigate vulnerabilities more effectively. These results demonstrate the potential value of a combined red and blue team approach in improving cybersecurity readiness. Further research is needed to fully explore the benefits and limitations of this approach.

Keywords: attack scenarios, competition, cybersecurity, mitigation, red and blue team, training

HEURISTIC APPROACH IN RING VOLTAGE CONTROLLED OSCILLATORS DESIGN FOR ANALOG TO DIGITAL CONVERTERS

Andrei Ciobănașu

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

Corresponding author: Andrei Ciobanasu, andrei.ciobanasu@student.tuiasi.ro

PhD Supervisor: Professor Radu Gabriel Bozomitu,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Nowadays global trends of digitalization, electrification of cars, autonomous driving, IoT etc. push integrated circuits specifications - energy efficiency, power supply level, area - to their limits. Therefore, in the attempt to design a circuit that will better suit the required specifications new paradigms appear or even old ones find a better implementation in current context. One idea from the latter category brings back to life time-encoding analog to digital converters (ADCs). In a few words, these ADCs take advantage of fast switching times in short channel technology nodes (less than 180nm) - which create higher accuracy in time - and use time related quantities - frequency, phase - to encode information.

At the core of these ADCs stand ring controlled oscillators - either by voltage or by current - that have a digital like topology (the simplest one being a chain of inverters) and digital like output waveforms. This fact enables a mostly digital implementation of an ADC that comes with benefits of voltage supply scaling. Even though delay cell structure can be as simple as a basic inverter their modelling for an analog behaviour (needed to design a voltage controlled oscillator, VCO) can became too difficult for rapid and precise enough hand calculations.

This paper introduces a procedure that relies on Computer Aided Design tools (industry compatible SPICE simulator and MATLAB) to get a first rapid design solution that can be further analysed and optimized using the system derived requirements for the Ring VCO. Due to the fact that linearity is a key performance metric of an ADC a special attention will be given to this characteristic during the design and for this matter several control mechanisms will be analyzed. To exemplify the design procedure two different delay cell topologies (simple inverter and pseudo-differential cross coupled inverters) will be analysed and designed in a 130nm CMOS technology.

Keywords: VCO, analog to digital converters, integrated circuits, VCO based ADCs, linearity of VCOs

ANALOGOUS MODE IMPLEMENTATION OF STATE SPACE BASED CONTROL OF BUCK CONVERTER

Diana-Elena Cucoș, Dorin Octavian Neacșu

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

Corresponding author: Diana-ElenaCucos, diana-elena.cucos@student.tuiasi.ro

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

Abstract:

The necessity for modifications to the control system for the traditional buck converter results from the revised specifications for point-of-load converters, which incorporate the dynamic behavior. Typically, the regulator design aims for a zero steady-state error and a phase margin of over 60 degrees in order to provide stability at parameter or mode fluctuation. To accomplish this topic, a design based on DJ Venable's K-factor approach was created in 1983. On digital platforms, a more up-to-date control design technique built on state space is increasingly adopted. This study adds an analogous mode implementation to the benefits of the State Space based design process. Platforms constructed utilizing integrated circuits (ICs) are utilized mostly for the control of point-of-load converters, which are used to power low-voltage loads. These integrated circuits are based on designs from the 1970s by Mammano for power ICs. In regulator functions, the load voltage must be maintained constant at a certain reference value. Accordingly, their design specifications imply stability with adequate margins and no steady-state error. State-space-based control, which is entirely digital, appears as a design option at the other extreme of the design spectrum. Because computers are used by modern people for design and implementation, this is also known as modern control. The dynamic requirements are converted into preferred positions for the system poles when using a state- space-based control design technique. The existing poles from the buck converter model are moved to the new location using a linear control law that is generated in MATLAB® using the "acker" or "place" commands. This simple mathematical approach guarantees dynamic performance. The addition of a new state variable as the error integral is the method that can lower the steady-state error. This study's conclusion is that the State Space based design method has the advantages of a quicker design and less reliance on component precision. Controllability and compliance with the design specifications are assured via a straightforward MATLAB® approach for the State Space design. The State Space based design process, which is essentially digital, is also illustrated in this study as being adaptable to an analog implementation platform.

Keywords: Buck converter, dynamic behavior, state space, steady-state error, system poles

ANALYSIS OF SCREEN-PRINTED ELECTRODES' ARCHITECTURES BASED ON ELECTRIC FIELD NUMERICAL SIMULATION AND MODELLING

Tudor-Alexandru Filip, Ina Turcan, 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: Tudor-Alexandru Filip, tudor-alexandru.filip@academic.tuiasi.ro

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

Abstract:

Screen-printed electrodes (SPE) are the core element of the modern electroanalytical analysis experiments. The technology is expected to pull out the electroanalytical experiments outside the laboratory, in the real world, and consequently, boost utilization of electrochemical analysis in onsite or outdoor determinations. Consecrated configurations of screen-printed electrodes (SPE) have been widely used lately in both scientific and industrial experiments. The most common SPE configuration is assuming integration of a working electrode (WE) of different dimension and geometry (circular or rectangular) along with a reference (RE) and a counter electrode (CE) on top a flatted substrate, fact which is allowing the determination of the target analyte to be done on a small amount of solution. However, in spite of the fact that this configuration is providing outstanding results when related to various analysis (using the antibodies as bio-receptors - *E.coli, Salmonella typhimurium, Listeria innocua, Staphylococcus aureus*, using monoclonal antibody – *E. coli, Salmonella typhimurium, Campylobacter jejuni*, glucose, proteins, nucleic acids), the SPEs are still lacking sufficient sensitivity for allowing large scale deployment of the devices on the market. In order to improve the performances of SPEs, and consequenctly the electric field distribution and current density, a thoroughly understanding of the relation between the geometrical dimensions of the WE and CE is needed. Clarrifications in this sense are needed as the current state of knowledge is not clearly describing how the geometrical parametrization is affecting the sensitivity of the SPEs. In this regards, the herein paper is presenting and benchmarking a series of numerical modeling and simulation results obtained at the level of different SPEs architectures of different dimension and shapes. Influence of geometrical and dimensional relation between electrodes is discussed in detail for understanding the role of each component at the level of detection performance. Nonetheless, technological recommendations are provided with the aim of improving the screen-printing process and thus reducing the material waste during the manufacturing process.

Keywords: counter electrode, electrochemical performance, screen-printed electrochemical electrodes, simulation, working electrode

HOLISTIC APPROACH TO THE SECURITY OF CLOUD COMPUTING SYSTEMS

Răzvan Florea

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

Corresponding author: Răzvan Florea, razvan.florea@student.tuiasi.ro

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

Abstract:

In the last few years, cloud computing technology has benefited many organizations that have embraced it as a basis for revamping the IT&C infrastructure. Cloud computing utilizes Internet capabilities in order to use other computing resources. Even though this technology is complex and widely used, some security experts have pointed out that some of its vulnerabilities can be exploited in launching attacks aimed at cloud technologies.
Analyzing the traditional network and the Software Defined Network (SDN) access control technology based on OpenFlow protocol, a custom virtual machine users’ access control protocol based on the SDN network is designed, to realize the control of virtual machine users’ operation accessing a network. In this paper, we present a holistic security analysis of cloud computing systems by examining the vulnerabilities, threats, and attacks that these technologies are susceptible to.
We illustrate our findings by implementing several of these attacks on a test bed representing an OpenStack-based cloud computing system. The main contributions of our paper are: (1) We provide a holistic view of cloud computing systems security that integrates the underlying threats, vulnerabilities and mitigation techniques. (2) We proposed a novel taxonomy of attacks targeting such systems (3) A custom access control protocol’s authentication server module and client module are designed and implemented, and the authentication process of virtual machine user access control in the network is described in detail.
The outcome of the conducted experiments showed some of the vulnerabilities of the cloud computing platforms, but we aim that our proposed work on the security of cloud-based systems defined networks will be helpful for cybersecurity researchers and practitioners.

Keywords: cloud computing, low-rate distribute denial of service, openstack, software defined network,

APPROACHES TO THE PROCESSING AND SEGMENTATION OF NON-ELECTRICAL BIOLOGICAL SIGNALS

Robert Fuior

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

Corresponding author: Robert Fuior, E-mail address: robert.fuior@student.tuiasi.ro

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

Abstract:

This paper presents our results on signal processing of non-electrical biological signals. One of the most famous examples is that of the respiratory cycle. So that recordings of respiratory signals can often have a series of artifacts/noises at the time of signal acquisition. To eliminate these noises, a variety of high-performance digital filters are needed. Carrying out a filtering as thorough as possible depending on the type of signal given for analysis and the type of filter chosen for processing. After filtering, the biosignal can be exported, allowing a doctor to analyze this information and establish a diagnosis or a certain medical behavior. The working and display interface of the processed signals was developed with the help of the MATLAB 2021B software for the digital filtering of the signals and also for their segmentation according to the type of recognized noise. Having introduced a series of functions necessary for filtering and segmenting the signals given in the analysis. For user-friendly design, App Designer Toolbox, an interactive development environment for designing programming applications that have a number of well-established functions, was used. Programming was done using the MATLAB editor. Means of the predefined buttons the user can load the raw biological signals or choose the desired filter. The digital filter specific to respiratory cycles being Butterworth that responds to the frequency range of interest. In addition to this filter, the High pass, Low pass filters and last but not least the Notch 50Hz filter were also implemented. Certain functions were also introduced to segment signals according to function. Recommendations are presented for selecting the most appropriate topology for the applied filter, whether it is finite impulse response or infinite impulse response.

To validate the filtering results, the publicly available database "ICBHI 2017 Challenge" was accessed. This comparative validation contributes to the professional training of the bioengineer. This is because an incorrectly designed or incorrectly chosen filter can affect the processed signal, introducing considerable errors. This reference database supports those who want to evolve in the field of respiratory parameter analysis and research. The paper compares (before and after filtering) a series of respiratory biosignals, which can be exported for analysis and comparison. These files can be displayed and exported in either XSLS, M file and PNG format. The interface enables the training of the bioengineer in the design and use of digital filters intended primarily for the very difficult processing of non-electrical biosignals.

Keywords: digital filters, non-electrical biosignal, segmentation signals

A CLUSTERING-BASED EFFICIENT FRAMEWORK FOR VOLTAGE QUALITY PATTERN RECOGNITION IN MICROGRIDS

Ștefania Gălbău, Constantin Zetu, 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: Ștefania Gălbău, stefania-loredana.galbau@student.tuiasi.ro

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

Abstract:

The low-voltage electric distribution networks represent a type of microgrid usually encountered at the end of the distribution process. These microgrids are going through a radical transformation, with the centralized concept becoming a distributed one where the small-size renewable energy sources installed at the consumers (which in this case are called prosumers) play a significant role in meeting the electricity needs of the world's future. These small-size renewable energy sources include wind generators, solar photovoltaics, and storage systems. Due to the importance of the prosumers, the development process of smart technologies integrated into the devices/equipment that can be implemented in the microgrids has become a critical component of the distribution sector. But, when the number of single-phase prosumers increases over a threshold, various technical issues can appear regarding bidirectional energy flows, additional energy losses, over-voltages, and phase load imbalances. The voltage quality of the power supply is one of the most important factors that can affect the capacity of a microgrid to accommodate its growing number of prosumers, representing a vital component of the decision-making process in the development of microgrids. Also, an unsatisfactory voltage quality can affect the operations and lifetime of the electric equipment installed by the end users. This issue can lead to significant economic losses and even cause widespread power outages. Unfortunately, it is not easy to identify a general index to characterize the voltage quality in the microgrids.

In this context, an efficient framework for the voltage quality pattern recognition in the microgrids based on a clustering-based unsupervised learning process has been proposed. The input features of the clustering are the phase voltage indicators calculated for each node from the microgrid: minimum voltage, maximum voltage, average voltage deviation, voltage deviation with the energy flows, the variance of voltage deviation, and mean squared value of voltage deviation. The framework has been tested in a microgrid with 36 nodes from a peripheral urban area supplying 53 end-users, of which 26 are prosumers. The phase voltage profiles have been achieved from the steady-state calculations performed for each time slot (in our study, 1 minute). The patterns obtained allowed the identification of the "hot" areas from the microgrid with unsatisfactory voltage quality such that an optimal voltage control strategy based on the On-Load-Tap-Changer has been applied.

Keywords: clustering, microgrids, pattern recognization, prosumers, voltage quality

COMPARATIVE STUDY FOR PATH PLANNING BASED ON THE DECOMPOSITION OF A CO-SAFE LTL SPECIFICATION

Ioana Huștiu, Marius Kloetzer

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

Corresponding author: Ioana Hustiu, ioana.hustiu@academic.tuiasi.ro

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

Abstract:

This paper is concerned about the path planning problem which is mandatory in robot navigation. A team of mobile agents that are evolving in a discretized, static and known environment which contains some regions of interest and must accomplish a Linear Temporal Logic (LTL) specification is considered. The preference for the mentioned temporal logic is motivated through the expressivity of the language and the easiness to translate the colloquial language into the mentioned mathematical formalism, which can be shown to be equivalent with the monadic predicate logic. The work is assembling previous results since it has the objective to compare different methods to decompose the global mission and the trajectories that are obtained. The methods are ensuring that the LTL specification will be divided into tasks that can be executed by single robots and by executing all tasks, the mission will be accomplished by the team. The independence of the tasks is strongly influenced by real-life scenarios when it is desired to minimize the number of communications and synchronizations between agents. The decomposition step is followed by the allocation of tasks to robots, where a robot can end up with more than one task. To achieve the mentioned step, an allocation matrix is obtained after formulating and solving a Mixed Integer Linear Programming (MILP) problem based on a cost matrix. Here, the cost that we are considering is referring to the number of cells through which an agent must move across such that a task is executed. Based on the allocation matrix, the trajectories of the robots are computed. In order to compare the methods, the number of agents and the number of regions of interest are taken into consideration. A flow diagram that describes the methods is provided for the entire path planning problem, while the scenarious used for simulations that are accompanied by the results are highlighting the advantages, but also the disadvantages of each one.

Keywords: discrete events systems, path planning, robotic-systems

FREQUENCY DOMAIN MODELLING OF COMMERCIAL HEAT PUMPS FOR HARMONIC STUDIES

Muhammad Ishaq, Roberto Langella

University of Campania "Luigi Vanvitelli", Italy, Faculty of Industrial and Information Engineering, 81031, Aversa, Italy

Corresponding author: Muhammad Ishaq, muhammad.ishaq@unicampania.it

PhD Supervisor: Professor Roberto Langela,
University of Campania "Luigi Vanvitelli", Italy

Abstract:

Harmonic analysis is necessitated when there is the presence of non-linear equipment in the electrical system. Harmonic analysis is compulsory for ensuring the levels of harmonics are in an acceptable range to avoid non-desirable interference among the connected devices across the distribution system. Frequency domain modeling is considered one of the most powerful techniques and is widely adopted when considering harmonic analysis. The frequency domain modeling is deemed as the frequency coupling matrix technique. In this research study, the power-dependent frequency domain model of the commercial heat pump is analysed considering six different output powers along with experimental validation. The main purpose of the research is to study the effect of the input filter (inductor) of the heat pump and its resultant harmonic components on the distribution system. Harmonics of orders 3 up to 19 are considered for this study. The harmonic voltage is varied to around 1% of the source voltage injected into the system. The experimentation proceeded with MATLAB/SIMULINK. The time domain and frequency domain models of the heat pump are incorporated in the study for the listed harmonic levels. The results of the study verify the impact of the input filter on the system. It is noticed that the behaviour of the diagonal elements of the frequency coupling matrices for each harmonic from 3-19 are almost identical with and without the consideration of the input filter. This confirms a linear behaviour of the heat pump when considering only the de-coupled circuits of the considered heat pump. Furthermore, frequency scanning is also performed, and afterward, waveforms are compared with the real and simulated results. For verification purposes of the results, Monte Carlo simulations of 1000 iterations are performed for five different modeled circuits of the heat pump to measure the magnitude of error in the current of each output power. The output of the Monte Carlo simulation verifies the current error to be in an acceptable range.

Keywords: frequency domain modelling, frequency coupling matrix, harmonic analysis, heat-pumps, HVACs, power quality

REAL-TIME FIXED-POINT IMPLEMENTATION OF A PASSIVE-CONSTRAINED OBSERVER AND CONTROLLER FOR IN-WHEEL SYNCHRONOUS MACHINE

Răzvan Mocanu

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

Corresponding author: Răzvan Mocanu, razvan.mocanu@ac.tuiasi.ro

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

Abstract:

The In-Wheel Synchronous Machine (IWSM) is an outrunner permanent magnet synchronous machine with 30 or more magnetic poles affixed on a ring or sleeve outside the stator coils. IWSMs provide sufficient power density for mobile robotics and small, compact e-vehicles. Our findings propose a control technique based on passivity-based control with the controller-observer's guaranteed passivity. Using the Euler-Lagrange (EL) mathematical model of the electrical machine, the control strategy is designed. Observably, the plant specifies specific passive mappings; consequently, the dynamics are regarded as two distinct EL passive subsystems, namely mechanical and electrical. Feedforward commands assure parameter variation toleration. Observably, the plant specifies specific passive mappings; consequently, the dynamics are regarded as two distinct EL passive subsystems, namely mechanical and electrical. The dynamics of the mechanical subsystem are treated as passive disturbances to the electrical subsystem. A damping term is introduced to strengthen the passivity of the electrical dynamics. In addition, the internal closed-loop energy is remodelled in order to achieve current tracking. Finally, control laws are established to ensure internal stability through monitoring of global current and speed. A conventional PBC and PI controller-based control strategy is contrasted with the control strategy proposed in this study. The proposed control structure has superior dynamic performance and greater robustness against parameter variations.

Therefore, we present a passivity-based control (PBC) strategy for in-wheel permanent magnet synchronous machines that extends the traditional passivity-based controller. We derive the controller and observer parameter constraints in order to preserve the passivity of the interconnected system, thereby enhancing the control system's robustness to varying loads and plant parameters. In comparison to conventional PBC, the benefits of the proposed PBC technique are illustrated. The control method is implemented on an electronic development board containing a fixed-point digital signal processor and coupled to a gallium nitride voltage source inverter and 350 W electric motor. Test bench results and numerical simulations in Matlab-Simulink illustrate the efficacy and behaviour of the control system under varying loads and parameters.

Keywords: DSP, fixed point, observer, passivity, power electronics

A COMPARATIVE EVALUATION OF TWO EMPIRICAL MODE DECOMPOSITION METHODS AND MULTI-FEATURES FOR CLASSIFICATION OF FOCAL AND GENERALIZED EPILEPSY

Mădălina-Giorgiana Murariu, Daniela Tărniceriu

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

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

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

Abstract:

Epilepsy is a chronic neurological disorder that manifests as recurrent, unprovoked seizures including focal and generalized seizures. Accurate identification of the type of epilepsy helps to determine the most appropriate surgically treatment options and improve patient outcomes. The purpose of this study is to compare two empirically-based approaches and different feature extraction for classifying focal and generalized epileptic signals. The dataset used in this study consists of focal and generalized signals obtained from 46 epileptic patients diagnosed with epilepsy at the at the EEG Epilepsy and Monitoring Centre in Cluj-Napoca, Romania, during both sleep and wakefulness states. The first approach uses empirical mode decomposition methodology to decompose the EEG signals into intrinsic mode functions (IMFs). The power spectral density (PSD) of the first six extracted IMFs is calculated to form a feature vector for classification stage. The K-nearest neighbour (KNN) classifiers with 10-fold cross validation is applied to identify the type of signals based on the extracted spectral characteristics. The signals collected during sleep are classified into focal and generalized with a maximum accuracy of 98% and the signals collected in wakefulness are classified with a maximum accuracy of 99.47%. The second approach involves to classify the EEG signals extracting four features from the first five IMFs obtained by applying EMD method on EEG signals. The median, skewness, kurtosis, and fluctuation index features are calculated for each IMF and form a feature vector which is fed into KNN classifier. The proposed method attained a maximum classification accuracy of 86.33% for signals collected during sleep and 88.03% for signals collected during wakefulness. The first approach achieved higher classification accuracies compared to the second approach, but both methods demonstrated successful classification of focal and generalized epileptic EEG signals. The promising results of these methods suggest the valuable clinical application in aiding decisions for epilepsy patients by providing accurate and efficient EEG signal classification. The success of the EMD method in this study opens up opportunities for future research on machine learning algorithms that could automatically detect and classify different types of epilepsy from EEG signals.

Keywords: electroencefalography, empirical method, epilepsy, focal signals, generalized signals

TARGET LOAD PROFILES FOR DEMAND RESPONSE STRATEGIES

Mihaela Năstase, Mihai Gavrilaș, Ovidiu Ivanov, Bogdan Constantin Neagu

"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:

Energy efficiency for the entire European Union as well as for the European Council, has become an extremely sensitive subject, establishing for each member state separately goals and deadlines for the implementation on short, medium or long periods of time certain methods, strategies and technologies, with the purpose of improving, reducing and optimizing energy consumption, for all sectors but especially for the building sector. A method that has become more and more popular is the demand response due to its undeniable advantages in the fight against energy waste, with benefits both at a social, technical and economic or market-based level.
In this paper, the main techniques and benefits of the demand response were described, and in the same measure, a study was performed by developing and improving the mathematical function used for calculating the target loads, so that later a comparative-practical analysis was carried out, due to the need of reducing operating costs as well as the energy consumed. As input data, information on wholesale prices, along with forecasted loads for each hour of a 24-hour period, for three areas of interest: residential, commercial and industrial, was used. It was considered a reference mathematical function for the calculation of the target load profile, previously determined by the distribution operator, and based on it, two other equations were developed with the goal of improving and increasing the reduction of energy together with total costs. The developed mathematical functions have the quality of offering a different load shifting for the day-ahead from a smart grid distribution operator point of view, with the objective of optimizing the target loads. The three resulting equations were evaluated and compared to determine which of them is the most suitable for each area. Thus, it was observed that the proposed solutions bring a greater reduction compared to the values of the reference function.
The aim of the work is to provide a clear comparative view on other possibilities for calculating the profile of the target loads, through an improvement of the cost reduction percentage.

Keywords: demand response, forecasted load, load shifting; target load, optimization

CONTRIBUTIONS ON SOCIAL DISTANCE IDENTIFICATION METHODS AND TECHNIQUES USING EMBEDDED COMPUTER BOARDS

Marius-Emanuel Obreja

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

Corresponding author: Marius-Emanuel Obreja, marius.obreja@etti.tuiasi.ro

PhD Supervisor: Professor Dan-Marius Dobrea,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

In last years, interest of research studies on social distance identification methods and techniques using embedded computer boards, such as Jetson Nano, Raspberry Pi, and Arduino.
One of the main contributions of these studies is the development of computer vision algorithms for social distance identification. These algorithms use techniques such as object detection, tracking, and triangulation to detect and measure the distance between people in a given scene. Another important contribution is the integration of embedded computer boards into the social distance identification system. These boards provide a compact and low-cost platform for running the computer vision algorithms and can be easily deployed in public spaces such as airports, train stations, and shopping malls.
Many studies have focused on developing real-time social distance identification systems that can provide immediate feedback to individuals who are not maintaining a safe distance from each other. These systems use audio or visual alerts to notify individuals when they are too close to each other and can help to prevent the spread of infectious diseases. Other studies have evaluated the performance of social distance identification systems using embedded computer boards. These evaluations have shown that these systems can achieve high accuracy in detecting and measuring social distance, even in complex environments such as crowded public spaces.
The results of the study can provide the useful method of embedded computer boards for social distance identification and has the potential to improve public health and safety by providing real-time monitoring and alerts to individuals who are not maintaining a safe distance from each other.

Keywords: artificial intelligence, computer vision, embedded computing boards, image detection, social distance

APPROACHES TO THE DEVELOPMENT OF A VIRTUAL ELECTRIC MACHINE LABORATORY IN MATLAB&SIMULINK

Petronela-Camelia Oprea, Alexandru Sălceanu

"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:

This paper presents a virtual laboratory for electrical machines simulation developed in the framework provided by Matlab&Simulink. This virtual lab integrates the Matlab&Simulink experimental model, which gives pupils/students the opportunity to verify their theoretical knowledge and helps them improve their ability to combine theory with practice. The paper proposes examples from the development of the Simulink model of the DC motor, aiming to achieve a more effective speed control.
Furthermore, the role we assign to this virtual laboratory is to provide a more efficient interaction between pupils/students and teacher. There are presented some of our developments in the domain of new teaching resources essential to the learning process of the electrical engineering topics.
We describe in detail the implementation of a virtual lab for simulating electrical machines, based on mathematical models. The influence of various parameters on the performance and behavior of a certain electrical machine is addressed.
Our paper supports the claim that the development cycle of the Matlab&Simulink-based virtual lab in correspondence with the traditional one implies particular advantages: the time allocated to the development of a virtual laboratory is shorter than that required for a classic one, the scalability is wider and the cost is lower.
The paper presents a Simulink model of the DC motor, with the three main blocks: the excitation, the inductor and the mechanical block. The influence of various factors on the absorbed current and on the speed of the motor has been studied.
The parameters defining both the transient regime of the excitation circuit (application duration and excitation voltage) and the stabilized operating regime at idle are established. Also, the new transient regime of operation under load is studied, followed by the stabilized regime of operation under load.
Our simulations allowed the development of some recommendations regarding the correctness and veracity of the virtual experiment.

Keywords: demand response, digital technologies, electrical machines, forecasted load, load shifting, Matlab&Simulink, optimization, target load, virtual laboratory,

ETHICAL CONSIDERATIONS OF ARTIFICIAL INTELLIGENCE ALGORITHMS IN MEDICINE

Irina Pavel

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

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

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

Abstract:

Artificial Intelligence technologies have a remarkable and empowering impact on society, specifically in the medical and healthcare industry. Among these technologies, we recall machine learning, a subset of AI that uses structured data to learn, and deep learning, a machine learning technique based on neural networks inspired by the human brain that uses unstructured data to learn. Medical practitioners diagnose patients faster and more accurately, make predictions about the patient's future health, and find more suitable treatments. Regardless of how successful this industry might appear, the power of these technologies generates a novel set of ethical challenges that must be taken into account and mitigated concerning the patient's privacy and safety. By applying an ethical lens, as developers, we control the design and build technologies to reduce their potential harm, or to decide not to build them, if it goes against the ethical principles we will review in this work. The journey of creating ethical AI models starts with human-centered designs that serve people's real needs and add value to people's lives, physically and emotionally. A faster and smarter healthcare system might detect tumors and diseases in real-time, decreasing the patients' waiting period for a diagnosis or a treatment. However, replacing the doctor-patient interaction might not positively impact people' s emotions. Privacy-wise, there need to be more laws to protect individuals' data in healthcare systems. When collecting human data to train a model, it takes only a second to leak the information of the patients, an issue that puts them in danger. By identifying possible bias cases, on condition to improve lives by building fair AI models, we must direct our gaze at prior events when models discriminated against individuals based on their race, sex, religion, and other categories. In the end, we discuss model cards, a short and transparent documentation of the AI algorithm. Communicating critical information to people, how the model has been trained, on what datasets, and what is the primary purpose of using it on a patient increases awareness and people will overcome rigidness.

Keywords: artificial intelligence, ethics, medicine, bias, AI fairness, privacy and data protection, human-centred design, model card

STATE-OF-THE-ART DEEP LEARNING APPROACHES TO EARLY DETECTION OF ALZHEIMER'S DISEASE

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:

Technologies based on artificial intelligence have a remarkable and liberating effect on society, particularly in the medical and healthcare sectors. Among these technologies, we may think of deep learning, a machine learning approach based on neural networks inspired by the human brain that utilizes unstructured data to learn, and machine learning, a subset of AI that uses structured data to learn. Medical practitioners diagnose patients faster and with higher accuracy, make predictions about the patient's future health, and find more suitable treatments. Alzheimer's disease (AD) is a type of brain degeneration that begins with mild memory loss and progresses to loss of speech and awareness of one's surroundings, eventually impairing a person's ability to carry out daily tasks. Early diagnosis and categorization of Alzheimer's disease are active study fields because of the rapid progression of Alzheimer's patients and the absence of reliable diagnostic methods. One of the many researchers' objectives is to effectively and accurately diagnose Alzheimer's disease to slow the progression of the disorder and to improve the patient's life. Hence, early-stage detection of Alzheimer's disease is of fundamental importance for treating patients accordingly to delay its progression. The current methods used in medicine to detect AD are invasive and costly, limiting their potential for widespread use. In this paper, we review in a simplified manner state-of-the-art approaches that apply deep learning (DL) methods to detect the early stages of Alzheimer's which could benefit medical specialists to examine patients' data, including convolutional neural networks, sequential models, and autoencoders. Regarding the data used to feed deep learning models, we can mention imaging techniques like magnetic resonance imaging (MRI), optical coherence tomography (OCT), positron emission tomography (PET), computer tomography (CT), and biomedical signals, including electroencephalography (EEG) and electrocardiogram (ECG) analysis, to make a faster prediction without invasive and costly procedures. Moreover, we discuss the most common deep-learning architectures used for classification in medical applications, specifically, in neurodegenerative diseases.

Keywords: artificial intelligence, deep learning, early detection, Alzheimer's disease, biomarkers, non-invasive.

APPLICATION OF DEEP LEARNING IN POWER SYSTEM SECURITY ASSESSMENT

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:

Deep learning is an important part of machine learning and the product of the evolution of traditional machine learning algorithms.
The emergence of deep learning offers a new approach to applied research on power systems. Combined with the current situation of the gradual transformation of power system development into artificial intelligence, the application of deep learning in energy systems is very important for energy companies.
Deep learning research in the areas of natural language processing, computer vision, speech recognition and image processing has matured and deep learning research methods have gradually entered the power industry. Today, research areas such as transmission line inspection, power equipment fault diagnosis and power load forecasting use artificial intelligence techniques.

Keywords: deep learning, cyber-security, power system

DATA MINING IN ADVANCED METERING INFRASTRUCTURE TO IDENTIFY THE CONSUMPTION PATTERNS AND BEHAVIORS OF THE RESIDENTIAL END-USERS

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:

One of the main tools within large databases is data mining (DM), which involves extracting "hidden" information. DM is a part of the Knowledge Discovery in Database (KDD) process, which includes data analysis and gathering. Although both are often referred to as the same, they are distinct concepts. The main advantage of DM is its integration into the data processing from large databases based on the classification techniques, such as the one associated with the smart metering infrastructure from which the consumption patterns can be determined. One of the classification techniques is clustering, which is a process that involves identifying and classifying different models and features in large databases so that they can represent the core of various applications such as demand-side management, electricity price policies, or load forecasting.

In this context, the paper aims to develop a data mining-based extraction framework of the consumption patterns related to the expectations and behaviour of the residential end-users (consumers and prosumers). In addition, the appliance-level consumption patterns to predict long and short-term energy usage are analysed. The used database is the Pecan Street Dataport platform which includes a large amount of residential energy consumption data. Every second, the data collected by the Pecan Street Dataport platform are stored in a database. The database contains the time series associated with electric vehicle charging, rooftop solar generation, energy storage and energy used by individual household circuits, including heating and cooling systems.

The consumption patterns describing various aspects of a household's energy usage, such as the time of day, week, month, and season have been identified using clustering-based data mining. Determining the patterns represents the first stage of an Internet of Things (IoT) application which will help the residential end-users (consumers and prosumers) to obtain an optimal plan regarding the energy injected and consumed from the network.

Keywords: Advanced Metering Infrastructure, clustering, consumption patterns, data mining, large database, residential end-users

DEVELOPMENT OF A POWER ELECTRONICS LABORATORY WITH REMOTE CONTROL OF BOTH OSCILLOSCOPE AND LOAD RESISTOR VIA THE INTERNET

Ciprian M. Stan, Dorin O. Neacșu

Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electronics, Telecommunications and Information Technology, 11A Carol I Blvd., 700050, Iasi, Romania

Corresponding author: Ciprian M. Stan, ciprian-marian.stan@student.tuiasi.ro

PhD Supervisor: Professor Gheorghe Dorin O. Neacșu,
„Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Experimentation is a critical aspect of engineering education and research and is a foundational requirement for science and engineering programs. However, traditional laboratory settings have limitations such as the need for physical presence of students and instructors, resulting in restricted scheduling flexibility. These limitations are due to factors such as technological costs, physical space constraints, security concerns, time limitations, and maintenance needs. Creating outstanding engineering study programs that address individual needs, provide customizable learning paths, and allow for easy and rapid access to pertinent educational resources and teachers is a challenging and intricate undertaking that must be addressed to guarantee a promising future for engineering education. Thankfully, advancements in computer technology have opened up new possibilities to overcome these limitations. Two new methods, namely virtual laboratories and remote laboratories, have emerged as viable alternatives. These approaches provide adequate supervision and ensure safe equipment operation while allowing learners to access experiments remotely with fewer geographic and time constraints. This technology enables learners to remotely access experiments, offering greater flexibility and convenience without sacrificing safety or quality of education. A virtual laboratory typically consists of one or more computer programs that display a visual representation of equipment and objects being studied and provide results based on a model's description of their behavior and interaction. A remote laboratory employs computer-based management and monitoring of physical equipment and objects under study, with remote access to the computer made available through a specific communication network. This technological innovation is advantageous for students enrolled in traditional face-to-face courses, as well as online or distance learning programs. Thanks to the increasing number of smart and portable devices that can connect to the internet, students can now extend or modify their study schedules. This convenience significantly aids their ability to manage their time and develop self-directed learning skills, which will be beneficial to their future careers. Furthermore, virtual and remote laboratories' flexibility and convenience benefit educational institutions with limited financial resources by reducing maintenance costs and allowing universities to collaborate on experiments. In this paper we aim to analyze the operation of the boost converter in discontinuous (high resistance) and continuous (low load resistance) conduction mode, an experiment based on the Red Pitaya development board, Esp8266-12F relay module and DL24P load resistor, which it gives us the possibility to perform, analyze, control and monitor the experiment remotely.

Keywords: power electronics, relay, remote laboratory, red Pitaya, variable resistance

INNOVATION THROUGH EMERGING TECHNOLOGIES AT THE GOVERNMENT LEVEL

Marius Stefan

Bucharest University of Economic Studies, Bucharest, Romania

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

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

Abstract:

Globalization, consumerism, the fragmentation of authority and the transformation of knowledge into an object of use, being included in the defining features of the postmodern condition. Thus appears the phrase informational society found in the specialized literature of post-industrialism, as a notion that in sociology, refers to a type of postmodern society, in which the old norms and ways of thinking are replaced by new technologies and new lifestyles. Thus, a transformation of civilization is produced, which leads to the informational society through scientific and technical revolutions.

Starting from the increasing role of science, combined with the emergence of information technologies, the economy and society become centered on a new central principle, called theoretical knowledge. In such a society, living standards, work and leisure patterns, the educational system and the labor market, are all significantly influenced by advances in information and knowledge.

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

A NOVEL SENSORLESS CONTROL OF A HYBRID EXCITED SYNCHRONOUS MACHINE USED IN THE FIELD OF ELECTRIC TRACTION

Alexandru-Iulian Timofte, Iulian Bălan, Vasile Horga, Alexandru Sălceanu

"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: Alexandru-Iulian Timofte, alexandru-iulian.timofte@academic.tuiasi.ro

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

Abstract:

From all the vehicle subsystems, the drive train is influencing the most the overall performance of the vehicle. In the last years, we saw a rapid advance of the electric vehicles (EV) manufacture firstly because of the solid advantages of the electrification process of the automotive products which we are so often using. Performance and environment related question are now tackled by the automotive industry and their answer is an alternative to fuel-based engines. Of course, despite the benefits which an electric motor brings into the vehicle system, there are still some real questions which need to be answered. One of those is the performance of the electric motor at high speeds, higher than the nominal speed. It is already known that the motor speed is directly proportional to the applied voltage. But if the speeds are high, then also the electromotive voltages are high. To drive the motor even higher in speed, an additional voltage source which translates into a higher electric power input is needed. This paper gives an overview of the existing solutions to this question but also provides insides of a new strategy used with the Double Excitated Synchronous Machines or the so-called Hybrid Excited Synchronous Machine (HESM). Usually, induction or synchronous machines are used to provide the traction vehicle functions. The synchronous machines are helpful, but they introduce a drawback because of the constant excitation of the permanent magnets. This will translate to an always increasing electromotive voltage with a higher value in speed. The HESM solves this with a double excitated rotor (permanent magnets and a rotor field weakening winding). When the vehicle is running at high speeds, there is no need for a high torque demand and response from the motor but a high cruising speed. In this case the field weakening winding will decrease the magnets flux by opposing it with a magnetic flux of opposite sign. This will reduce the already high electromotive force and the rotor can be driven even higher by using the remaining voltage resource. The second part of the paper proposes a novel sensorless control strategy for the HESM adding a comparison between different position speed observers described in the literature. The development and analysis of models and control strategies for HESM will be done using Matlab. Conclusions and further research paths will be discussed in the end of the paper.

Keywords: double excitation, EV, field weakening, field-oriented control, hybrid excited synchronous machine, Matlab, sensorless

BRUXISM ACTIVITY ACQUISITION USING IoT DEVICES AND CLOUD COMPUTING

Teofil Ilie Ursache[1], Radu Gabriel Bozomitu[1], Cristian Rotariu[2]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Electronics, Telecommunications and Information Technology, 11A Carol I Blvd., 700506, Iasi, Romania
[2] "Grigore T. Popa" University of Medicine and Pharmacy, Iaşi, Romania, Faculty of Medical Bioengineering, 9-13 M. Kogalniceanu Street, 700454, Iasi, Romania

Corresponding author: Teofil Ilie Ursache, teofil-ilie.ursache@student.tuiasi.ro

PhD Supervisor: Professor Radu Gabriel Bozomitu,
Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Sleep bruxism is an oromotor parafunction characterized by an involuntary activity of contraction and/or grinding of the teeth when the individual does not chew or swallow. Bruxism is classified in two forms according to their manifestation, the first form being the moderate one, a semi-voluntary "grinding" activity, and the second is the nocturnal bruxism, which is the most dangerous pathology.
In this paper is presented a low-cost medical system implemented for clinical use, in centres for sleep medicine, or at home, based on IoT devices for detecting, storing and alerting patients who suffer from night bruxism episodes. The system is mainly composed of a BITalino development board, a Raspberry Pi 4 compute module and a cloud database.
The BITalino development board uses an ATMega328P microcontroller and removable modules for biomedical signal acquisition in paraclinical investigations such as electromyography, electrocardiography, electrodermal activity or electroencephalography. It also uses a HC-02 Bluetooth module to send the acquired data to Raspberry Pi 4 compute module. A Raspberry Pi 4 is used as a slave device to receive acquired data from the BITalino's EMG module, and to process data according to the proposed software algorithm in order to detect bruxism episodes. The proposed system can be operated in online and offline modes and uses a screen attached to computer for displaying the detected events and other debug information during the acquisition time.
In offline mode, the signal and the detected events are stored on an internal memory card, also used as primary boot device for the operating system, or online in a cloud database. The data stored in the cloud will be displayed to the patient or doctor on a web interface.
The algorithm running on a Raspberry PI 4 compute module removes the parasitic noise generated by the patient's movements, bad skin-electrode connection or by radio interferences and uses an adaptive threshold for bruxism episodes detection in the EMG recorded signals. The system has been tested on 10 healthy individuals that simulate multiple bruxism episodes and the results are promising, with a 91.2% accuracy, 98.43% sensitivity and 77.13% specificity.

Keywords: bruxism, biosignals, electromyography, IoT, edge computing

BRIEF SURVEY ON COLLABORATIVE AND NON-COLLABORATIVE BEHAVIORS IN MULTI-AGENT SYSTEMS

Dumitru-Daniel Vecliuc

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

Corresponding author: Dumitru-Daniel Vecliuc, dumitru-daniel.vecliuc@academic.tuiasi.ro

PhD Supervisor: Professor Florin Leon,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The concept of Multi-Agent System (MAS) is extensively utilized and has multiple definitions in existing literature. Based on the reviewed literature, an MAS can be defined as an environment comprising multiple individual agents that interacts with one another or with the environment, guided by a predetermined set of rules, with the aim of achieving a shared or individual goal.

The survey starts with the clarification of the opposite concepts of collaborative (or cooperative) and non-collaborative (other possible references: individualist or selfish) behaviours in the context of the MAS. Collaborative behaviours in the MAS refers to agents that work together in a cooperative manner, actively exchanging information, coordinating actions and making collective decisions in order to achieve a shared goal. Conversely, the non-collaborative behaviours involve agents that operate independently, make decisions guided only by individual objectives, with minimal engagement with other agents.

The survey also describes the benefits and caveats of the two types of behaviours. The collaborative behaviour allows agents to utilize their individual abilities, resources and knowledge in order to achieve an improved collective outcome or an outcome that would have not been possible without the cooperation of the agents. Moreover, the collaboration between agents can lead to unpredictable behaviours and global optimizations in which the collective outcome surpasses the sum of the individual contributions. Non-collaborative behaviours also have their advantages. Individualist agents can make independent and fast decisions; this may be suitable for tasks that require individual expertise or where the coordination is feasible or necessary. These behaviours may also allow agents to tackle a problem with various approaches, leading to a more varied outcome and with an improved adaptability. To summarize, this work highlights the characteristics, benefits, challenges and applications of the collaborative and non-collaborative behaviours in the context of the MAS, from the perspective of the "real world" scenarios. While collaboration between individuals may result in superior collective outcomes and emergent behaviours, it requires effective communication, coordination and consensus. As for the non-collaborative behaviours, these can provide autonomy and adaptability, but without exploiting the potential benefits generated by the collaboration. A better understanding of the collaborative and non-collaborative behaviours in the context of MAS can have benefits both in the academic research, by helping the researchers and practitioners to make informed decisions on the design and implementation of the multi agent like systems and in the "real world", by providing recommendations on how to behave in certain scenarios.

Keywords: autonomous agents, collaboration, coordination, Multi-Agent Systems (MAS), non-collaboration

RESEARCH ON METHODS AND TECHNIQUES FOR THE IMPLEMENTATION OF DRIVER ATTENTION EVALUATION SYSTEMS

Ionel Vrânceanu, Cristian Foşalău

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

Corresponding author: Ionel Vranceanu, ionel.vranceanu@student.tuiasi.ro

PhD Supervisor: Prof. Cristian-Ioan Foşalău,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

This paper presents an algorithm in Python for detecting different characteristics of drivers' faces. The data collected from the video clips will be processed later with the help of artificial intelligence to evaluate the degree of attention of the driver. The algorithm uses the OpenCV library, dlib and numpy. OpenCV provides a wide range of functionalities and algorithms for image analysis and processing, such as: face detection, object recognition, image segmentation, camera calibration, image stabilization, feature extraction, and more. Due to its open-source nature, OpenCV has an active community of developers who contribute new functionality and improve the library's performance. Dlib contains a variety of tools to develop machine learning and machine vision applications. With NumPy, one can create and manipulate vectors and matrices, calculate eigenvalues and eigenvectors, perform arithmetic operations, linear algebra, filtering and many other basic mathematical operations, in addition, the NumPy library is commonly used in combination with other libraries to create data analytics, scientific and machine learning applications. The proposed algorithm has the ability to apply gamma correction depending on the degree of illumination of the image, it can detect and track the position of the face in the frame, it can detect the degree of eye opening, yawning, the presence of eyeglasses or sunglasses. These images are captured by a video camera that is placed in front of the driver, above the windshield. The system also has a second camera placed in front of the passenger, but oriented towards the driver. This camera has the role of detecting the degree of inclination of the driver's head. If the driver wears eyeglasses or sunglasses, the assessment of the degree of fatigue is more difficult, therefore the degree of tilt of the head will also be taken into account in the assessment of the degree of attention. The experimental data were taken from different videos, and the collected data are presented in this paper using the proposed algorithm. To summarize, this work highlights the characteristics, benefits, challenges and applications of the collaborative and non-collaborative behaviours in the context of the MAS, from the perspective of the "real world" scenarios. While collaboration between individuals may result in superior collective outcomes and emergent behaviours, it requires effective communication, coordination and consensus. As for the non-collaborative behaviours, these can provide autonomy and adaptability, but without exploiting the potential benefits generated by the collaboration. A better understanding of the collaborative and non-collaborative behaviours in the context of MAS can have benefits both in the academic research, by helping the researchers and practitioners to make informed decisions on the design and implementation of the multi agent like systems and in the "real world", by providing recommendations on how to behave in certain scenarios.

Keywords: openCV, artificial intelligence, driver fatigue, driver drowsiness, image processing, machine learning

CONTRIBUTIONS ON SOCIAL DISTANCE IDENTIFICATION METHODS AND TECHNIQUES USING EMBEDDED COMPUTER BOARDS

Marius-Emanuel Obreja

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

Corresponding author: MARIUS-EMANUEL OBREJA, MARIUS.OBREJA@ETTI.TUIASI.RO

PhD Supervisor: Prof. Dan-Marius Dobrea,
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

In last years, interest of research studies on social distance identification methods and techniques using embedded computer boards, such as Jetson Nano, Raspberry Pi, and Arduino.
One of the main contributions of these studies is the development of computer vision algorithms for social distance identification. These algorithms use techniques such as object detection, tracking, and triangulation to detect and measure the distance between people in a given scene. Another important contribution is the integration of embedded computer boards into the social distance identification system. These boards provide a compact and low-cost platform for running the computer vision algorithms and can be easily deployed in public spaces such as airports, train stations, and shopping malls.
Many studies have focused on developing real-time social distance identification systems that can provide immediate feedback to individuals who are not maintaining a safe distance from each other. These systems use audio or visual alerts to notify individuals when they are too close to each other and can help to prevent the spread of infectious diseases. Other studies have evaluated the performance of social distance identification systems using embedded computer boards. These evaluations have shown that these systems can achieve high accuracy in detecting and measuring social distance, even in complex environments such as crowded public spaces.
The results of the study can provide the useful method of embedded computer boards for social distance identification and has the potential to improve public health and safety by providing real-time monitoring and alerts to individuals who are not maintaining a safe distance from each other.

Keywords: social distance, embedded computing boards, image detection, artificial intelligence, computer vision

SECTION 3.
Chemistry;
Chemical engineering;
Environmental engineering

PERFORMANCE OF SOME NEW HYBRID COAGULANTS-FLOCCULANTS IN THE TREATMENT OF INDUSTRIAL WASTEWATER

Marius Alexandru Afrăsinei, Carmen Zaharia

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

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

Abstract:

In modern society, it is widely recognized that the treatment and even reuse/recycling of all wastewaters (WWs) is necessary to reduce environmental pollution. Coagulation and flocculation processes have long been used in conventional water and wastewater treatment technology, involving specific chemicals known as coagulants-flocculants that effectively reduce solid impurities such as turbidity, suspended solids (SS), color, heavy metals, oil, and organic matter. To remove particles from WW, coagulation-flocculation agents are added to destabilize the suspension/disperse aqueous system and aggregate the small particles into large flocs that can be easily separated by sedimentation, air flotation, or filtration. Recently, researchers have been exploring novel hybrid materials for industrial WW treatment using coagulation-flocculation processes. These hybrid materials have proved to be highly effective, efficient, and cost-effective in removing specific impurities from WW.

Industrial WW is characterized by a wide variation in concentrations and composition, and can contain raw materials, intermediate products, and end products in the same WW. Coagulation-flocculation is extensively employed as an effective and easy way to treat industrial WW. The selection of coagulant-flocculant and its dosage is critical, especially considering the complexity of inorganic and/or organic pollutants found in WW discharged from industrial units that produce a range of products, such as dyes, drugs, various additives, and adjuvants. Recent studies have focused on improving coagulation-flocculation techniques in WW treatment by employing hybrid coagulants with multiple properties, including inorganic-inorganic, organic-natural, and inorganic-organic combinations.

The use of novel hybrid materials as coagulation-flocculation agents has been found to be beneficial in removing numerous polluting species from industrial WWs, such as turbidity, color, COD, and ionic heavy metal species. The combination of WW treatment steps, including coagulation-flocculation-sedimentation/flotation/filtration, increases the removal of polluting species. Operating factors such as coagulant/flocculant dosage, pH, mixing speed and time, and temperature must be considered in the process. The use of these materials has the potential to improve the efficiency, effectiveness, and cost-effectiveness of WW treatment, leading to reduced environmental pollution and increased protection of water quality.

Keywords: coagulation-flocculation, hybrid materials, industrial wastewater treatment, removal, turbidity

OPTIMIZATION OF EXPERIMENTAL CONDITIONS FOR CR(VI) BIOSORPTION FROM AQUEOUS SOLUTIONS ON RAPESEED BIOMASS

Teodora-Daniela Arsenie (Ionel), Laura Bulgariu

"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: Teodora-Daniela Arsenie (Ionel), teoionel21@yahoo.com

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

Abstract:

The presence of heavy metals in the environment is a major concern due to their non-biodegrability, bioaccumulation tendency, persistence in nature and toxicity to many life forms. Therefore, treatement of wastewaters containing heavy metal ions before discharge is an important component of water pollution control and becomes more important with increasing of industrial activities. Biosorbtion has been recently considered an effective and low-cost technique for the removal of various heavy metals from aqueous media, due their important advantages: inexpensive removal of heavy metals, an almost complete recovery of the retained heavy metals from depleted biosorbents, the minimization of sludge, the ease of operationand high efficiency, etc. Rape (*Brassica rapa*) is a common plant, wich is cultivate on large surface worldwide and in our country, due to its multiple utizitation: biofuels production industry, in food industry and in animal husbandry. On the other hand, chromium is one of the major heavy metal pollutants, usually present in various industrial fields like mining, mettalurgy, electroplating, leather tanning, textile dyeing, paint and pigment production, etc. Cr(VI) is listed by US-EPA as one of priority pollutant ans as a known carcinogen, while Cr (III) is less toxic. Starting from this consideration, in this study rapeseed biomass (obtained from low quality rapeseeds) was tested as biosorbentfor the removal of Cr(VI) ions from aqueous solutions. The influence of the most important experimental parameters of the biosorbtion process was analyzed at room temperature (22 ± 1 °C) in batch systems, in order to found the optimal conditions.These are: initial solution pH of 2.0, biosorbent doze 5.0 g/L. The results presented in this study indicates that the rapeseed biomass can be used as potentially low-cost biosorbent, and its use in Cr(VI) removal processes is also helpful for environmental protection.

Keywords: biosorbtion, Cr(VI) ions, rapeseed biomass, wastewater treatement

ADSORPTION CAPACITY OF *Ocimum basilicum* AND *Lavandula angustifolia L.* FOR CADMIUM(II) IONS

Dana-Mihaela Asiminicesei, Laura Bulgariu, Maria Gavrilescu

"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: Dana-Mihaela Asiminicesei, dana-mihaela.asiminicesei@student.tuiasi.ro

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

Abstract:

Medicinal plants are widely used in various industries such as pharmaceuticals, gastronomy, and personal care products. However, the current pollution context highlights the potential contamination of medicinal plants by various pollutants, particularly heavy metals like lead, cadmium, and mercury. In light of this, the aim of this study is to demonstrate that basil (*Ocimum basilicum*) and lavender (*Lavandula angustifolia L.*) possess the ability to adsorb cadmium in their dry biomass.

To assess the adsorption capacity of basil and lavender for cadmium (q, mg/g), a series of tests were conducted to determine the optimal pH and biomass dose for the experiment. The experimental results indicate that the optimal pH for cadmium adsorption is 6.5, and the optimal amount of biomass for both plant species is 0.1 g. Next, the plant biomass was contaminated with cadmium at concentrations ranging from 20 to 500 mg/L, and after 24 hours, the filtered liquid was analyzed using spectrophotometric determination of xylenol orange for Cd(II) ions.

The results indicate that pH and biomass amount are critical factors that affect the adsorption capacity of basil and lavender in a dry state. Lavender shows a fairly higher adsorption capacity for cadmium than basil at all heavy metal concentrations used in this study. For instance, at a concentration of 300 mg/L Cd(II), the adsorption capacity of lavender was 24.6 mg/g, while that of basil was 20.3 mg/g. Moreover, the maximum cadmium adsorption capacity for both plant species when using 0.1 g of dry biomass occurs at the concentration of 300 mg/L Cd(II).

In conclusion, determining the adsorption capacity of cadmium by basil and lavender is important to minimize the risks of heavy metal contamination in medicinal plants. By identifying the optimal conditions for cadmium adsorption, this study provides valuable information for ensuring the safety and quality of medicinal plant products.

Keywords: adsorbtion capacity, cadmium, dry biomass, *Lavadula angustifolia L.*, *Ocimum basilicum*, medicinal plants

DIFFUSION COEFFICIENTS IN POROUS MATERIALS. EXPERIMENTS AND MODELLING

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

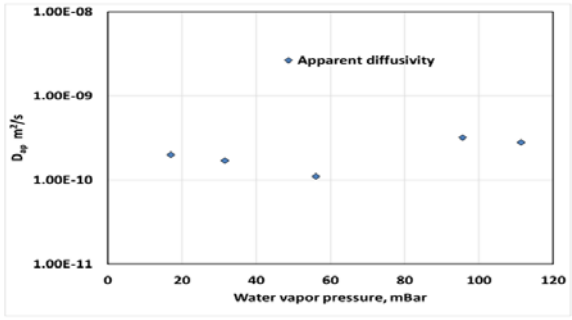
"Gheorghe Asachi" Technical University of Iasi, Romania, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection, 73 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

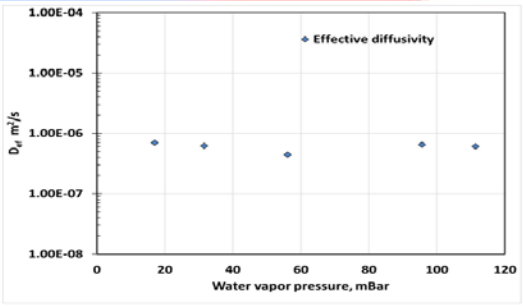
Corresponding author: Adriana-Mariana Asoltanei, adriana-mariana.asoltanei@student.tuiasi.ro

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

Abstract:

To design the adsorption apparatus diffusion data are needed. Several experimental methods for determining equilibrium and diffusion coefficients in porous materials have been reported in literature. Studies of adsorption kinetics of water vapours in porous materials offer information for designing and operation of air conditioning and gas purification plants [1]. In this paper, we will present a way to determine the diffusion coefficients in porous materials. The effective diffusion coefficients depend on the structure of the porous material. The effective diffusion coefficient is calculated taking in account the apparent diffusion coefficient, the porosity of the material and the average slope of the equilibrium isotherm. Using the same assumptions, effective diffusion coefficients can be determined in materials with a flat, spherical, cylindrical or irregularly shaped surface. The proposed method for calculating the effective diffusion coefficients is based on kinetic and equilibrium data obtained when contacting a porous material with a regular geometric shape (sheet, sphere) with a gaseous phase. The experimental data used in the modelling were obtained on an installation that works on the principle of measuring the pressure variation at constant temperature and volume. The porous material used was characterised, highlighting its characteristic properties: porosity, pore distribution.





Analytical solutions to Fick's second law of diffusion for the kinetics of adsorption in flat, spherical and cylindrical adsorbents are well known, however numerical application is limited due to the solutions being given as infinite series. In order to measure the quantity of water adsorbed on the porous material, a pressure decay technique was used. Diffusion coefficient is expressed as a function of normalised adsorption in case of spherical adsorbents, and for both normalised adsorption and the length/radius ratios in case of cylindrical adsorbents. The diffusion coefficient depends on the adsorption equilibrium taking into account the local slope of the water sorption isotherm.

Keywords: effective diffusion coefficients, porous materials, water vapours

BIOMEDICAL APPLICATIONS OF GELAN DERIVATIVES

Adina-Maria Baroi (Danila-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: Professor Leonard Atanase
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Gelan is a microbially synthesized polysaccharide - exopolysaccharide - approved in 1992 by the FDA for food, pharmaceutical and medical applications. The presence of carboxyl and hydroxyl functional groups as substituents on the base chain allows chemical transformations with the formation of functional derivatives that are increasingly finding applications in the medical field. The characteristics of the native gelan, to which are added the new ones introduced by chemical modification, such as the gelling capacity, the sensitivity to the presence of some metal ions and to pH, the mucoadhesive character, the ability to be formulated in different ways (hydrogels, micro/nanoparticles, micelles, etc.), the possibility to model their physical-mechanical properties, etc. justifies the special interest enjoyed by gelan derivatives from researchers. Gelan and its derivatives can be used as carriers for the realisation of systems capable of loading and releasing various biologically active principles such as drugs, cells, enzymes, proteins, cosmetic or food principles. The formulation of drug carrier systems, which have found important medical applications, is also varied, including tablets, films, gels, hydrogels, beads, micro/nanoparticles, and micelles. Such drug delivery systems have been studied for ophthalmological, gastrointestinal, tissue engineering applications with antimicrobial and/or anti-inflammatory actions.

To date, biomedical applications have been found for ester, amide, ether gelan derivatives, thiol derivatives, ionic complexes of gelan with biologically active compounds of opposite ionic character, graft copolymers, amphiphilic derivatives. But there are still new materials to be exploited, such as composites with inorganic powders (clays, metal oxide-based particles or even metals with magnetic properties), other types of grafted copolymers, amphiphilic derivatives, etc.

Without any doubt, Gl and its derivatives constitute a vein that must be further explored and exploited, leading to new valuable results with potential biomedical applications.

The present communication aims at a brief review of the biomedical applications of gelan derivatives (controlled drug delivery systems, tissue engineering, etc.), their performances, in relation to the formulation of the systems used for this purpose, based on the literature of the last years.

Keywords: biomedical applications, drug delivery systems, gelan, gelan derivatives, hydrogels, particles, tablets

SYNTHESIS OF HIGHLY ACTIVE AND STABLE Cu NANOCATALYSTS ENCAPSULATED IN MESOPOROUS SILICA FOR THE SELECTIVE HYDROGENATION OF LEVULINIC ACID TO γ-VALEROLACTONE

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

[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]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:

The conversion of platform molecules derived from lignocellulosic biomass into high-value-added products has attracted much scientific attention in the last years as a sustainable way to produce both fuels and chemicals. One such platform molecule is levulinic acid (LA), which can be catalytically hydrogenated into γ-valerolactone (GVL). Among various transition metal-based catalysts proposed to date for the hydrogenation of LA to GVL, supported Cu nanoparticles (NPs) have gained significant interest due to their promising catalytic activity and selectivity. However, controling the size and stability of Cu NPs to maximize catalytic performance is challenging, particularly at high copper loadings (≥ 5 wt. %). In this study, we report strategies to fabricate highly active and stable copper nanocatalysts (10 wt. % Cu) for the hydrogenation of LA by the encapsulation of Cu NPs within the pores of a high-surface area ordered mesoporous silica support. Several encapsulation strategies, including: incipient wetness impregnation followed by mild drying on calcined SBA-15 support and non-calcined SBA-15 support containing triblock copolymer P123 surfactant, glycine-assisted combustion and deposition-precipitation on calcined SBA-15 support, were investigated. The obtained materials were characterized by X-ray diffraction, nitrogen physisorption, thermoprogrammed reduction, chemisorption of nitrogen protoxide, and transmission electron microscopy. The catalytic performance was evaluated in the liquid-phase hydrogenation of LA in 1,4-dioxane (130 - 200 °C, 40 bar H2). The reaction mixtures were analyzed by GC-MS. The characterization results showed that the most effective strategy for encapsulating Cu NPs in mesoporous silica, with a size below 3 nm, while avoiding pore blockage, was the impregnation on SBA-15 supports partially occluded with P123 surfactant. In well agreement with these results, the corresponding Cu/SBA-15 catalyst exhibited the best catalytic activity in the series, with a complete conversion of LA to GVL measured at 150 °C after 4 h of reaction. Overall, the study has demonstrated the positive effect of pore encapsulation in obtaining a high and stable dispersion of the metal copper NPs and achieving a high catalytic activity in the hydrogenation of biomass-derived molecules.

Keywords: Biomass, Copper nanoparticles, Hydrogenation, Levulinic acid, γ-valerolactone, SBA-15

BIOCOMPOSITES BASED ON HYDROXYAPATITE FOR BONE TISSUE REPAIR AND DRUG DELIVERY

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:

This paper presents a review of the specialized literature regarding obtaining biocomposites based on hydroxyapatite and their potential use as bone tissue substitutes. Biomaterials for bone reconstruction are of major interest for tissue engineering and regenerative medicine and a permanent challenge for specialists in the field. Bone reconstruction methods and biomaterials used as bone substitutes for bone defect repair have seen enormous progress in recent decades, increasing in number and efficiency. In the bone tissue engineering applications, it is very important to create organic-inorganic hybrid biomaterials that can be successfully integrated into the tissue areas affected by disease or trauma. Currently, the biocomposites obtained by combining bioactive, biodegradable and mechanically resistant materials, are considered a good solution of biomaterials with appropriate biological, chemical, physical and mechanical properties in bone tissue repair. These biomaterials, in addition to basic characteristics such as biocompatibility, osteoconductivity and specific mechanical properties, must be able to mimic the repaired tissues and protect them against some unwanted inflammatory reactions and infections through the controlled release of specific biomolecules/active principles. Most studies presented in the specialized literature mention the possibility of obtaining biocomposites by using some polymers as matrix and some inorganic materials (such as hydroxyapatite) as filler. In addition, a series of researches focused on the introduction of an active principle (i.e. drug) in the composite to ensure the safety of the implant from the point of view of zonal infection. The results suggested that these biocomposites with a controlled release capacity of bioactive factors may be of use in bone tissue engineering for enhancing the bioactivity and bone inductivity for the regeneration of bone defects. These biocomposites possessing synergistic properties, offer many advantages, very important being the achievement of favorable cellular interactions and the controlled release of active principles. In conclusion, the field of biomaterials for bone reconstruction is in a continuous dynamic because there is the possibility of creating new hybrid organic-inorganic biomaterials in the form of scaffolds for the application of bone tissue engineering.

Keywords: biocomposites, bone substitutes, drug delivery, hydroxyapatite, polymer

TAILORING THE SYNTHESIS OF IBUPROFEN/LAYERED DOUBLE HYDROXIDES NANOCOMPOSITES FOR TARGETING CONTROLLED DELIVERY OF IBUPROFEN

Denis Cutcovschi[1,2], Corina Eugenia Ignat[1], Sofronia Bouariu[1], Gabriela Carja[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]"Antibiotice S.A., 1 Valea Lupului Street, Iasi 707410, Romania

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

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

Abstract:

Inhalation aerosols defined by dry powders with mesoporous features, large surface area and small mass density permitted the highly efficient delivery of the pulmonary inhaled therapeutics into the systemic circulation. This work presents the dry-powders of ibuprofen/layered double hydroxides (Ibu/LDHs) as a novel drug delivery system with micro/nanoparticulates characteristics that are suitable for pulmonary delivery. XRD, TEM and SEM analyses were used to study the micromorphology characteristics of Ibu/LDHs nanocomposites. The micromorphology characteristics as: micro/nano particles/inter-particles sizes, mesoporous features, BET surface area and Mg/Al molar ratios, were optimized to control the amounts of Ibu that is released by Ibu/LDHs dry- powders. Results demonstrated that the heterostructuring between Ibu and LDHs can be manipulated the incorporation of the drug in the LDHs matrices such that to sustain a slow, fast or fast/slow delivery of ibuprofen. The facile and versatile strategies to develop Ibu/LDHs nanocomposites as dry powders with controlled nanomorphologies features might be important in the conformal fabrications and applications of the efficient pulmonary delivery therapeutics and specifically for achieving better therapeutic action and bioavailability of Ibu at low dose.

***Keywords*:** heterostructuretargeted delivery, ibuprofen, layered double hydroxides, nanocomposites

IMPROVING HYDROGEL FORMULATION FOR TRANSDERMAL DELIVERY OF HEPARIN: "A PROMISING THERAPEUTIC OPTION FOR VARICOSE VEINS AND ASSOCIATED COMPLICATIONS"

Elena Farcaș[1], Leonard Ionu, Atanase[2,3]

[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]"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:

Transdermal delivery of heparin through hydrogels is a popular therapeutic option for treating varicose veins due to its controlled and sustained release of the drug, reducing the need for frequent administration. However, increasing the concentration of heparin in hydrogels has been shown to improve their therapeutic efficacy, leading to better outcomes for patients with venous leg ulcers. Researchers propose adding permeation enhancers or other adjuvants to improve the transdermal penetration of heparin and enhance its bioavailability. A promising approach is to use a combination of natural and synthetic polymers in the hydrogel formulation, improving physical and pharmacological properties and increasing the concentration of heparin delivered transdermally. A promising hydrogel formulation for transdermal delivery of heparin contains a combination of chitosan, hyaluronic acid, and poloxamer. Chitosan is a natural polymer with mucoadhesive properties that can enhance drug permeation through the skin, while hyaluronic acid promotes wound healing and enhances heparin bioavailability. Poloxamer is a synthetic polymer that forms a gel-like structure and improves heparin release. The optimal heparin concentration for an improved hydrogel depends on the patient's specific needs, but a possible formula is a combination of chitosan (1%), hyaluronic acid (0.5%), and poloxamer (15%). The hydrogel can be prepared by dissolving chitosan and hyaluronic acid in water, adding poloxamer and stirring until it is completely dissolved. Heparin can then be added and stirred until completely dispersed.

An improved hydrogel for transdermal delivery of heparin provides an effective and safe therapeutic option for treating varicose veins and associated complications. It offers sustained and controlled release of heparin, leading to better symptom relief and outcomes for patients. The combination of chitosan, hyaluronic acid, and poloxamer has excellent biocompatibility and low toxicity, making it a safe option for transdermal delivery. The use of this improved hydrogel could also have implications beyond varicose vein treatment, such as the treatment of chronic wounds like diabetic foot ulcers.

The economic benefits of an improved hydrogel formulation for the transdermal delivery of heparin could be significant, potentially reducing healthcare costs associated with varicose veins and their complications. Further studies are required to evaluate long-term efficacy and safety, as well as to identify the optimal dose and administration regimen for different patient populations.

Keywords: : chitosan, heparin, hyaluronic acid, hydrogels, poloxamer, transdermal delivery

DESIGN STRATEGIES FOR TAILORING NANOARCHITECTONICS OF 2-D MATRICES OF Cu AND Sn SUBSTITUTED LAYERED DOUBLE HYDROXIDES

Andreea Loredana Gavrilă[1], Aben Regi Abraham[2], Gabriel Ababei[3], Gabriela Carja[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]"Dunărea de Jos" University of Galati, Faculty of Engineering, 111 Domnească Street, Galaţi, 800201, Romania
[3]"Stefan cel Mare" University of Suceava, Faculty of Electrical Engineering and Computer Science, 13 Universității Street, Suceava 720229, Romania

Corresponding author: Andreea Loredana Gavrila, loredana-andreea.gavrila@student.tuiasi.ro

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

Abstract:

Layered double hydroxides (LDH) are typical 2D nanomaterials that have recently shown unprecedented advances in controllable and simplified chemical construction, versatile surface engineering, and comprehensive biological investigation. The reason LDH have such a wide range of potential applications stems from their structure. LDH are represented by the general formula: $[Me^{II}_{1-x}Me^{III}x(OH)_2]^{x+}\bullet A^{n-x}/n\bullet mH_2O$. Co-precipitation is the most common method used to prepare LDH and is often described as a simple and inexpensive "one-pot" method. Our work aims on studying the influence of the synthesis parameters of the LDHs on the nanoarchitectonics of the LDHs for ZnAlLDH partially substituted with Sn^{IV} or Cu^{II}, denoted as SnZnAlLDH and ZnCuLDH, respectively. Results show that the composition of the LDH impacted the micro/nanomorphology features that establish LDH nanoarchitectonics, such as nanoparticle sizes and their organized patterns (Fig. 1).

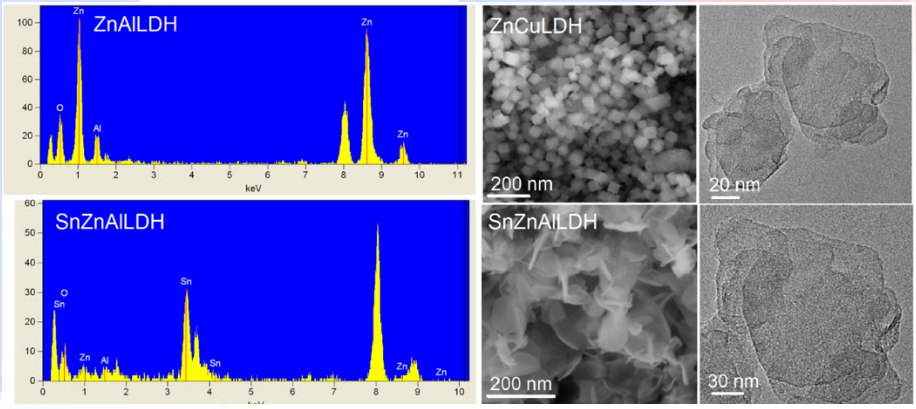


Fig. 1. Micromorphology features of ZnAlLDH and SnZnAlLDH by SEM and TEM analysis.

This work might pave the way to fabricate versatile LDHs nanoarchitectonics with specific applications in nanomedicine and nanocatalysis.

***Keywords*:** Co-precipitation, LDH, nanoparticle, ZnAlLDH

PRELIMINARY ANTI-CORROSIVE STUDY OF *Rhus typhina L.*

Denisa-Ioana Gheorghe[1], Ecaterina Matei[1], Sorin-Marius Avramescu[2]

[1]University Politehnica of Bucharest, Doctoral School "Biotechnical Systems Engineering",
313 Splaiul Independentei, Bucharest, Romania
[2]University of Bucharest, Research Center for Environmental Protection and Waste Management,
36-46 Mihail Kogălniceanu Blvd., Bucharest, Romania

Corresponding author: Denisa-Ioana Gheorghe, denisa.gheorghe1911@stud.isb.upb.ro

PhD Supervisor: Professor Ecaterina Matei
University Politehnica of Bucharest, Romania

Abstract:

The main purpose of this study is to provide an environmentally friendly, non-toxic and affordable solution to the corrosion that can seriously affect and cause damage in everyday life, thus prolonging the service life of household items and more. In this study we used double pickled black sheet, OL 37, used for household products and also to protect cars.
Corrosion is commonly understood as the material transformation of metal surfaces caused by the influence of the contact environment. As a result, the oxide of that metal is formed. In the case of iron this oxide is rust. Corrosion as a technical term is used both in geology (dilution of minerals by water-carbon dioxide) and in medicine (the negative influence of inflammation on tissues). As a solution to reduce corrosion and protect the surface of metals, various hydroalcoholic plant extracts are used today. In this study we chose *Rhus typhina* L. which has a strong adaptability and resistance, it is often used in vegetation restoration of degraded habitats, and due to its better visual effect, it is also widely used in landscaping. However, in recent years, researchers have continuously concluded that *R. typhin*a L. grow rapidly in landscapes with good ecological conditions, sprouting a large number of new branches with increasing in growing years, increasing understory depression and weakening light, which greatly threatens community biodiversity and ecosystem function.
For the hydroalcoholic extracts were used leaves of *Rhus typhina* L. collected in summer and autumn. The microwave-assisted extraction (MAE) method was applied, as an important technique for extracting valuable compounds from plant materials. Qualitative and quantitative analysis of the composition of the different parts was performed by high performance liquid chromatography (HPLC). Hydroalcoholic extracts were applied to double pickled sheet metal used for household and car manufacturing. For corrosion rate, the weight loss measurements method was applied. The metal plates were weighed, measure their dimensions: thickness, width, length, and spray the extracts on both sides. The simplest way to measure the corrosion rate of a metal is to immerse the sample in the test medium (HCl acid) and measure the weight loss of the material, in time. After 76 hours, the metal plates were removed from solution of 1 M HCl and cleaned and weighed again. From the results of the weight loss method, the extract collected in summer has the best inhibition efficiency on corrosion. *Rhus typhina L.* hydroalcoholic extract collected in summer presented a 88.4131 inhibition efficiency (IE %), compared to *Rhus typhina L.* hydroalcoholic extract collected in autumn with 83.9248 inhibition efficiency (IE %). In the future, studies will be continued, with other solvents/ ratio and other plants will be tested for their anti-corrosive potential.

Keywords: corrosion, extracts, HCl, metal, *Rhus typhina* L.

POTENTIAL SOURCE IDENTIFICATION OF NO_2 AND COMPARISON BETWEEN MODELLING RESULTS AND IN-SITU MONITORING DATA: CASE STUDY STREET ROAD NETWORKS (SRN) OF KIGALI CITY, RWANDA

Elisephane Irankunda[1], Zoltán Török[1], Alexandru Mereuță[1], Alexandru Ozunu[1], Jimmy Gasore[2], Egide Kalisa[3], Beatha Akimpaye[4*], Theobald Habineza[5*], Olivier Shyaka[5*], Gaston Munyampundu[5*]

[1]Babeş-Bolyai University of Cluj-Napoca, Faculty of Environmental Science and Engineering, 30 Fantanele Street, 400294, Cluj-Napoca, Romania
[2]University of Rwanda, Department of Physics, KK737 Street, PO BOX 4285, Kigali, Rwanda
[3]University of Rwanda, Department of Biology, KK737 Street, PO BOX 4285, Kigali, Rwanda
[4]The Rwanda Environment Management Authority, Division of Environmental Compliance and Enforcement, KG 7 Street, Kigali Rwanda, PO BOX 7436 Kigali, Rwanda
[5]Rwanda Space Agency, Department of Technical Expert, KG 7 Street, PO BOX 6205 Kigali, Rwanda

Corresponding author: Elisephane Irankunda, elisephane@gmail.com

PhD Supervisor: Professor Alexandru Ozunu
Babeş-Bolyai University of Cluj-Napoca, Romania

Abstract:

The incomplete combustion of fossil fuels from petrol, natural gas, and fuel oil in the engine of vehicles contributes to air quality degradation through traffic-related air pollutant emissions. The Real-time affordable multi-pollutant (RAMPs) monitors were installed in Kigali, the capital of Rwanda, to fill the gap in air quality datasets. Using RAMPs, this is the first air quality modelling research in Rwanda aiming to report the concentration of NO_2 by comparing In-situ monitored data and modelled results. We targeted NO_2 emissions from 27 road networks of Kigali to address the impacts of traffic emissions on air quality over 2021. The American Meteorological Society and Environmental Protection Agency regulatory models (AERMOD and ISCST3) were used for simulation. Statistical indexes include fractional bias (FB), the fraction of the prediction within the factor of two of the observations (FAC2), normalized mean square error (NMSE), geometric mean bias (MG), and geometric variance (VG) used to assess models' reliability. Monitoring shows the annual mean of 16.07 µg/m^3, 20.35 µg/m^3, and 15.46 µg/m^3 at Mont-Kigali, Gacuriro, and Gikondo-Mburabuturo stations, respectively. Modelling shows the daily mean of 111.77 µg/m^3 and annually mean of 50.42 µg/m^3 with AERMOD and daily mean of 200.26 µg/m^3 and annually mean of 72.26 µg/m^3 with ISCST3. The FB, NMSE, and FAC2 showed good agreement, while MG and VG showed moderate agreement with AERMOD. The FB, NMSE, and MG showed moderate agreement, while FAC2 and VG disagreed with ISCST3. Traffic and urban residential emissions were identified as potential sources of NO_2. Results indicated that Kigali residents are exposed to a significant level of NO_2 exceeding World Health Organisation limits. Findings will help track the effectiveness of Rwanda's recently executed pollution-control policy, suggest evidence based on the recommendations to reduce NO_2, and use further dispersion models to support ground-based observations to improve public health.

Keywords: AERMOD, environmental impact and protection, ISCST3, NO_2, potential pollutant sources, street road networks, traffic emission

ESTABLISHING THE OPTIMUM CONDITIONS FOR THE RETENTION OF PHOSPHATE IONS BY MARINE GREEN ALGAE (Ulva intestinalis) BIOMASS

Loredana Munteanu, Gabriela Antoaneta Apostolescu, Laura Bulgariu

"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: Loredana Munteanu, nastasadana72@gmail.com

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

Abstract:

Phosphorus is a crucial nutrient for all life forms, found in abundance in both animal and plant tissues. Its most common form, the phosphate anion, is used to increase the fertility of soil, with particularly widespread use in large-scale agricultural production. Unfortunately, the excessive use of phosphorus-based fertilizer leads to the environmental release of large quantities of phosphate ions, which contribute to the eutrophication of water sources and, as a consequence, the death of numerous species of fish and other aquatic organisms. To avoid such consequences, it is necessary to find ways to remove phosphate ions from aqueous media.
The use of marine algae to recover phosphorus from aquatic environments presents a unique opportunity to utilize this type of biomass, which is found in significant quantities on costal regions. In addition, the retention process is simple and requires only a few steps, making it advantageous from an economic perspective. Based on these considerations, in this study we used green marine algae (Ulva intestinalis) samples from the Romanian coast of the Black Sea, in 2022. The biosorption capacity of the marine green algae biomass was examined as a function of the initial solution pH, the algae biomass dosage, the initial concentration of phosphate ions, the contact time, and temperature. The obtained experimental results show that phosphate ions are retained with maximum efficiency by *Ulva intestinalis* biomass under the following conditions: an initial solution pH of 6.5, a concentration of biomass of 2g/L, a minimum contact time of 5 minutes, and a temperature of 22^{o}C. Under these conditions, the biosorption capacity reaches a value of 25.19 mg/g for an initial concentration of 333.0768 mg/L. We conclude that the biomass of the green marine algae, *Ulva intestinalis*, exhibits a potential for use as a biosorbent in processes aiming to remove phosphate ions from aquatic environments.

Keywords: Algae, aquatic environment, biosorption, phosphate removal

COMPARISON OF DIFFERENT SYNTHESIS METHODS OF PEROVSKITES WITH APPLICATIONS IN PHOTOCATALYSIS

Laura Nistor, 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: Laura Nistor, laura.nistor2@student.tuiasi.ro

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

Abstract:

The perovskite oxides have been researched in the last years due to their special structures and unique properties. Perovskite-type oxides with special properties are required depending on the ultimate end use. For example, there are applications that require densification by high temperature sintering to minimize both surface area and surface free energy in order to maximize mechanical strength. In contrast, catalytic materials have to maintain sufficiently high surface area in order to maximize their surface and activity. The requirement for these special properties mostly could be achieved by choosing a proper synthesis method, such as the solid-state reaction, combustion or chemical vapor deposition. Recent advances in the design and preparation of perovskite-type oxides have proved that a numerous variety of these materials can nowadays be synthesized through microwave and sonication pathways and by overcoming the limitations of traditional synthesis methodologies. Such designer materials will have significant impact in many areas, including increasing applications in catalytic processes, sensors, photovoltaics, fuel cells, and environmental protection. On the other hand, must not forget that the preparation of perovskite-type oxides must be approached in a green and sustainable manner, with the tenets of reducing waste and the use of toxic compounds, promoting room-temperature aqueous solution protocols, and improving manufacturing safety as well as decreasing production costs. Therefore, to find a synthesis method with novel processing undoubtedly is an interesting subject of future tasks. The preparation route plays a critical role on the physical and chemical properties of perovskites. The approach to synthesis of perovskites was examined in function of the specific demands concerning activity and/or selectivity, both of which depend on the arrangement of atoms at a small scale. A general objective is to locate the different constituting atoms at precise positions. The objectives of this study was to transform the starting precursor into a highly porous solid, without segregation of different elements, that would produce tiny parts with photocatalytic properties.

Keywords: perovskite, photocatalysis, synthesis methods

TiO_2-Ag NANOCOMPOSITE AS PHOTOCATALYSTS FOR DEGRADATION ORGANIC POLLUTANTS

Cătălina Nuțescu Duduman, Gabriela 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: Catalina Nutescu Duduman, catalinanutescu@yahoo.com

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

Abstract:

In this research, a simple sol-gel method was used to easily create TiO_2-Ag nanocomposites with superior catalytic performance. Because of its stability, high photocatalytic activity, low toxicity, low cost, etc., titanium dioxide is widely used to remove pollutants from wastewater. The TiO_2-based materials showed a quite low activity in the photodegradation of MB alone. The photocatalytic activity of TiO_2 can be enhanced by several methods: doping, surface modification, shape tailoring. The noble metals (Me): Pt, Ag, Au, Pd, Mo and Ru have been widely investigated and have been reported to favor the photocatalytic reactions yields. From these Ag is extensively used due to it's efficiency at low cost. The TiO_2-Ag photocatalysts were synthesized by sol-gel method, using titanium isopropoxide as a precursor for TiO_2 and silver nitrate as a precursor for Ag. The photocatalytic degradation of methylene blue (MB) using sol-gel synthesised TiO_2-Ag as a catalyst under UV light was investigated in the current research. Tests were conducted in a batch reactor that was magnetically stirred and exposed to UV rays from the outside. The impacts of some factors, including initial solution concentration, catalyst dosage, light intensity and time of irradiation, were studied. Results indicated that at an MB content of 1.2435^{-5} mol/L, the best catalyst concentration was 0.03 g/L. The results are very encouraging when using TiO_2- Ag as a photocatalyst, particularly when acetone is used intensification of the process; the degradation degree increase from 60% for TiO_2 to 92.58% for TiO_2-Ag and 0.1% acetone and then to 97.45% for TiO_2-Ag and 0.2% acetone, respectively. The photocatalysis followed a pseudo-first order reaction kinetics, with rate constants ranging from 0.0009 to 0.11 min^{-1} under the studied conditions.

Keywords: acetone, kinetics, methylene blue, photocatalytic degradation, TiO_2-Ag

SEPARATE COLLECTION OF RECYCLABLE WASTE - AN EARLY STAGE IN MEETING THE MUNICIPAL SOLID WASTE TARGETS

Dorina Petrișor[1,2], Raluca Mateescu[1,2], Carmen Teodosiu[1]

[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
[2]ADI Ecodolj, 22 N. Titulescu Street, Craiova, Romania

Corresponding author: Dorina Petrișor, dorina-maria.petrisor@student.tuiasi.ro

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

Abstract:

This paper aims to provide a dynamic analysis of the achievement of targets in the municipal solid waste sector and highlights individual local performance. According to the EU Landfill Directive, the total amount of municipal solid waste landfilled must be less than 10% by 2035. The diversion of municipal waste from landfills through separate collection of recyclable paper/cardboard, plastic, metal and glass waste and further processing of recyclable waste in sorting facilities to prepare the recycling process is an early step towards achieving the performance required by the European Directives.
The quantities of waste in the records of the authorities responsible for monitoring delegation contracts in the waste management sector were taken into account for this work. The wastes collected from 109 localities of Dolj County were analyzed quantitatively and their performance was highlighted in the period analyzed, from 2019 to 2022, through graphical representations. A first step of the methodology is to classify the analysed areas according to their individual performance in achieving the targets for separate collection of recyclable waste.
It was found that there are significant differences for all localities during the analyzed period, waste management in Dolj County has developed considerably from the date of initiation of activities for collection, transport and treatment of paper/cardboard, plastic, metal and glass waste until the end of 2022.
The database created through this work will subsequently allow a detailed analysis of the studied area to investigate which factors mostly affect the performance of the waste collection system to meet municipal waste targets. It can therefore be used as a tool to support local authorities and authorities with responsibility in waste management for defining future decisions on sustainable investments and strategies needed to increase the collection of good quality recyclable waste and to achieve national targets.

Keywords: household waste, municipal solid waste, separate collection, waste management, waste targets

IBUPROFEN REMOVAL FROM WATER USING MATERIALS BASED ON ALUMINUM, IRON AND ACTIVATED CARBON

Mina Ionela Popescu[1,2], Cornelia Bandas[1], Corina Orha[1], Carmen Lazau[1], Narcis Duteanu[2]

[1"]National Institute of Research-Development for Electrochemistry and Condensed Matter Timisoara, 1 Plautius Andronescu Street, Timisoara 300224, Romania
[2"]Politehnica" University of Timisoara, Faculty of Industrial Chemistry and Environmental Engineering, 2 P-ta Victoriei, Timisoara, 300006, Romania

Corresponding author: Mina Ionela Popescu, mina.popescu@student.upt.ro

PhD Supervisor: Narcis Duteanu
Politehnica University of Timisoara, Romania

Abstract:

The aim of this study is to remove ibuprofen (IBP), a drug used to treat pain, fever, and inflammation. Ibuprofen is a nonsteroidal anti-inflammatory drug (NSAID), but its presence in water has negative impacts and risks on human health. Therefore, this study focuses on the removal of ibuprofen using materials based on aluminum-iron-activated carbon and powdered activated carbon alone.
Among oxides, aluminum oxide is an important chemical due to its many valuable properties, such as good thermal conductivity, non-toxicity, high strength, easy incorporation in polymers/synthesis, and low cost. Iron oxides have also gained interest in the scientific community due to various applications, such as photocatalysis and gas detection. The Al2O3-Fe2O3 oxide system has received special attention for industrial applications, especially adsorption/absorption processes. The Al2O3-Fe2O3 system offers different advantages, such as surface, textural structure, and catalytic properties, which provide indications related to the processes used in this study. Therefore, a mixture of oxides was obtained by the sol-gel method, which is considered an easy and low-cost method. The compounds obtained were characterized by X-ray Diffraction (XRD), UV-Vis spectrophotometry, and Scanning Electron Microscopy (SEM). Powdered activated carbon (PAC) was tested as a sorbent and was also introduced in the synthesis of materials. PAC-based filtering belongs to mature technology for wastewater treatment, but its performance for removing emerging pollutants, especially drugs, is important. The purpose of the obtained materials is to compare their removal efficiency. The synthesis methods differ by the use of various reagents, the amount of dopant, and the thermal treatment applied. For the efficiency of the adsorption process using PAC, it is important to know the dependence on the operating variables of the experiments, such as pH, PAC dosage, and IBU initial concentration. In conclusion, this work is related to the fast adsorption capacity of Al/Fe-based material using PAC to remove drugs. All experiments and materials were designed to remove ibuprofen from water.

Keywords: absorption, drugs, Ibuprofen, mixed oxides, PAC, polluants

STUDIES ON ENERGY RECOVERY FROM WASTE USING THERMOGRAVIMETRIC ANALYSIS

Loredana-Vasilica Postolache, Gabriela Șoreanu, Igor Crețescu, Gabriela Lisa

"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: Loredana-Vasilica Postolache, loredana-vasilica.postolache@student.tuiasi.ro

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

Abstract:

Thermogravimetric analysis is a time or temperature dependent analysis technique of a mass of substance subjected to heating in controlled atmospheric media, providing information on heat and mass transfer, mass-independent physical changes and other thermal characteristics. Thermogravimetric analysis has been used by many researchers in the analysis of the decomposition process of municipal waste for energy recovery. In this study, thermogravimetric analysis was used to evaluate the degradation process of four types of waste: cardboard - C, tyres - A, railway sleepers - G, used microalgae - Cho and mixtures of them in different proportions.The experimental determinations were carried out with the Mettler Toledo - TGA-SDTA851e, in the temperature range 25-700 °C, at a speed of 10°C/min using air as working atmosphere. The processing of the recorded thermogravimetric curves was carried out using the STARe software version 9.10. The temperatures at which 5% (T_5%) and 30% (T_{30}%) of the sample mass was lost were determined and the heat resistance index $T_{HRI} = 0.49 \cdot [T_5\% + 0.6 \cdot (T_{30}\% - T_5\%)]$ was evaluated.The results showed T_{HRI} reduction for waste A, C and G by 5%, 14% and 18% when mixed with 30%, 50% and 15% Cho. This showed a reduction in thermal stability and an increase in the energy potential of different types of waste by adding microalgae residues from photobioactors for treating contaminated air.

Keywords: energy recovery, thermogravimetric analysis, waste

DIRECTIONS OF EFFICIENT INTEGRATED MANAGEMENT OF HOUSEHOLD WASTE AT THE LEVEL OF RURAL AREAS. CASE STUDY: ȚIBANA COMMUNE

Cătălin Constantin Spiță, Ioan Mămăligă, Laura Bulgariu

"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: Cătălin Constantin Spiță, catalin.spita@yahoo.com

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

Abstract:

Ţibana is a commune in Iaşi County, Romania, consisting of 10 villages with a population of over 7000 inhabitants. In order to streamline the mechanism of collection, transport, recycling of household waste in the commune of Țibana Iasi County, it is necessary to apply and revise a waste management plan. It is a fundamental planning tool for ensuring environmental action at local level, involving: waste prevention, preparation for re-use, recycling, recovery and, as a last preferable option, disposal (including landfilling and incineration with and without energy recovery). The aim of this study is the presentation of theoretical and applicative approachs for efficient integrated management of household waste at the level of Țibana commune, Iasi County. In order to achieve the purpose of the work, the following objectives were set: (i) study on the composition of household waste; (ii) aspects in the area of population involvement in the process of separate waste collection through the implementation of the "door to door" system (the degree of participation of the population in separate waste collection, the degree of information of the population about the separate collection of waste and the extent to which the population is aware of the importance of this process, opinions, attitudes of the population's behavior in terms of separate waste collection); (iii) evaluation of the process of collection, transport and management of household waste generated in the studied area and dissemination of results and project management). In this study will be highlighted the working tools and the use of techniques and methods, such as: the method of document analysis, the output method in determining the composition of waste and the statistical analysis of data. The study will identify several directions that can be followed by economic agents, educational institutions, involved in the system of separate waste collection for its improvement. Thus, given the increase in the quantities of waste generated in the context of a constantly developing economy, the steps taken within this work can contribute to the integration of the management of the waste generated in the studied area within the broad framework of the circular economy.

Keywords: household waste, integrated management, recyclable waste, rural area

AIR POLLUTION EVALUATION, ENVIRONMENTAL IMPACTS AND ASSOCIATED RISKS ASSESSMENTS

Ioana Tanasă, Dumitru Boțan, Eduard Străinu, Brindusa Sluşer

"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: Ioana Tanasa, ioana-madalina.tanasa@student.tuiasi.ro

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

Abstract:

It is well known that one of the greatest world problems is air pollution, with severe consequences for environmental health. The negative effects of this phenomenon affect, among others, human health, causing acute or chronic diseases, depending on certain factors, such as the concentrations of pollutants and the exposure duration of the population to them. Thus, permanent monitoring and air quality assessment are required, with the aim of ensuring a healthy environment and intervening where the situation requires it. Considering these aspects, our paper aims to evaluate the air quality for 4 cities in Romania (Brasov, Cluj-Napoca, Iasi, Timisoara), for a period of 12 years (2011-2022). A series of measured concentrations were collected and organized from the National Environmental Protection Agency reports, followed by the application of two methods for environmental impact quantification. For each selected city, the annual average concentration for certain pollutants was considered in 3 monitoring stations. At the same time, based on the type of pollutant, its toxicity, and negative effects, 3 pollutants were selected for environmental impacts and risks assessment, namely $PM_{2.5}$, carbon monoxide and arsenic. For environmental impacts quantification of the 3 pollutants measured in Brasov, Cluj-Napoca, Iasi and Timisoara cities, for the period 2011-2022, Rapid Impact Assessment Matrix (RIAM) and the integrated method were applied, considering also the values of the alert threshold and the maximum allowed concentration, specific to each pollutant. Results highlighted that the main impacts are generated by $PM_{2.5}$ pollution, and this was proved through a series of graphic representations varied depending on the pollutant, city and year, the scenarios falling into impacts from slightly negative to moderately negative. Also, another resulting situation is that represented by a moderate risk, with an environment modified by industrial activities causing discomfort conditions, requiring monitoring and prevention actions. Thus, the importance of continuous monitoring and air quality evaluation has highly increased, and one of the main goals of these actions is the prevention of pollution and the minimization of impacts.

Keywords: air quality, environmental impact, integrated method, RIAM method, risk assessment

A SHORT REVIEW ON URBAN AIR POLLUTION AND INNOVATIVE BIOREMEDIAL APPROACHES

Adrian Cătălin Toma, Irina Volf

"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: Adrian Cătălin Toma, adrian-catalin.toma@student.tuiasi.ro

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

Abstract:

The World Health Organization estimates that each year in Europe, high levels of air pollution are responsible for the premature deaths of more than 400,000 people. Air pollution is regarded as the environmental hazard that poses the greatest threat to human health and has the largest direct influence on the environment in the European Union. The ever-increasing demands for electricity, heat and products for chemical, metallurgical, cement, road, transport industries have resulted in an air pollutants concentration increase.

In this regard, from 2016 to 2018, Romania experienced a significant increase in the PM10, NO_2 and SO_2 annual average levels, followed by a decrease from 2019 to 2021, with values of 24 $\mu g/m^3$, 27 $\mu g/m^3$, and 8 $\mu g/m^3$, respectively, which are lower than the WHO Global Air Quality Guideline recommendations. Despite the optimal values from a WHO standpoint, air pollution remains a significant public health concern in Romania, as heart disease and stroke are the leading causes of death associated with air pollution, followed by lung disease and cancer.

Adopting new innovative techniques for air (bio)remediation is crucial in reducing the negative effects of air pollution on human and environmental health. Indoor phytoremediation, which uses plants to absorb and remove pollutants from the air, is a promising approach for remedying air pollution in urban spaces (homes, offices, stores). Literature reported that indoor plants systems significantly reduce air pollutant levels, enhancing the indoor air quality and reducing associated health risks. Green walls and biofilic systems represent phytoremediation possibilities for indoor air pollution leading to substantially lower levels of formaldehyde, benzene, and nitrogen oxides, thus making them a promising solution for mitigating indoor pollution. The plants and carriers, both naturals and synthetics, which have a critical contribution in bioremediation sistems were also considered in this paper.

In conclusion, air pollution represent a significant issue that affects both human health and the environment; hence, it is essential to take active measures to lessen its impact on both the quality of life and the environment.

Keywords: air pollution, (bio)oremediation, green walls, health effects

INFLUENCE OF ALTERNATIVE FUELS AND RAW MATERIALS ON CLINKER BURNING PROCESS

Leonid Vasiliu, 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: Leonid Vasiliu, leonid.vasiliu@student.tuiasi.ro

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

Abstract:

In the cement industry, the challenges are the preservation of the raw materials and energy resources, as well as reduction of pollutant emissions. In this context, the cement producers demand studies to reduce of the production costs. One way to achieve this, is to use alternative fuels or by-product raw materials. Any reduction in the required energy has a beneficial influence both on the viability of the cement plant and on the environment. One of the approaches aimed at reducing thermal energy consumption is the partial substitution of traditional raw materials (limestone, clay, gypsum) with other alternative materials, with a melting effect, among which stand out by- products of the steel industry such as furnace and steel slag. Blast furnace slag is a by-product resulting from the process of extracting pig iron from ores. It is formed because of the reduction reactions of iron oxides with carbon monoxide, originating from the burning of coke. Ungranulated (crystallized) slag is obtained by slowly cooling the slag melt in air (at atmospheric conditions). Because the slag has already suffered a thermal process, less fuel is required for combustion in the kiln, thus reducing CO_2 emissions from combustion. In addition, the calcium oxide in the slag replaces some of the limestone in the raw mix, which is another source of CO_2. Since steel slag does not require crushing, it indirectly reduces CO_2 emissions generated by electricity. The principal objective of this paper is to establish the influence, at the industrial scale, of the use of steel slag in clincher burning during using different types of fuels. Therefore, experimental results, at the industrial scale, demonstrated that the using of steel slag in clinker burning are having multiple benefints like: reduction og specific heat consumption with at least 4%, kiln production increasing, CO_2 emission decreasing with 0.4% on kiln chimney, no bad influence on gaseous pollutants emissions, clincker produced quality is corresponding with European Standard SR EN 197-1, also the cement obtained from clincker produsedwith steel slag is respecting the European Standard.

Keywords: alternative raw materials, cement production, clinker, emission, energy, kiln

SECTION 4.

Civil engineering and installations

THEORETICAL AND NUMERICAL ANALYSIS REGARDING COOLING THERMAL PHOTOVOLTAIC PANELS WITH WATER

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 Building Services
67 Mangeron Blvd., Iași, 700050, Romania

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

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

Abstract:

Cooling photovoltaic thermal panels (PV/T) with water is one of the most used methods to increase the efficiency of electricity production and an important parameter that influences heat transfer from the PV/T to the cooling system. The paper presents an analytical study regarding the amount of heat that is transferred from PV/T to the water-cooling system. The amount of heat given by the system was evaluated by a mathematical model that is feasible to be used in realistic scenario and with dedicated software – Cool-PV, in ich the mathematical calculation model was implemented. The amount of heat taken by the cooling system can be used for preheating domestic hot water, under floor heating or other usage of the building, which supports the concept of sustainability and nearly Zero Energy Building – nZEB.

The improvement of the efficiency of buildings in terms of energy consumption can be achieved by integrating water-cooled photovoltaic systems into the building. Therefore, the approach regards the following aspects: converting solar energy into electricity and cooling PV/T with water. In this way, in addition to their increased efficiency and energy production, the amount of heat resulting from cooling can be used for other activities related to green energy and sustainability like preheating domestic hot water, under floor heating of rooms, maintaining a constant temperature in the workspaces without interruptions, etc.

The amount of energy is determined by calculating the temperature difference between the PV/T surface and the cooling system, the circuits through which the coolant flows.

The data obtained analytically represent input data for the Cool-PV software, in the specific module dedicated to sizing, processing and analysis of the amount of heat obtained as a result of the cooling process for improving the efficiency of the photovoltaic panels. The main problem is represented by the efficiency of this hybrid system, the ratio, from an economic point of view, between the energy consumed and the amount of heat obtained for the needs of a building.

Keywords: nearly zero energy building, photovoltaic/thermal panels, PV/T cooling, solar energy, sustainable energy, thermal efficiency

STATE OF THE ART REVIEW OF CEMENTITIOUS ENGINEERED COMPOSITES

Marius-Constantin Artenie

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services
67 Mangeron Blvd., Iași, 700050, Romania

Corresponding author: Marius-Constantin Artenie, marius-constantin.artenie@student.tuiasi.ro

PhD Supervisor: Assoc.Professor Petru Mihai
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

This paper will provide an overview of the latest developments and characteristics of Engineered Cementitious Composites. ECC is a type of strain hardening cement-based composite belonging to the broad class of fiber reinforced concrete, as it contains fibers in the cementitious matrix. It is more commonly known as bendable concrete because of its increased tensile strain capacity, generally above 2%, several times greater than that of regular concrete or other fiber reinforced concretes, which only reach about 0,01%. Thanks to this high tensile strain capacity, ECC acts more like a ductile material, rather than brittle. This behavior is especially noticeable when testing very high strength concrete.

The design basis of ECC is also significantly different from that of ultra-high strength concrete or high-performance concrete, which tend to be based on dense particle packing. Instead, ECC must be tailored around the interactions between the microstructural components, based on a body of knowledge known as ECC micromechanics. In short, the fiber, matrix and fiber-matrix interface features are engineered to interact with one another in a certain manner when the element is loaded. Emphasis on this design basis has given this specific composite its name.

Concrete, representing about 80% of all engineering materials used, plays an important role in the construction of human habitat. The large material flow of concrete coupled with high energy and carbon intensity of cement, however, has drawn increasing scrutiny due to the threat of climate change on urban communities. As a new construction material, ECC must be developed taking into account environmental sustainability. This means that the embodied energy and carbon in ECC must be minimized with judicious choice of material ingredients, preferably incorporating as much materials from industrial waste streams as possible, but without compromising its performance. A particularly important performance is structural durability as this directly impacts on the resource use and emissions during the use phase of ECC structures.

Keywords: concrete, sustainability, composite, ductility, ECC

STUDIES REGARDING THE SAFETY IN OPERATION OF THE HĂLCENI RESERVOIR, IAȘI COUNTY, ROMANIA

Ioan Bălan, Ion Giurma

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Hydrotechnics, Geodesy and Environmental Engineering, 65 Professor D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ioan Bălan, ioan.balan@student.tuiasi.ro

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

Abstract:

The dam of the reservoir Hălceni, located on the Miletin River is a homogeneous earth dam, made of dusty-clay materials, with a maximum height of 10.5 m. According to the current Romanian legislation (Technical Standards for Hydro Technical Works – 021/2002), the Hălceni dam has a 0.39 risk index, which fits the reservoir in „B - special", category of importance. To monitor the evolution of infiltration through the dam body, 16 piezometers and a drainage pipe with discharge in the downstream connection channel of the bottom outlet are used. Also, 9 piezometers, arranged in 5 characteristic measurement sections, are used to intercept the layers of sandy clay dust, sand, and gravel in which the water table in the dam's foundation is contained.

The behavior monitoring of the dam is a very complex activity, performed by following the indications of specific legislation and technical regulations. The monitoring is performed by interpreting the visual observations and the measurement data from gauges, in relation to external stresses on the dam. The analysis of the behavior in time of the dam Hălceni was performed by examining the evolution of the response parameters (piezometer levels, infiltration flows, displacements) to the external stresses.

This paper presents the characteristic elements of the theoretical infiltration curve in the dam. It also shows the hydro isohypses for the dam drawn with SURFER program, using the maximum hydrostatic levels in the piezometers measured in the year 2019. The distribution of the hydro isohypses across the dam is strongly influenced by the location of the piezometers and the other points of measuring the hydraulic head. The pattern circulation of the infiltration water inside the dam body could be studied with increased accuracy, if the dam had been equipped with several piezometers. Even in these conditions, it is clearly observed that the regime of infiltrations through the dam body is similar to the theoretical way of behavior.

Keywords: behavior monitoring, earth dam, hydrostatic level, hydro isophypses, seepage, water management

RESEARCH ON EROSION FACTORS ON THE LOWER COURSE OF THE VORONET RIVER

Petru-Daniel Brăineanu, Mihail Luca

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Hydrotechnics, Geodesy and Environmental Engineering, 65 Professor D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Petru-Daniel Brănianu, petru-daniel.branianu@student.tuiasi.ro

PhD Supervisor: Professor Mihail Luca
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The morphological change of the riverbed influences the stability of the works located in the riverbed and in the riparian zone. The modification of the bed in cross-sections and longitudinal profile is achieved by the phenomena of erosion and clogging. Researching the phenomenon of erosion involves knowing the specific factors for each type of river that influence the morphology of the bed. The Voronet River has been affected in the last ten years by a series of floods that caused significant erosion of the bed and the riparian area. A significant example is the flood of 2016 which presented a discharge with a calculation probability of 1% ($Q_{1\%}$ = 118 m^3/s) on the lower course. The research area was located on a length of 6.0 km on the Voroneț River, where works are located in the bed (bridges, footbridges, bank defenses, bed calibration) and in the riparian area (housing, roads, water intakes, agricultural land). The research carried out between 2016 and 2022 on the lower reaches of the Voronet River highlighted a series of factors that intensified the erosion phenomenon. The main factors are natural and anthropogenic. The natural factors investigated were: the frequency of torrential precipitation, the frequency of floods, the type of alluvial transport in the bed, the geotechnical structure of the bed, geometric parameters of the flow section. Anthropogenic parameters researched were: the method of regularization of the bed, the type of bank defense works, the protection works of the bridge piles, the maintenance works of the bed. The research revealed that bed erosion occurred due to high flow velocities in a cross-section that is varied in shape and size. Also, the alluvial transport consisting of boulders, boulders, gravel and sand contributed to the erosion of the flow section and the constructions located in the bed (bridge piles and embankments). The absence of coastal defense works has contributed to the erosion of the riverside area where a number of homes are located. The flood of 2016 destroyed by erosion the county road DJ 177D on a length of 400 m and partially degraded it on a length of 800 m. The absence of bank defense works in the contact area with the road intensified the phenomenon of erosion.

Keywords: alluvium, anthropogenic factors, flow, natural factors, velocity

RESEARCH ON THE APPLICATION OF SYSTEMATIC CADASTRE IN THE RURAL AREA OF ROMANIA

Iustina Gabriela Ignat, Mihail Luca

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Hydrotechnics, Geodesy and Environmental Engineering, 65 Professor D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Iustina Gabriela Ignat (Ștefan), iustina-gabriela.ignat@student.tuiasi.ro

PhD Supervisor: Professor Mihail Luca
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The integrated system of cadastre and land register includes the technical, economic and juridical records of the properties within the same administrative-territorial unit. The property title issued based on the property laws is the document that serves as the basis for registering in this system. Any discrepancy between the title and the reality on the ground results in the rejection of the reception documentation and registration in the land register. Among the inconsistencies that may occur in property titles are errors in the spelling of the name of the owner of the property rights, errors regarding the cadastral identifiers (field/parcel), neighborhoods and parcel areas. Rectifying property titles is a lengthy process because it involves multiple public institutions. The lack of parcel plans and cadastral specialists at the level of administrative authorities creates an impediment in the process of preparing rectification documentation by the local land fund commission. In the event that a change in the property's surface area is found as a result of measurements, correcting the title of ownership cannot be done administratively, and the owner is obliged to address the courts. A solution to avoid the lengthy time required for rectifying titles is systematic cadastre. In systematic cadastre, all properties in a cadastral sector are registered ex officio in the integrated cadastre and land register system without the need to rectify the property titles. Systematic cadastre work involves identifying the properties, measuring, describing and recording them in cadastral technical documents, representing them on cadastral plans, as well as storing data on information technology supports. The highlighting of some aspects is achieved through a case study performed for a rural area. Due to modern technologies that have emerged in land surveying, represented by both software and hardware equipment, systematic registration work can be performed at the highest standards. Updated and accurate cadastral data can be used in urban planning, infrastructure development and environmental projects. Systematic cadastre is the best option at present for updating cadastral data and resolving uncertainties related to parcel positioning.

Keywords: Properties, rectification, cadastral sectors, property title

DISPLACEMENT CONTROL SYSTEMS, IN CIVIL ENGINEERING

Cosmin-Petru Mocanu-Basalic, Septimiu George Luca, Petru Mihai

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services
67 Mangeron Blvd., Iași, 700050, Romania

Corresponding author: Cosmin-Petru Mocanu-Basalic

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

Abstract:

The displacements and deformations of the structures, caused by the seismic action, are the main cause of initiation of the mechanisms for the formation of plastic joints and redistribution of internal forces. The study and understanding of these displacement, deformation and degradation mechanisms have led to the development of two main directions for equipping structures with seismic energy dissipation capacity: a) seismic energy dissipation by equipping structures with sufficient load-bearing capacity to meet the requirements of safety during service; b) altering the behavior of the structure by introducing seismic dissipation systems, systems that have the role of controlling displacements and deformations, in the desired manner. This paper briefly presents the main structural displacement control systems and the principles underlying their operation. These systems can be classified, depending on the need for an external power source, into: passive systems, active systems, hybrid systems, mixed systems. Among the passive systems, one can distinguish base isolation systems and systems based on elements that control movements through plastic deformation, such as braces with prevented buckling. The principle of operation of the base isolation systems involves the introduction into the structure of some elements that have the role of altering, in the desired way, the building's own vibration modes, thus dissipating an important amount of the seismic energy. In practice, the objective is to "decouple" the infrastructure from the foundation by introducing a physical element whose elastic constant directly influences the mechanism of transferring of the seismic energy into the structure. Active, mixed and hybrid systems are systems that require, totally or partially (in the case of soft and hybrid systems) an external power source to fulfill their function. An example for these types of systems are the motion control systems with an added mass. This displacement control mechanism involves the introduction of a calibrated mass into the structural system whose movement will reduce the lateral displacements of the complex formed by the structural elements and the non-structural elements.

Keywords: displacement, control, base insulation, hysteretic damping, tuned mass dumper

RESEARCH ON THE NATIONAL AND INTERNATIONAL USE OF STEEL SLAG

Andreea Monoranu, Gheorghe Gugiuman

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services
67 Mangeron Blvd., Iași, 700050, Romania

Corresponding author: Andreea Monoranu, andreea.monoranu@student.tuiasi.ro

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

Abstract:

In the present economic situation, the main objective of all developed nations and of emergent ones is economical growth. This objective can't be accomplished without taking account of the eventually side effects, as environmental pollution. A prosperous society needs solutions that can reach both objectives namely, having a continues economical growth and keeping a clean environment, that is to say, a sustainable development of the society. One of the solutions already exists in our society for several decades, continuing to grow, trying to access more and more different environments, this solution is recycling. Industry is the main socio-economic segment that certainly has the largest share of environmental pollution. Of the total industrial waste, metallurgical waste has a significant share, representing an important problem in terms of pollution at the moment. What if this problem not only disappears but also could generate a saving of raw materials? This paper shows how a metallurgical waste, steel slag, not only does not require larger storage spaces, but can be used in many fields, generalizing an important economy of other raw materials. The study shows the quantities of steel slag produced annually by several countries around the world, as well as what share of them is used for road construction as well as in other fields. We will see which countries represent an example in terms of steel slag recycling and which are the countries where steel slag recycling is practiced very little, as well as some examples where this metallurgical waste was used. After studying the fields of use of slag internationally, we notice that developed countries do not consider steel slag a waste but a co-product in the manufacture of steel that can be used in a proportion of even 100% thus bringing a double benefit, a cleaner environment and a saving of money.

Keywords: recycling, secondary product, steel, crushed steel slag, road construction

EVALUATION OF THE FUNCTIONALITY OF METROPOLITAN AREAS IN ROMANIA

Veronica Muraru, Florian Stătescu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Hydrotechnics, Geodesy and Environmental Engineering, 65 Professor 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:

Metropolitan areas are the most dynamic spatial structures globally, with high development dynamics, being considered the engines of socio-economic development. The dynamics of the development of the big cities in Romania and the peri-urban areas around them is in line with the European and world trend. Thus, through the assets of the big cities in Romania (effective spatial planning, functional specialization and intelligent functional specialization, good governance) investments are attracted that can generate well-being both at the level of the city and in its metropolitan area. The development of a polycentric development strategy and the definition of smart functional urban areas has the role of laying the foundations at the national level of priorities, objectives and needs in order to develop a functionally efficient polycentric network and in direct correlation with regional and local strategic levels.

The efficient functioning of metropolitan areas is closely related to a number of socioeconomic and legal factors. In addition to these, the functionality of metropolitan areas is linked to the fulfillment of criteria related to the level of quality of life. This is dependent, among other things, on the degree of coverage of a metropolitan area with public and private services, as well as on their accessibility to the general public. In order for this condition to be fulfilled, it must be taken into account in the stage preceding the establishment of the metropolitan area. In the case of the Romanian metropolitan areas, the functionality criteria were not a priority or a serious concern at the time of their declaration. Among the fundamental functional criteria are: shape, concentricity, homogeneity, size, land fragmentation and specific altitudinal difference. The degree of coverage with different infrastructures and the operating costs of metropolitan areas are related to these indicators.

Keywords: concentricity, effective spatial planning, functional specialization, homogeneity, intelligent functional specialization, land fragmentation, shape, size, specific altitudinal difference

INVESTIGATIONS REGARDING CONCRETE MIXES SUITABLE FOR 3D PRINTING

Alexandru Panțiru, Marinela Bărbuță, L.I. Diaconu, M. Rujanu, A.C. Diaconu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services
67 Mangeron Blvd., Iași, 700050, Romania

Corresponding author: Alexandru Pantiru, alexandru.pantiru@student.tuiasi.ro

PhD Supervisor: Professor Marinela Barbuță
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

3D printed concrete is a relatively new technology that has been gaining popularity in the construction industry in recent years. It involves the use of a 3D printer to deposit layers of concrete in a pre-determined pattern, gradually building up a three-dimensional structure. This process offers several benefits over traditional concrete construction methods, such as the ability to create complex geometries and reduce material waste.One of the main advantages of 3D printed concrete is its ability to produce highly customized and unique designs that would be difficult or impossible to achieve using traditional construction techniques. Additionally, the precision of the 3D printing process allows for greater control over the properties of the concrete, such as its strength and porosity, which can be tailored to suit the specific requirements of the project. Another benefit of 3D printed concrete is its potential for sustainability. By minimizing material waste and using eco-friendly materials, this technology has the potential to reduce the environmental impact of construction. Furthermore, 3D printed concrete structures can be designed to incorporate features such as insulation and ventilation, further increasing their sustainability. Despite its numerous benefits, there are also challenges associated with 3D printed concrete, such as the need to optimize the concrete mix for the printing process and the limitations of current 3D printing technology. The purpose of this research paper is to analyse different concrete mixes suitable for the 3D printing process looking at both fresh and hardened properties of the mixtures, materials proportions, water content and the use of additives. The mixes are design to provide high compressive and tensile strengths for the printed speciment which is directly influnece by the aggregate size- nozzle size relation and the time gap between layer by layer extrusion. However, ongoing research and development are addressing these challenges, and 3D printed concrete is expected to become an increasingly important technology in the construction industry.

Keywords: 3D printed concrete, sustainability fresh properties, hardened properties, concrete mix, digital concrete

PIATRA-NEAMT WATER SUPPLY SYSTEM GENERAL PRESENTATION/DEFICIENCIES

Andrei Păvăleanu, Catrinel-Raluca Giurma-Handley, Ion Giurma

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Hydrotechnics, Geodesy and Environmental Engineering, 65 Professor D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Andrei Păvăleanu, andrei.pavaleanu@student.tuiasi.ro

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

Abstract:

This work presents the results of the analysis of the existing Piatra Neamt Water Supply System, the analysis of current water sources in terms of the quantity of water supplied, the quality of raw water and future availability, the forecasted demand for water and the current operating conditions.
Also, in addition to the water source, the other components of a water supply system (intakes, pumping stations, treatment/chlorination stations, reservoirs, distribution networks) were also analyzed, from the point of view of current capacities and perspective, population access to the water supply system and the quality of water distributed to consumers. For each analyzed water system, the current deficiencies were identified, and various relevant technical economic scenarios were analyzed to solve them.
The Piatra-Neamt water supply system includes rural areas of communal type or urban areas of city type. Of the two, the developed water supply systems are very visible in the urban area where they are generally in the last stages of expansion compared to the inhabited area. In the rural territorial administrative units, the component localities of the commune have, in their vast majority, extended water supply systems, especially in the heartland of the residence village and partially in the rest of the localities.
The general strategy of the Neamt county involves increasing the connection rate to 100% in the water supply systems which must ensure a sufficient quantity and quality in accordance with the sanitary norms in force. Therefore, the public water supply systems in urban and rural localities must be extended to the level of the entire street section so that consumers can be connected. Ensuring the water requirement at the required quality can be done by rehabilitating and expanding the existing sources and treatment capacities (local) or by connecting the local water supply system to another zonal/regional one served by a centralized source.

Keywords: analysis, components, failing, prognosis, water supply system

IMPACT OF WATER MANAGEMENT WORKS ON THE MORPHOLOGY OF RIVERBEDS

Petronel Ionuț Romanescu, Mihail Luca

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Hydrotechnics, Geodesy and Environmental Engineering, 65 Professor D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Petronel Ionuț Romanescu, petronel-ionut.romanescu@student.tuiasi.ro

PhD Supervisor: Professor Mihail Luca
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Water management works influence the morphology of riverbeds in cross-section and longitudinal profile with a negative impact on the environment. This paper presents an analysis of the morphological changes occurring in the middle and lower reaches of the Bahlui River. Studies and research were carried out on a number of sectors where water management works are carried out. The research considered the river sectors with the Parcovaci and Tansa Belcesti accumulations. Also, the river sectors regularized and dammed on the middle and lower course. Hydrological data were taken from hydrometric stations (flows and levels). Part of the research data was collected from river sections where riverbed stabilisation, deepening (degradation) or uplift (grading) processes have occurred. The data were collected by repeated topographic measurements at intervals. The analysis of the data showed that after the execution of the hydrotechnical works in the 1960s and 1970s on the Bahlui River there was a continuous phenomenon of deepening of the riverbed, but also a reduced process of bank erosion. At the hydrometric station Harlau a maximum depth of 43 cm was found in 1991, at Podu Iloaiei the bed depth was at a maximum of 56 cm between 1980-1996, and at Iasi of 100 cm in the measurements made between 1985-1986 and 1996. The research revealed that the water management works (dams, reservoirs, bed regularization, dykes, etc.) carried out in the 1970s, together with the non-permanent Podu Iloaiei and Bahluet reservoirs built in 2013-2015, caused changes in the distribution of natural runoff over time by amplifying minimum flows and attenuating maximum flows. At the same time, there was an increased retention of silt in the accumulations, and as an effect a reduction in the clogging of the river bed downstream.

Keywords: dams, dykes, morphology, regulation, watercourse, water management

USE OF DRONES WITH THERMAL CAMERA - CASE STUDIES

Alexandru Postăvaru, Catrinel-Raluca Giurma-Handley

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Hydrotechnics, Geodesy and Environmental Engineering, 65 Professor D. Mangeron Blvd., 700050, Iasi, Romania

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

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

Abstract:

One of the main advantages of using drones equipped with thermal imaging cameras for water loss detection is their ability to cover large areas quickly and efficiently. Traditional methods for detecting water losses, such as manual inspections or acoustic listening devices, can be time-consuming and require signifi manpower. Drones equipped with thermal imaging cameras can fly over large areas and detect temperature anomalies in real-time. This can significantly reduce the time and cost associated with water loss detection.

Another advantage of using drones for water loss detection is their ability to access hard-to-reach areas, pipes, distribution systems, and storage tanks can be located in remote or difficult-to-access areas, such as mountainous regions or dense forests. Drones can fly over these areas and capture thermal images that can be analyzed to detect water losses.

However, there are also limitations to the use of drones equipped with thermal imaging cameras for water loss detection. One challenge is that the accuracy of thermal imaging depends on environmental factors, such as wind, humidity, and temperature. Additionally, the effectiveness of thermal imaging can be affected by the size and depth of the leak, as well as the type of material the pipes or storage tanks are made of.

Despite these limitations, drones equipped with thermal imaging cameras have been successfully used in a variety of applications for water loss detection. For example, in a study conducted in California, drones equipped with thermal imaging cameras were used to detect water losses in the irrigation system of an almond orchard. The drones were able to detect temperature anomalies that indicated leaks, even in areas that were diff to access by traditional methods. Similarly, in a study conducted in Israel, drones equipped with thermal imaging cameras were used to detect leaks in the city's water supply system. The study for that the drones were able to detect leaks with high accuracy and speed.

Keywords: best practices in water loss control, distribution networks, thermal scanning drone, water leak detection

IMPROVEMENT MEASURES OBJECTIVE VISIBILITY ON ROADS

Irina-Cristina Rusu-Ungureanu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services
67 Mangeron Blvd., Iași, 700050, Romania

Corresponding author: Irina-Cristina Rusu-Ungureanu, irina-cristina.rusu-ungureanu@student.tuiasi.ro

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

Abstract:

Improving visibility on roads is an important aspect of road safety in Romania. There are several measures that can be taken to improve objective visibility on roads in Romania.
One of the most critical measures is the proper placement of traffic signs in visible and recognizable locations. The placement of traffic signs is governed by strict regulations that require them to be placed in well-lit areas and in positions where they can be easily seen by drivers. The size and clarity of the signs are also important factors that influence visibility.
Another measure to improve visibility is to ensure adequate lighting on roads, especially in areas with reduced visibility, such as tunnels or underpasses. The use of modern lighting systems, such as LED lights, can provide better illumination, reduce energy consumption, and improve visibility for drivers. If there are obstacles in the way of visibility, such as trees, bushes, or other plants, they should be removed to ensure better visibility. Additionally, special attention should be given to the placement of urban furniture items such as benches and trash cans, so that they do not obstruct the visibility of traffic signs or other objects on the side of the road.
Romania has implemented programs to improve the condition of roads and remove obstacles that may impede visibility, such as vegetation or poorly placed street furniture.
An efficient way to improve road visibility is through the use of adequate lighting equipment, such as headlights, low beam lights, and position lights. Additionally, the installation of reflective and phosphorescent elements or visual signaling devices can also be useful in increasing visibility during nighttime or reduced visibility conditions.
Road markings are essential to guide drivers and warn them of obstacles and changes in direction. Unfortunately, in Romania, road markings are often damaged or incomplete, which can endanger the safety of drivers.
To improve road markings, it is important for authorities to invest in road infrastructure. This may include repairing and maintaining existing markings and adding new markings where necessary.

Keywords: phosphorescent, retroreflection, road accidents, road safety, visibility

THE MODULUS OF ELASTICITY OF CONCRETE AND MICROCONCRETE WITH MICROSILICA OR FLY ASH AND ADDITION OF FIBERS

Sabina Scripcă, Marinela Bărbuță

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services
67 Mangeron Blvd., Iași, 700050, Romania

Corresponding author: Sabina Scripcă, sabina.scripca@student.tuiasi.ro

PhD Supervisor: Professor Marinela Bărbuță
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The main purpose of this study is to investigate the impact of microsilica and fly ash as cement replacements on the modulus of elasticity of concrete and microconcrete, as well as the effect of metal and polypropylene fibers in this context. Different concrete and microconcrete mixtures were designed with 5% and 10% microsilica or fly ash as cement replacements, with and without metal or polypropylene fibers. The modulus of elasticity was determined through compression tests, and the results were analyzed to evaluate the effects of the additives and fibers on the modulus of elasticity compared to traditional concrete. According to the results obtained, it was found that microsilica and fly ash as cement replacements can improve the modulus of elasticity of microconcrete in most cases, while in the case of concrete, only a few exceptions with a higher modulus of elasticity were recorded. Comparing the values of the modulus of elasticity from the two data sets, it can be observed that the modulus of elasticity values of the fly ash/microsilica-based microconcrete are up to 27.03% higher than those of the fly ash/microsilica-based concrete. The general trend observed is that replacing a higher proportion of cement with microsilica and fly ash can lead to a decrease in the modulus of elasticity of concrete/microconcrete. Regarding fibers, they did not significantly influence the modulus of elasticity of microconcrete and concrete with fly ash or silica, except for metal fibers, which had a more pronounced effect in some cases. With regard to strength class, the majority of concretes were classified as C12/15 strength class. It is essential to highlight the benefits of replacing cement with fly ash or microsilica in terms of reducing costs and carbon dioxide emissions associated with cement production. Therefore, using these additives brings multiple environmental advantages and, at the same time, maintains or even improves the properties of concrete.

Keywords: concrete, fibers, fly ash, microconcrete, microsilica, moduls of elasticity

SEISMIC BEHAVIOR, PARTICULARITIES OF USE OF FLAT SLAB STRUCTURES COMPARED TO STRUCTURES WITH A CLASSIC SKELETON

Anatolie Sili

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services
67 Mangeron Blvd., Iași, 700050, Romania

Corresponding author: Anatolie Sili, anatolie.sili@student.tuiasi.ro

PhD Supervisor: Professor Petru Mihai
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The strong earthquakes that occurred in the last century on the territory of the Republic of Moldova had disastrous consequences and at the same time they offered the possibility to analyze the behavior of buildings and the revision of construction regulations.
A major problem of compliance with the current norms is the existing buildings, especially in cities where a good part of the housing stock is made up of multi-storey buildings built in the 60s - 80s.
The flat buildings being built today are in most cases designed according to a structural system with a load-bearing frame. The structural system with load-bearing walls made of small blocks of lacustrine limestone has a small share in the number of new buildings, and the height regime usually does not exceed G + 8.
In the case of structures with load-bearing skeleton, 2 variants can be highlighted: classical frame with beam-post joint; frame with flat slab.
The structures with a classical structural system are characterized by good resistance to seismic loads, the column-beam joint provides the necessary resistance. In cases of buildings with a large number of levels in addition to columns and beams, to ensure the rigidity of the building, structural walls are used.
Another type of frame structures are flat slab building systems, where the beams are missing and the joint is made directly between the column and the slab. In this regard, the question arises about the stability of these structures, the method of making these connections and stability over time to seismic effects. This type of structures has gained popularity due to many advantajes. Thus, the calculation of 3 structures was performed: classic skeleton; flat slab structure; flat slab structure with flares in the area of the pillars.
The structural calculation was performed in LIRA-SAPR software. Analyzing the structures and the values of the loads to which they are exposed, a classic behavior can be highlighted, therefore, in beams and slabs, the maximum stresses are in the middle lower part of the elements and for the joints the maximum stresses are in the upper part. In conclusion, according to displacements of the buildings in the x and y direction, we can observe that the slab structures have a behavior similar to the classical system.

Keywords: beam, column, earthquake, Eurocode, height regime, standards

THERMAL CONDUCTIVITY DURING AGING FOR MORTARS CONTAINING PERLITE

Sergiu-Mihai Stratulat[1], Georgiana Bunea[1], Dan Covatariu[1], Ionuț-Ovidiu Toma[1], Florin Leon[2], Petru Mihai[1]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services
67 Mangeron Blvd., Iași, 700050, Romania
[2]"Gheorghe Asachi" Technical University of Iasi-Romania, Faculty of Computer Science
Nr. 27 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Sergiu-Mihai Stratulat, sergiu-mihai.alexa-stratulat@staff.tuiasi.ro

PhD Supervisor: Professor Petru Mihai
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

With declining natural resources available for construction materials, an increasing interest has been developed for finding replacements for these compounds. Perlite is an amorphous volcanic rock used in the construction industry, due to its thermal insulation properties, for the past 30 years. Following a high-temperature thermal treatment, it expands its volume between 4 and 20 times the initial value, due to the water content it presents in its natural state (2%-6%). In this modified form, it is chemically and thermally stable and it has a very low thermal conductivity. Due to these properties, it is an attractive material in replacing natural sand and thus obtaining highly-insulting mortars.

In the present context of high energy demand, increased costs and environmental impact of energy production, insulating materials have been attracting a lot of research interest. The main focus of this research is producing cement-based mortars with perlite-replaced sand in order to address the problems of resource availability and thermal conductivity of construction materials.

The experiment consisted in assessing the specific heat and thermal conductivity factor of mortars, at different curing ages, for which sand was replaced in different volume percentages with perlite. Three replacement values where considered: 10%, 20% and 30%. Thermal conductivity was tested at ages 14 days, 21 days and 28 days. The measurements were correlated with mass measurements and, consequently, density determinations.

Machine learning is a valuable tool to predict the long term properties of materials. The experimentally obtained values were used to train the proposed algorithm into predicting the values of the thermal conductivity coefficient of perlite mortar at the age of 28 days. The values of density, surface moisture and temperature were used as input parameters, together with the replacement percentage, and considered with their individual weighting factors. The obtained results were in good agreement with the experimentally obtained data. Predictions were made on the values of thermal conductivity for medium and long term.

Keywords: machine learning, mortar, perlite, thermal conductivity

SUSTAINABLE DEVELOPMENT CRITERIA EVALUATION OF EXISTING PERMANENT RESERVOIRS, BY APPLYING THE IHA PROTOCOL TO CINCIS DAM, HUNEDOARA, ROMANIA

Camelia Teau, Ioana Popescu

Politehnica University of Timisoara, Faculty of Civil Engineering, 2 Traian Lalescu Street, 300223, Timisoara, Romania

Corresponding author: Camelia Teau, camelia-maria.teau@student.upt.ro

PhD Supervisor: Professor Ioana Popescu
IHE Delft Institute for Water Education

Abstract:

Present paper presents the ongoing research that aims to develop a framework to evaluate the sustainability of reservoirs behind a dam, after years of being in operation. The proposed framework starts from the coherent and internationally recognized method of IHA (International Hydropower Association), and adapts it for in-operation structures. As such it highlights the opportunities for improvement and the development of a sustainability evaluation framework that is easy to understand and made available to the water boards and stakeholders, so that all stakeholders can have access to the obtained results

The IHA has issued a Hydropower Sustainability Assessment Protocol (HSAP) that covers all stages of a project: early stage, preparation, implementation and operation. The performance criteria specific to the project are studied and an evaluation rosette is created, in which there are five levels for each indicator, 1 for lowest rank and five for highest.

The research aims to adapt the protocol to existing operating infrastructures, keeping the relevant indicators for each study and creating a sustainability profile by evaluating the performance of the selected indicators. Each evaluation will be tailor made for each considered case study. The scoring of the indicators are based on available data regarding the objective of the structure, and on factual and verifiable evidence on current performance.

The results obtained so far indicate that the basic good practices were achieved for each investigated case study. The results were expressed graphically by creating the durability profile.

The aim of the research is to further extend the proposed evaluation method to a generic level, applicable to all types of dams and hydrotechnical infrastructure, currently in operation in the country. This framework and the development of sustainability profiles for different structures will open the communication channels between different stakeholders, and eventually will contribute to the improvement of the SDG indicators. The framework will support the process of achieving the SDGs assumed by Romania within the framework of the 2030 Agenda for sustainable development.

Keywords: hydrotechnical infrastructures (dams, dykes), IHA protocol, sustainable development goals

EVALUATING THE ENVIRONMENTAL SUSTAINABILITY OF SOIL IMPROVEMENT TECHNIQUES: A COMPREHENSIVE ANALYSIS OF ECO-CEMENT, BIOPOLYMER, GGBF SLAG, BIOREMEDIATION AND PHYTOREMEDIATION APPROACHES

Zakaria Owusu-Yeboah, Andreea-Vasilica Dascălu, Mircea Aniculaesi

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Civil Engineering and Building Services
67 Mangeron Blvd., Iași, 700050, Romania

Corresponding author: Sergiu-Mihai Stratulat, sergiu-mihai.alexa-stratulat@staff.tuiasi.ro

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

Abstract:

Soil improvement techniques play a critical role in geotechnical engineering for enhancing soil quality and mitigating environmental pollution. This article presents a comprehensive analysis of the environmental sustainability of five soil improvement techniques: eco-cement stabilization, biopolymer stabilization, GGBF slag stabilization, bioremediation techniques, and phytoremediation improvement. The analysis of these techniques considers factors such as availability, cost-effectiveness, applicability, efficiency, scalability, and compatibility with local conditions. The paper reviews relevant literature to evaluate these factors in relation to their mechanisms, limitations, and potential environmental impacts in using these techniques. The article also discusses the increasing emphasis on "green" initiatives in soil improvement, highlighting the contrasting environmental and health impacts associated with traditional methods. The advancements in soil and ground improvement technologies and their potential for problem-solving are also discussed. The paper compares and contrasts the economic feasibility and technical challenges of these techniques. It identifies research gaps and provides guidelines and recommendations for selecting the most suitable soil improvement technique for a given project. The findings of this research can contribute to improving and adapting environmentally sustainable soil and ground improvement practices to provide valuable insights into the challenges posed by climate change and population growth. By adopting environmentally friendly soil improvement techniques, civil engineers can play a role in promoting more sustainable and eco-friendly construction practices.

Keywords: bioremediation, eco-cement, environmental sustainability, phytoremediation, soil improvement

SECTION 5.
Mechanical engineering;
Industrial engineering;
Materials engineering;
Engineering and management

ANALYSIS OF THE POSSIBILITY OF USAGE CERAMIC THERMAL BARRIER COATINGS FOR INCONEL 718

Ionuț Adomniței, Nicanor Cimpoeșu

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

Corresponding author: Ionuț Adomniței, ionut.adomnitei@student.tuiasi.ro

PhD Supervisor: Professor Nicanor Cimpoeșu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Superalloys are unique high temperature materials used in gas turbine engines, which display excellent resistance to mechanical and chemical degradation. Certain classes of material possess a remarkable ability to maintain their properties at elevated temperatures. These are the high-temperature materials. Their uses are many and varied, but good examples include the components for turbines, rockets and heat exchangers. For these applications, the performance characteristics are limited by the operating conditions which can be tolerated by the materials used. For example, the thrust and fuel economy displayed by the modern aeroengine is strongly ependent upon, and limited by, the high-temperature strength of the nickel-based superalloys used for its hottest sections. When significant resistance to loading under static, fatigue and creep conditions is required, the nickel-base superalloys have emerged as the materials of choice for hightemperature applications. This is particularly true when operating temperatures are beyond about 800 ◦C. Zirconia-based ceramics do, however, find applications in thermal barrier coatings which are used in association with the superalloys for high-temperature applications. For this type of applications, with a higher temperature usage, we intend to consider obtaining of ceramic layers (75-150 µm thickness) from Metco 207 powders using an Atmospheric plasma spraying equipment. Metco 207 is an yttrium-stabilized zirconium oxide material with a high yttria content, manufactured by agglomeration and subsequent plasma densification. The main advantage of this material is its ability to chemically increase the resistance of a thermal barrier coating to degradation from CMAS (Calcium Magnesia Alumina Silicate) attack. Typically, thermal barrier coatings operating at surface temperatures above 1250 °C (2280 F) are subject to deposits of erosive particles (sand, volcanic ash, etc.) onto the conventional 7% to 8 wt.% YSZ (Yttria-Stabilized Zirconium) oxide ceramic, resulting in destabilization of the ceramic and/or cracking due to infiltration into the porous coating. When Metco 207 is used as a top coat over a conventional thermal barrier coating system, it can reduce CMAS-related degradation of the coating. Literature review provides good feedbacks abot Metco 207 coatings that have excellent high-temperature properties, lower thermal conductivity values than coatings produced from 7-8 wt.% YSZ materials; excellent thermal shock resistance when applied as a layer over a conventional 7-8 wt. % YSZ TBC coating system; resistant to CMAS attack and comparable thermal expansion coefficient to conventional TBC coating systems.

Keywords: APS, ceramic layer, thermal barrier coating Inconel, high temperatures

STUDY OF CAVITY ON NAVAL PROPELLERS. PENETRATED BLADE PROPELLER - REVIEW

Adrian Aldea, Dumitru Nedelcu, Constantin Cărăușu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Machine Manufacturing Technology
Blvd. Mangeron, No. 59A, 700050, Iasi, Romania

Corresponding author: Adrian Aldea, adrian.aldea@student.tuiasi.ro

PhD Supervisor: Professor Dumitru Nedelcu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

In order to understand the way that the performance of super-ventilated, submerged / partially submerged or surface piercing propellers can be improved, the present work will study the phenomenon of cavitation of a propeller by drilling a hole / slot into its blades. Penetrating the propeller's blade (hole / slot — it will be further explained in the study) should equalize the pressure difference between the soffit and upstream surface — thus, the propeller would not come into cavity, resulting, on one hand, a higher speed and, on the other, a much lower effort, low exploitation and longer life duty of the propeller. The purpose of this study is to establish whether executing this hole/slot in the blade of a propeller would allow it to be used at low speeds, as there is the risk that the propeller would not be able to power the ship forwards at low speed due to the loss of thrust, caused by the hole/slot and, on the other hand, if it reaches the desired value, at high speeds or even at the sonic speed, if the hole/slot is able to equalize the pressure on the propeller's blades' surfaces so that it overcomes the sonic speed without the occurrence of cavitation. Until now, in order to avoid the phenomenon, there have been attempts at changing the angle of the propeller blades (variable pitch propeller), the ventilation / semi-ventilation of the propeller, considering its position towards the water, or profiling the surface of the blade. As the last victory against cavitation, the supercavitating propeller was successfully promoted. Supercavitating propellers are a variant of propeller for water propulsion, which implies the active employment of cavitation in order to gain increased speed by reducing friction. The importance of this study relies on the fact that if it can be demonstrated that drilling a hole / slot in a propeller's blade will eliminate the effects of cavitation, we would be able to produce propellers with considerably longer lifetimes, low production costs and functional performance beyond the actual limits.

Keywords: cavity, perforated blade, pressure, propeller, speed

INNOVATION ECOSYSTEMS FRAMEWORK: PLATFORM-BASED STRUCTURE DEVELOPMENT WITHIN THE DIGITAL CONTEXT

Elena Avram, Silvia Avasilcăi

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

Corresponding author: Elena Avram, elena.avram@academic.tuiasi.ro

PhD Supervisor: Professor Silvia Avasilcai
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The pandemic and post pandemic periods became ones of the most relevant milestones in innovation ecosystems 'development as innovation itself acts a trigger in ecosystem participants' alignment. The faster development of technology, along with increasing arising changes associated with unprecedent environmental factors forced ecosystems 'participants to adapt in a faster and more flexible way. The increasing attention for digital transformation triggered further redesign of ecosystems internal processes. As result, value creation within digital setting became the most complex and required process especially in terms of ecosystems'orchestration mechanisms and non-boudaries structures co-evolvement. From this point of view digitalization reprezented the most relevant process which required more comprehensive and inclusive approach. Its adoption within organizational landscape seemed to shape new forms of interdependencies among ecosystems'participants and the advancement of new structural forms. Consequently, platform-based structures further development became a primary trigger in researching the dynamics of ecosystems. The growth and development of this type of structures within digital landscape was possible due to the acceleration of innovation business ecosystems adoption. Considering the fact that innovation is seen as a primary trigger in ecosystems dynamic development, the triadic approach based on the interdependencies of actors-relations-roles changed. Thus, this paper aimes to present the main transformation of ecosystems' structure developed especially within the fast digitalization context. Furthermore, based on literature review there was performed a critical analysis in order to gain insights into which factors influenced first of all the adoption of digitalization as a complex process with respect to the initial triadic approach: actors-relation-roles. Consequently, based on literature review, this paper aims to highlight the most relevant building blocks of ecosystems 'structure, to explore the most relevant features considering innovation as an enabler for shaping its structure, to reveal and emphasize the relevance of digital environmental factors. The main implication of the present research is to explore the main transformation of the triadic approach and to provide new framework of analysis adapted to the digital context which will be further developed and used in measuring the impact of digitalization on innovation ecosystems'development.

Keywords: digitalization, digital processes, dynamic capabilities, innovation ecosystem, interdependencies

NEW ADVANCED TITANIUM ALLOY RESEARCH AND DEVELOPMENT FOR MEDICAL APPLICATIONS

Mădălina Simona Bălțatu, Marius Albert Mazilu, Mihai Tofan, Claudiu Vasile Ciubotaru, Petrică Vizureanu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Materials Science and Engineering, 41 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Mădălina Simona Bălțatu, madalina-simona.baltatu@academic.tuiasi.ro

PhD Supervisor: Professor Petrică Vizureanu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Research and development of alloys for use in medical and biomedical applications are still a problem on a global scale. Hence, it is wanted to advance both the traditional technologies for implant execution and the technologies for the synthesis of the biomaterials used to create them, with the long-term objective of encouraging a new generation of multifunctional implants. The development and progress of biomaterials requires the use of metal materials with good mechanical, chemical and thermal resistance. The choice of the material requires the knowledge of the structure, the properties of the physical and chemical processes that take place in the use and processing of materials. The usage of biomaterials has evolved quickly, and doctors now need biocompatible materials with enhanced resistance to mechanical stress and corrosion. A biomaterial is a synthetic material that can be utilized to completely or partially replace a living organ or system or to work in close proximity to living tissues. The primary goal is to heal human tissues using biomaterials. Due to its many beneficial qualities, including biocompatibility, low thermal conductivity, low density, corrosion resistance, odorless/tasteless, and cost that is four times less than gold, titanium has caught the attention of the medical community. All components used to create medical implants must be biocompatible and adhere to strict specifications. The most recent developments in titanium-based alloys are discussed in this study, along with their characteristics and medical uses. This paper aims to investigate how alloying components affect titanium alloys used in orthopedic applications. The mechanical characteristics and microstructure of titanium alloys vary depending on the amount of alloying elements; hence it is crucial to research how these elements affect alloying. In accordance with the specialized literature, we develop a new titanium alloy using non-toxic Mo, Zr, and Mn. Research aims at structural and mechanical characterization regarding the identification of important characteristics for new alloys elaborated. According to the findings, the novel alloy is a potential contender for the medical industry and a promising biomaterial.

Keywords: biocompatible elements, characterization, new alloys, titanium alloys, obtaining

NOVEL NANO-ACTIVE REINFORCEMENT MATRIX – CASE STUDY, CARBON OXIDES

Elena Basalic, Daniel Lepădatu , Raluca Florea , Nicanor Cimpoeșu

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

Corresponding author: Elena Basalic, elena.mocanu-basalic@student.tuiasi.ro

PhD Supervisor: Professor Nicanor Cimpoesu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The discovery of Ordinary Portland Cement (OPC) binders at the beginning of the XIX century has revolutionized the field of constructions, opening new perspectives for the development of the field of resistance structures and of the mixtures used as binding components. However, from the beginning, the low capabilities for tensile stresses of these mixes was noticed. The solution most often used to counteract this unfavorable phenomenon, in certain situations, is the reinforcement, through various methods and with various solutions, of the materials that are the basis of these binders. Recent studies present a series of valid candidates for the microscopic reinforcement of these mixtures. Among these candidates, we note nano carbon oxides. The microscopic dimensions, as well as the physical and mechanical characteristics of these materials close to that of the gels that form the cement stone matrix, as well as the compatibility given by the chemical composition of the two materials make these materials a true candidate for this role. The defining factor that evaluates the character of the bonds formed at the micro level inside the massif of the mixture, the cooperation between the two main component elements (Carbon oxides and cement stone) is represented by the dispersion factor of the oxides in the massif of the cement stone matrix. In order for the dispersed reinforcing elements introduced into the mix to alter in the desired way, the character of the behavior of the final material, they must present a constant dispersion, throughout the volume of the material samples. For the validation of the above, a series of experimental tests was carried out. Departing from the classic recipes of mortars based on cement binders, he manufactured a series of samples. Each series included a set of standard samples, which respect the classic recipe of the mortar. To ensure a proper dispersion, a suspension solution composed of water, surfactants and nanoparticles of carbon oxides and graphene was used; for the dispersion of the nanoparticles in the volume of the solution, an ultrasonication device was used for the solutions mentioned above. The results of the experimental tests carried out attest to an optimal dispersion of both components, but the values resulting from the mechanical tests are below the expected values.

Keywords: carbon oxides, nano reinforcement, OPC mixtures, stone matrix reinforcement, reinforcement dispersion

STATE OF SUBJECTIVE AND OBJECTIVE EVALUATION OF TEXTILE PROTECTIVE MATERIALS AND TRANSPOSING THEIR PROPERTIES INTO A DIGITAL LIBRARY

Victoria Bocancea, Maria Carmen Loghin

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

Corresponding author: Victoria Bocancea, victoria.bocancea@student.tuiasi.ro

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

Abstract:

One of the pillars that influence many industries is the digital transformation that is progressively changing the way companies create and deliver decision-making proposals and interact with their customers. Therefore, companies need to react correctly to digital changes by developing and properly pursuing strategies to exploit digital technologies to ensure or enhance competitiveness in global markets. Digitalization has become an irremediable and far more important factor than ever. Due to the diversity of models and the use of flexible materials, there are still many unsolved problems in the textile industry that require in-depth research. The trend of constant use of digital devices in recent years has raised many questions about rendering as realistic as possible the multitude of things that exist, through a single image. The reason is to meet the needs and demands of users. The field of evaluation and processing of digital images is intended to offer duplicates have more accurate reproductions of visual information for human consumption. This paper proposes an investigation of the current state regarding the subjective and objective evaluation of textile materials with a protective role and the transposition of their properties into a digital library. Although published research on digital libraries has increased, it focuses mostly on technical issues and patterns of digital library use. In order to improve the design of existing and future digital libraries, it is necessary to identify which criteria should be applied in the evaluation process. The research of protective materials has been influenced by the following reasons: these materials do not involve aesthetic problems in the case of digital representation; the combination of physical and mechanical characteristics allows and facilitates the process of digital transposition; the process of evaluating protective materials in a 3D application is much easier; the prevention of digital transposition errors in accordance with the technical characteristics of the materials and especially the characteristics related to surface, design, structure, thickness, and porosity (transparency, gloss).

Keywords: digital library, digitization, subjective evaluation, objective evaluation, protective materials

THE IMPORTANCE OF SURFACE ACTIVATION IN THE CHEMICAL CONVERSION PROCESS

Diana-Petronela Burduhos-Nergis, Petru Lazar, Costica Bejinariu, Nicanor Cimpoeşu

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

Corresponding author: Diana-Petronela Burduhos-Nergis, diana-petronela.burduhos-nergis@academic.tuiasi.ro

PhD Supervisor: Professor Costică Bejinariu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The process of depositing thin layers of phosphate through chemical conversion, also called phosphating, is widely used in industry, due to the ability to improve the corrosion resistance of the material on which it is deposited, the high adhesion between the layer and the substrate, as well as due to the high porosity. Regarding the use of phosphating in the field of biomaterials, the layers deposited by this process began to be studied in the last decade. They are of real interest due to the previously mentioned properties, as well as the ability to control and efficiently design phosphating solutions. This can lead to a reduction in the risk of implant failure. Currently, most metal implants on the market are made of titanium or alloys. But, although it is the most used material for these applications, its biggest disadvantage is its bio-inert surface. Therefore, the deposition of a biocompatible layer on the titanium surface can lead to the improvement of the osseointegration properties of implants. In the literature, there are few studies reported on the deposition of phosphate layers by chemical conversion on titanium surfaces, because its surface activation is a challenge. Research on the deposition of phosphate layers on different materials shows several methods to activate their surface. The simplest and most used method is the mechanical one, by grinding or sandblasting, while the activation of the surface with pickling/activation solutions requires greater attention in terms of the concentrations of the substances used, as well as the time of immersion of the material in the solution. Regarding the surface activation of titanium and its alloys, this is an extremely significant step in the phosphating process. Grinding and the use of activation solutions influence the morphology of the phosphate layers. So, to highlight the importance of surface activation, as well as to study the influence of the type of activation on the formation of phosphate layers, different types of phosphate layers will be deposited on the surface of the alloy through the phosphating process Ti6Al4V. It will be analyzed how both the grinding of the material and the immersion time in the activation solution influence the morphology of the deposited phosphate layers, using scanning electron microscopy (SEM).

Keywords: biomaterial, phosphate coatings, SEM, surface activation, titanium alloy

MECHANICAL PERFORMANCE OF FLY ASH BLENDED GEOPOLYMER COMPOSITE REINFORCED WITH RECYCLED GLASS FIBERS

Dumitru Doru Burduhos-Nergis[1], Petrica Vizureanu[1,2], Andrei Victor Sandu[1], Nicanor Cimpoeşu[1]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Materials Science and Engineering, 67 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]Academy of Technical Sciences, Romania, 26 Dacia Blvd., 030167, Bucharest, Romania

Corresponding author: Dumitru Doru Burduhos-Nergis, dumitru-doru.burduhos-nergis@academic.tuiasi.ro

PhD Supervisor: Professor Petrica Vizureanu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The key to a circular economy relies on turning waste into raw materials, especially in those areas that consume a high amount of non-renewable resources. For the construction sector, geopolymerization is the most suitable method to create products suitable to substitute conventional concrete by using different types of recycled minerals. Moreover, it is essential that concrete products made from geopolymers withstand both compressive and flexural forces. These materials, however, exhibit low deformation before fracture due to their fragility, as well as poor flexural strength compared to their compressive strength. These constraints can be reduced by reinforcing the geopolymeric matrix with different types of fibers. This study evaluates the mechanical performance of ambient-cured fly ash-based geopolymer concrete reinforced with recycled glass fibers. First, the Taguchi method was used to optimize the fly ash-based geopolymer matrix, considering the Na:Al ratio, liquid:solid ratio, and sand content. Secondly, two types of glass fibers (20 mm length and 60 mm length) have been introduced in three different amounts (1, 2, and 3 wt. %, respectively) in order to improve the flexural strength of the developed composites. Compressive strength tests and the three-point flexural method were conducted to demonstrate the effect of fiber type and amount on the mechanical performances of fly ash-based geopolymers, while microstructural analysis was used to reveal the improving mechanism caused by the bridging effect of reinforcing fibers. Experimental results showed that Na:Al of 0.75, NaOH concentration of 10.85M, Na_2SiO_3:NaOH solution of 4:1, and Sand:Fly ash of 1:1 are the optimum parameters for compressive strength, while Na:Al of 0.5, NaOH concentration of 2.96M, Na_2SiO_3:NaOH solution of 2:1, and Sand:Fly ash of 1:4 exhibit the highest flexural strength, despite the aging time (14 or 28 days). Moreover, the addition of recycled glass fiber led to an increase of up to eight times in flexural strength due to the bridging effect. However, the compressive strength slightly decreased for all mixtures due to an increase in porosity. The microstructural analysis confirmed a homogenous matrix with high adhesion to the surface of glass fibers.

Keywords: eco-friendly, fly ash, geopolymer composite, mechanical properties, recycled glass fibers

HARD FRICTION TESTING OF THE SPARKING CHARACTERISTICS OF A CUALBE ALLOY IN AN EXPLOSIVE ATMOSPHERE

Romeo Gabriel Chelariu, Nicanor Cimpoesu, Petrica Vizureanu, Costica Bejinariu

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

Corresponding author: Romeo Gabriel Chelariu, romeo-gabriel.chelariu@student.tuiasi.ro

PhD Supervisor: Professor Costică Bejinariu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Explosion protection is of particular importance for safety as explosions also endanger the health of workers due to the uncontrolled effects of flames and pressure, the presence of harmful reaction products and the consumption of oxygen in the ambient air breathed by workers. CuAlBe alloy is proposed as a solution for mechanical actuators such as gears that work in environments with possible explosive atmosphere. Made of CuBe master alloy and pure aluminum in a induction furnace the material present large grains in melted state. After the hot rolling (heated 300s at 850 °C) of the ingots small variation of chemical composition was observed based on the oxidation of the material, appearence of small cracks on the edges and a preferential orientation of the grains along the lamination direction. Scanning electron microscopy (SEM), optical microscopy (OM) and atomic force microscopy (AFM) were used to characterize the microstructural states of CuAlBe as melted or laminated. Chemical composition was evaluated through spark-spectroscopy (Foundry Master) and X-ray energy dispersive spectroscopy (EDAX). Microstructure of the materials was evaluated in cast state and also in rolling state (hot rolling from 10 mm to 1 mm thickness after heating at 900 °C and a reduction percentage of 10% each time). Macroscopic investigations were made with an optical microscope (OM) and at microscopic state using a scanning electron microscope (SEM, SE detector, 30 kV, high vacuum). Mechanical characteristics of the new materials were investigated (in both cast and deformed states) by microhardness evaluation and scratch experiments along the grains and their limits. The results present a homogeneous material, structurally and chemically, with improved microhardness and better corrosion resistance. The microstructure present big grains in melted state and smaller and oriented grains after rolling. Martensite variants are present after rolling through austenite-martensite tension induced transformation. No sparks were produced or detected during the hard friction testing of a CuAlBe alloy in an explosive atmosphere.

Keywords: CuAlBe, casting, non-spark metallic materials, rolling

ANALYSIS OF AN IMPACT ON A 16-PLY PANEL WITH ARAMID FIBER YARNS

Larisa Chiper Titire, George Ghiocel Ojoc, Lorena Deleanu

"Dunărea de Jos" University of Galati, Faculty of Engineering, 111 Domnească Street, Galaţi, 800201, Romania

Corresponding author: Larisa Chiper Titire, larisa.chiper@ugal.ro

PhD Supervisor: Professor Lorena Deleanu
Dunărea de Jos" University of Galati, Romania

Abstract:

In this study, the damage mechanisms of two cases of impact, at meso-level, with the help of the finite element methods, are analyzed taking into account the initial impact velocity of the bullet, for the first case, the projectile has an initial speed of 400 m/s and for the second case, it has an initial velocity of 375 m/s. The two cases studied in this paper have the same geometry both for panel and the bullet. The contact condition between yarns is frictional, and the contact condition between the yarns and the bullet is also frictional. The friction coefficient is constant and has the same value of 0.3 for the two studied cases. The material properties of the yarn and the material properties of the bullet are the same for both cases. During the ballistic impact, the bullet may completely penetrate the target, with a certain residual velocity, or the bullet may partially penetrate the target (this case assumes the bullet can be rejected or remain in the target, with zero residual velocity. Numerical simulation is important in the process of testing ballistic materials to validate the theoretical aspect, for a correct interpretation of experimental results and leads to the interpretation and discovery of phenomena and processes that are not observable in actual events. Numerical simulation can validate the link between experimental models and theoretical predictions. To analyze the impact between the bullet and the target, the duration of simulations was set at 1 2410. For these intervals the damage mechanism and its stages will be determined. During the impact, the radius of the cone surface of the layered panel increasesm, from one moment to the next one, due to the propagation of the transverse wave, leading to an increase in fiber deformation and loading. The results are discussed for main yarns, using the "path" function from Explicit Dynamic Ansys, used to point out von Mises stress distributions on each layer and different moments of the impact.

Keywords: ballistic impact, bullet, FEM analysis, model, simulation

STUDY OF THE ABSORPTION COEFFICIENT OF SOUND ABSORBING PANELS USED IN ROAD TRAFFIC

Elena-Adelina Chiriac

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Mechanical Engineering, 61-63 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Elena-Adelina Chiriac, elena-adelina.grigoras@student.tuiasi.ro

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

Abstract:

The noise pollution has a negative effect on the human body and in some situations, exposure to high levels of pollution can lead to serious health problems. Referring to current studies, we can see a high interest in finding solutions to reduce the effects of noise pollution, such as sound absorbing panels. These have a particularly important role when placed between the noise source and the receiver. The purpose of this paper is to present the current stage of development of sound absorbing panels and the absorption coefficient of the materials used. The article will provide information on different types of panels and materials used in their construction, as well as their mechanical properties. New discoveries in the field related to recyclable materials used in the construction of sound absorbing panels represent an additional point of interest, as the construction of such prototypes protects the environment. The use of waste in the construction process of sound absorbing panels can be considered a future method, considering the high degree of pollution that our planet is facing. Among the examples that will be presented in the article, we can also discover a study on the use of coffee waste and measurements of the absorption coefficient of this prototype material type. Based on the information obtained, we propose to analyze the absorption coefficients of possible materials used in the production of new types of panels with a high degree of noise absorption. In addition to studying the absorption coefficients of different materials, it will be important to conduct traffic studies in which the degree of noise in various urban areas will be studied. Subsequently, the purpose of the research will be to find modern solutions to reduce the degree of noise pollution caused by traffic in various areas with a high degree of noise pollution.

Keywords: absorption coefficient, sound absorbing panels, road traffic, recycling materials, noise pollution

A STUDY ON THE INFLUENCE OF THERMAL INTERFACE MATERIAL IN PASSIVELY COOLED ELECTRICAL COMPONENTS WITH ATTACHED HEATSINK

George-Gabriel Chiriac[1], Cătălin Gabriel Dumitraș[1], Ionuț Mertic[2]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Machine Manufacturing and Industrial Management, 59A Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]S.C. Preh Romania S.R.L., 31 Națională Street, Iași, 700237, Romania

Corresponding author: George-Gabriel Chiriac, george-gabriel.chiriac@student.tuiasi.ro

PhD Supervisor: Professor Cătălin Gabriel Dumitraș
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

This paper studies the effect of the presence of a thermal interface material between a heat source and a heat sink. A heat sink is used as a passive cooling device for a thick film heating element used as a heat source. The heating element is fixed using 2 screws. The temperatures are measured in 2 scenarios: first, where the heating element is placed directly on the heat sink, and second, where a thermal pad is placed between the heat source and heat sink. In both scenarios, the thick film heating element is fixed using the screws, therefore the fixation method is the same and the thermal interface material is pressed between the components to create a good surface contact and improved heat transfer. Using a similar CAD model as the one tested and the same boundary conditions, finite element analysis were solved. The finite element software used is Simcenter Siemens Flotherm XT. The simulations done are CFD (Computational Fluid Dynamics) simulations, to replicate the heat transfer between solids, the heat transfer between solid bodies and air and the air movement around the assembly. The goal is to see if the finite element method delivers similar results as the measured ones and if the method is reliable in predicting the thermal behaviour of the electronic components. Temperature measurements were made using Type K thermocouples placed on the heat sourse and heat sink. Measured temperature values show an improvement in heat source cooling when the thermal interface material is placed between the heat source and heating element. The improvement occurs due to improved surface contact between the heat source and thermal interface material and between the thermal interface material and heat sink. And improved contact reduces the air trapped between the solid bodies and reduces the surface imperfections that may reduce the thermal transfer efficiency. Also, the temperatures from the finite element analysis are similar to the measured ones, making the method reliable for similar applications.

Keywords: FEA, heat sink, thermal, passive cooling, thermal pad, thermal interface material

PERSPECTIVE ON THE MOTIVATIONAL THEORIES IN ORGANIZATIONS

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:

Motivation in the workplace is a topic of interest for organizational managers. This article provides readers with systematic ideas from the literature on the importance of consistently motivating human resources. By constantly motivating their workforce, companies can achieve their established objectives. Within the article, motivational theories in organizations will be analyzed through a review of the specialized literature. This analysis shows that the level of satisfaction experienced by an employee reflects in their desire to work. In other words, a strongly motivated employee will achieve better performance at work. The employee is responsible for channeling this type of effort towards fulfilling organizational goals. Motivational theories study the moments of initiation and maintenance of positive behavior, helping to facilitate the smooth execution of activities and the continuous development of the potential of personnel. These theories are divided into two categories: process-focused motivational theories and content-focused motivational theories. Process motivational theories are based on psychological factors that influence the emergence of motivation in the workplace. They analyze employees' perceptions of the working environment and how it is interpreted. Content motivational theories are based on employees' needs. They describe human needs, and not addressing these needs can subject employees to stress and inefficiency in the workplace. Over time, several reasons have been analyzed that make it difficult for individuals to engage in activities at the workplace, such as social pressure through comparison, habit, or aspirations. Organizational objectives can only be achieved through the collective effort of employees. The quality and quantity of efforts made by an organization's employees are elements that make a difference in the competitive market. The article highlights motivational theories developed by specialists that help organizations to understand and determine the needs of human resources. This way, employees can be properly stimulated according to their own needs and expectations, recording maximum performance, while also helping to achieve organizational objectives. In addition, the article brings to the attention of readers news regarding the necessity of organizational potential of companies, as well as a workforce in accordance with the requirements of daily activities.

Keywords: employees needs, expectations human resources, work satisfaction, work performance

HIGH-ORDER DERIVATIVES OF SERIAL MANIPULATOR JACOBIANS USING MULTIDUAL DIFFERENTIATION TRANSFORM

Mihail Cojocari, Daniel Condurache

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Mechanics,
61-63 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Mihail Cojocari, mihail.cojocari@student.tuiasi.ro

PhD Supervisor: Professor Daniel Condurache
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The use of robots is continuously growing, from heavy-duty industries to nanotechnology. Exact multilink robot end effector control is required to withstand this tendency in modern robotics. Mapping between joint variables in joint-space coordinate and end effector configuration in task-space coordinate are provided by serial manipulator kinematics. By direct differentiation of forward kinematics, a Jacobian matrix is obtained. A computation of higher-order Jacobian matrix derivatives is required for accurate trajectory tracking. With conventional numerical derivation, only approximate results can be obtained. The traditional numerical derivation is feasible for manipulators with fewer DoFs and low precision and response time requirements. Still, it is highly time-consuming and difficult to compute when considering high-order derivatives of multi-DoF manipulators with high precision and response time requirements. This paper investigates a novel derivation method for a multilink robot Jacobian. According to this method, an exact value of higher-order acceleration can be obtained using a multidual differentiation transform. Multidual functions for sine and cosine will be used to get the exact value of acceleration, jerk, and hyper-jerk (jounce) expressions must be commonly used for accurate trajectory-tracking. Respectively first, second, and third-order time derivatives of the Jacobian matrix will be calculated in this paper. For calculation, a real available robot Jacobian specified by the manufacturer is considered. A comparison between different higher-order derivation methods for a Jacobian matrix of a multilink robot is provided. The derivation value of higher-order acceleration can be obtained using multidual differentiation transform. This method ensures accurate multilink robot end effector control, with the application for robots with exacting requirements regarding end effector movement control in order to achieve necessary precision. The investigated derivation method is not limited to robotics utilization but can be used everywhere. An exact higher-order derivation is required and provides many advantages compared to other available methods until now.

Keywords: higher-order acceleration, high-order derivatives, Jacobian matrix, multidual differentiation transform, serial manipulator Jacobians

ELECTROCHEMICAL MEASUREMENTS ON ARCHAEOLOGICAL IRON. A COMPARATIVE STUDY FOR VARIOUS METHODS OF THEIR CONSERVATION AND RESTORATION

Ilie Cojocariu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Materials Science and Engineering
41 Prof. D. Mangeron Blvd., 700259, Iasi, Romania

Corresponding author: Ilie Cojocariu, iliecojocariu01@yahoo.com

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

Abstract:

Currently, several methods are known to be used in the conservation and restoration of archaeological iron, such as simple washing with lye, alkaline sulfite treatment, rust converters, electrochemical methods, thermal reduction methods, the use of plasma, and others. In all these methods, it is possible, it is produced, or the thermodynamic conditions for the synthesis of magnetite on the surface of the treated object are met. This magnetite can sometimes appear as a side effect, but it always has a protective role because it slows or blocks corrosion at the metal-electrolyte interface. Any intervention that affects the integrity of this oxide layer or the already existing corrosion products can lead to a much more unstable electrochemical state over time. Electrochemistry is a rigorous science concerned with the quantitative relationships between the chemical, surface, and electrical properties of systems. Electrochemistry has strong links with many other fields of science, such as corrosion science, hydrogen technology, microelectronics, nanotechnologies or sensor elements. Specific methods of research and investigation have been developed in each field. This paper surveys the current state of the art in the field of electrochemical testing for archaeological iron. The evolution (modification) of some parameters such as Open Circuit Potential (OCP) is also studied, during conservation/restoration treatments, carried out by several methods (simple washing with lye, alkaline sulfite method or electrochemical anodization). It will also be studied the possibility of using established methods in the study of corrosion (linear voltammetry, cyclic voltammetry, and more), for the evaluation of the conservation and restoration methods mentioned above. A three electrode electrochemical setup was used for measurements in this study.

Keywords: archaeological iron, cyclic voltammetry, linear voltammetry, open circuit potential

EXPERIMENTAL MODEL FOR THE STUDY OF MAGNETIC GEARS WITH NEODYMIUM PERMANENT MAGNETS

Laurentiu Cretu, Cristian Cojocaru, Laurentiu Larco

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Machine Manufacturing and Industrial Management
59 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Laurentiu Cretu, laurentiu-ioan.cretu@student.tuiasi.ro

PhD Supervisor: Professor Petru Dusa
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Gears and spur gears are widely used in a wide range of industrial applications where the rotational speed of an input shaft must be matched to the required rotational speed of an output load. Mechanical gears are often used for this purpose, but they are subject to wear, can overheat, are often damaged in overload situations, and require periodic lubrication and maintenance. In recent years, magnetic gears are receiving more and more attention both from research institutions and from industry, scientific publications (magazines, conferences, patents) revealing a significant increase in activity in this field. The fundamental principle of operation of a magnetic gear is very similar to that of conventional mechanical gears, except that the force/torque transmission exerted by meshing teeth is replaced by non-contact magnetic interaction, a magnetic gear can be designed according to every available topology of its mechanical counterpart. There are many types of magnetic gears, but the most significant can be classified into concentric, harmonic and planetary. The main characteristic that is analyzed for the study of different types of magnetic gears is the torque capable of being transmitted. The design and analysis of magnetic gears involves analytical and experimental approaches from both an electromagnetic and a mechanical perspective. This paper proposes an experimental study model for the study of magnetic gears configured on the typology of planetary gears. All the components of the planetary gear (minus the teeth) are made by 3D printing technology. The teeth of the gears are niodium type magnetic teeth, magnetization degree N54, made by sintering. The actuation of the experimental model will be done with a brushless direct current motor powered by means of a controller connected to a computer. This model allows the modification and measurement of the experimental parameters of speed and actuation torque. By using this experimental model, objective of this work, it will be possible to plan complex experiments for analytical models (objectives of further research).

Keywords: actuation torque, configuration typologhy, experimental model, magnetic gears, magnetig teeth sintering

THE INFLUENCE OF REWARD SYSTEMS ON THE WORK PRODUCTIVITY OF EMPLOYEES IN THE PUBLIC SYSTEM

Silviea Crețu

"Gheorghe Asachi" Technical University of Iasi, Romania, Doctoral School
67 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Silviea Cretu, silviea.cretu@gmail.com

PhD Supervisor: Professor Mihaela Luminița Lupu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Reward management influences employee performance by recognizing and rewarding performance, being an important human resource management strategy. The purpose of reward systems is to obtain the desired behaviours from employees so that the desired productivity is achieved. The effective management of a reward system offers the opportunity to motivate employees to improve their efforts, to increase their productivity and the organizational ability to meet its goals. The normative framework in Romania categorically excludes the possibility of granting financial benefits for the staff of the public system. The main intrinsic rewards that have applicability in public administration are the delegation of powers, participation in the decision-making process, promotion, the creation of a better organizational climate and a sense of belonging. Non-monetary rewards have the ability to generate a long-term motivational effect on employee labour productivity. This article analyses how the non-monetary reward system influences labour productivity, the relationship between non-monetary benefits and work outcomes. The analysis of scientific literature indicated a relationship between motivation and the professional satisfaction of employees and work productivity. For the statistical validation of the research results, in this paper, quantitative and qualitative methodologies were used to examine and explore the perceptions and experiences of public administration employees regarding motivation, productivity, individual and organizational performance. The questionnaires were applied to a number of fifty civil servants from the central and local public administration, from the human resources departments, motivated by the fact that these departments manage the entire professional performance evaluation system. The results of the statistical processing confirmed the conclusions of the bibliographic study, demonstrating that non-monetary rewards have the ability to generate a long-term motivational effect on the work productivity of employees. We conclude that reward policies have an essential role in improving employee productivity, the lack of a clear reward system has adverse effects such as a decrease in work productivity, staff turnover or non-involvement of staff in achieving organizational goals.

Keywords: reward management, labor productivity, non-monetary reward system, motivation, civil servants

THE ACCESSIBILITY OF THE APPLICATION OF EFFECTIVE MEDICAL CARE THROUGH ADAPTED CLOTHING PRODUCTS

Victoria Dănilă

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Textiles, Leather and Industrial Management, 59A Blvd. Mangeron, 700050, Iasi, Romania

Corresponding author: Victoria Dănilă, victoria.danila@student.tuiasi.ro

PhD Supervisor: Professor Antonela Curteza
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The evolution of technologies in the neonatal intensive care unit have contributed to the increase in the survival of premature babies. Finding the premature child in an environment very different from that of the mother where he was in a state of comfort and safety, after which he is subjected to complications and anxiety. The correct handling of preterm infants in the NICU was studied and identified in 10 studies. These investigated handling of preterm infants, four studies [1,2–5] measured the nature and frequency of handling and three studies [6-8] evaluated the implementation of a protocol such as minimal touch, kinesthetic stimulation and gentle touch. And the other three studies [9-11] addressed the pain to which the child was subjected when he was manipulated. The purpose of this research is to describe the types of manipulations and reduce their number, as well as focusing on care focused on humanized growth and development, which would contribute a lot to creating as little discomfort, pain and stress as possible for the little ones. Frequent handling of premature babies increases heart rate, breathing rate and blood pressure. It is very important to do as few manipulations as possible so as not to create discomfort and trouble for the child. The development of comfortable and aesthetic products with functional and constructive elements that facilitate the performance of medical procedures, in the case of premature babies, can improve the efficiency of rehabilitation and improve the quality of life of these children. The models of the clothing products must ensure their dressing and undressing easily and without pain, facilitating the performance of medical procedures; saving undressing time for medical interventions [12]. The accessibility of the application of effective medical care by medical personnel is somewhat restricted by the types of clothing used, which significantly affects the possibility of using high medical technologies. In order to solve the objective of the work, the method of observation and subsequent testing of the newly designed products was chosen, and each medical manipulation was intensively studied. The children's reactions to wearing the selected products were also carefully monitored. Later, manipulations were also observed when dressing and undressing the products during the daily control performed by the neonatologist.

Keywords: handling, medical procedures, premature baby

METHODOLOGY FOR CREATING A COMPUTER PROGRAM FOR STRUCTURING THE RECONSTRUCTION TECHNOLOGIES BY LASER WELDING OF THE METAL MOULDS

Florin Dimitriu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Machine Manufacturing and Industrial Management
59A Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Florin Dimitriu, florin.dimitriu@student.tuiasi.ro

PhD Supervisor: Professor Neculai Eugen Seghedin
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Almost all mass-produced metal and plastic parts are made in metal moulds, in production processes such as plastic injection, metal alloy die casting and plastic deformation moulding. In order to increase economic efficiency it is necessary that the moulds are kept in good working order so that their useful life is extended beyond the limits normally imposed by wear, accidental damage or obsolescence. When they are in use, moulds are exposed to severe operating conditions: continuous wear, impact, corrosion, thermal cycling and high mechanical stresses, which cause their constant damage. Mould rebuilding has developed more and more, precisely because to new repair techniques and technologies, such as laser beam welding. By using laser technologies, the benefits are maximum and the main advantages are observed in the increase of work speeds, the reduction of thermally influenced zones (Heat Affected Zones), reductions of material losses, the decrease of additional working times for other mechanical machining processes, heat treatments, grinding. The methodology underlying the realization of this computer program for the structuring of reconstruction technologies by laser welding requires the introduction into the equation of all input elements necessary in the reconstruction process (Input): types of the moulds, materials used for moulds, mechanical and material specifications (hardness, heat treatment), reconstruction equipments and the desired characteristics following the process. The computer program will provide the results (Output) necessary for the operator to configure a correct, automated and optimized laser welding process: filler material (welding wire), type of seam, technological parameters: maximum voltage (V), laser power (W), pulse energy (J), welding speed (mm/s), laser frequency (Hz), pulse duration (ms), laser spot diameter (mm), welding wire diameter, welding wire tilt angle (degrees), welding shielding gas, shielding gas flow rate (l/min). The main advantages of the methodology presented in this paper and the computer program created are quantified in the configuration of a correct, precise, automated and optimized laser welding reconstruction process.

Keywords: laser welding, moulds reconstruction, moulding, methodology

DESIGN AND DEVELOPMENT OF COOLING SYSTEMS FOR PV CELLS PERFORMANCE IMPROVEMENT

Eduard Enășel, Ana Georgiana Lupu, Gheorghe Dumitrașcu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Mechanical Engineering
61-63 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:

This paper presents a concise review of cooling techniques for the solar PV systems. The photovoltaic effect was firstly experimentally demonstrated by the French physicist Edmond Becquel in 1839. The first useful solar cell (6%energy efficiency) was performed by the Bell Laboratories (1950). They realized that the semiconducting materials such silicon were more efficient than selenium. The solar panel efficiency might reach today almost 47.1%, this value was attained in 2019 by using multi-junction concentrator solar cells, developed at National Renewable Energy Laboratory. However this technology differs from traditional solar cell because it uses a monolithic six junction material structure that is operated under the direct spectrum at 143 Suns concentration. Lately, at NREL, they made a set of a new solar cell with terrestrial efficiency of 39.5%, also accomplished under lighting condition to the sun wich is an obvious change to the previous achievement, when the cell was exposed to extremely concentrated light. They achieved that with inverted metamorphic multi-junction (IMM) cells, with three layers, each made of a different material (gallium indium phosphide on top, gallium arsenide in center, and gallium indium arsenide on the bottom). So the improvement of the solar cells was obtained in researches using various types of construction design of the solar cell and solar panel. In real life, conditions are different than the laboratory ones. Besides manufacturing factors that were improved with time and are playing a significant role in the increasing solar cell efficiency (reflectance, efficiency, charge carrier separation efficiency, charge carrier collection efficiency and conduction efficiency values), there are also external important elements that alter the energetic performance of the panel: - natural causes, i.e. operational temperature, wind, irradiance level, hail, rain (snow, ice), chemical residues; - operational restrictive conditions such as shading, panel orientation, location, dust and dirt, aspects that can be smoothly controlled when panels are installed;
The following conditions have a significant impact on solar panel's efficiency, in real-world use: irradiance (W/m2), shading, orientation and temperature. The ambient temperature, wind speed, time of day and the amount of solar irradiance (W/m2) make real variation in cells temperature that often rises above 25ºC. The optimum internal cell temperature is typically 25-30ºC above the ambient air temperature and solar cell performance decreases with increasing temperature with 8-15% in total power output. That's why engineers design cooling systems to improve the efficiency of solar panels that operate in non-optimal conditions.

Keywords: cells performance, cooling systems, photovoltaic, solar energy

ANALYSIS OF SOME DESIGN PARAMETERS AND CONSTRUCTIVE SOLUTIONS FOR COAXIAL MAGNETIC GEARS

Gheorghe Galmadi

"Gheorghe Asachi" Technical University of Iasi, Romania, Department of Machine Manufacturing Technology
59A Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Gheorghe Galmadi, gheorghe.galmadi@student.tuiasi.ro

PhD Supervisor: Professor Oana Dodun
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Magnetic gear design parameters have been previously investigated in a several dozens of scientific artiles by way of warying one parameter individually ore more parameters simultaneously. Most of the research on magnetic gears is done on theoretical models and did not anlyze the assembly solutions and its subsecvent impact on magnetic gear performance. Many experimental investigations on magnetic gear show reduced performances when compared with the previously held, theoretical investigation, due to the use of simplified magnetic gears topologies and calculation methods that are not taking into consideration the impact of all parameters on the calculation. This paper presents the multi-objective design optimization and analysis of coaxial magnetic gears parameters when implementing some constructive and assemble solutions. A theoretical investigation of several proposed solutions for mounting the permanent magnets on the surfaces of inner and outer rotors is held. Design, geometry, assembly and mounting of magnetic flux modulator are studied to determine the feasible solutions. The robustness of the magnetic gears is also taken into consideration, as the high torque capability ensured by some rare earth magnets can lead to undesirable deformations or even damages. The impact of above-mentioned parameters on the torque capability are then studied and some observations are summarized. The magnetic field distribution in the coaxial magnetic gears and the torque capabilities are calculated and compared to a theoretical model with the finite element method (FEM), instead of simplified and more agile calculation methods that cannot include all the particularities of the study. The results of the investigation show that proposed solutions for magnetic gears topologies have a reduction of more than 10% of torque capability when compared to simplified, theoretical models. The compromise is still in a reasonable range for most of the topologies and the proposed constructive solutions could be a good start for an experimental prototype of magnetic gear.

Keywords: constructive parameters, design parameters, magnetic gear, optimisation, torque capability

STUDIES OF THE THIN LAYERS OF W AND TI DEPOSITED ON TOOLS STEEL

Mihai-Ionut Gînju, Petrică Vizureanu, Dragoș-Cristian Achiței

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

Corresponding author: Mihai-Ionut Gînju, mihai-ionut.ginju@student.tuiasi.ro

PhD Supervisor: Professor Vizureanu Petrică
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The paper presents a study of the thin layers obtained through the vibrating electrode method. For this study, we use two electrodes from W and Ti, and the base material is tool steel. For the study, we had some investigations: the determination of the chemical composition of the cutter, the hardness of the cutter before the deposition of thin layers, the analysis of the structure, and the determination of the microhardness on the thin layers. After the depositions, the cutters will be fixed to the shredder. After a long period, we will make a new study to determine the usage. The method of vibrating electrodes is used to obtain high hardness and good wear resistance. The electrodes from W and Ti have a compact and high-purity composition. Before the depositions, the samples are polished on abrasive papers to eliminate the oxides and all the impurities. The high temperature is generated by the ELITRON 22 installation. At this temperature, the electrode and the surface of the sample are melted, and a combination is obtained from both materials. The properties obtained in this layer are improved. Usually the tungsten electrode is used to improve the mechanical characteristics, and the titanium electrode is used to increase the corrosion resistance. The steel is used to manufacture the cutters of an installation for recycling the plastic materials. The steel used for experiments is a medium-alloyed steel. The cutters obtained through mechanical processing are subjected to final heat treatments: quenching and tempering. In the shredder, the cutter is partially degraded, and it is necessary only for an easy refurb of the active blades. The method of vibrating an electrode is recommended for this. The microhardness obtained in the thin layers has good values and meets the limits imposed by the manufacturer of the cutter. The depth of the layers can vary from hundreds of microns to a few milimeters.

Keywords: cutters, tool steel, usage, thin layers, properties

FACTORS OF INFLUENCE IN ORGANIZATIONAL PERFORMANCE – DIGITIZATION

Marius Teodor Gramaticu

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

Corresponding author: Marius Teodor Gramaticu, marius-teodor.gramaticu@student.tuiasi.ro

PhD Supervisor: Professor Silvia Avasilcai
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Organizational performance is a measure of the efficiency and effectiveness of an organization and reflects the degree of achievement of the objectives and goals proposed by the organization, as well as the level of satisfaction of customers, employees and other interested parties, and represents the ability to be competitive. and to make a profit. Also, organizational performance refers to the extent to which an organization can achieve and exceed set expectations and goals given its resources and abilities to cope with changes and challenges. We know that Porter's Forces is an analytical model used to analyze the business environment and identify the key factors that can affect the performance of a company in a certain sector of activity but there are many influencing factors in business that can vary according to the type of business and the environment in which the activity is carried out. These factors include: competition, government regulations, geopolitical risk, economic changes, social influence, human resources, etc. These are only the most known business influencers and other factors can be climate change, sustainability and social media etc. A relatively new but important factor is digitization. We know that business digitization is the activity of converting many activities from traditional business models and even business models themselves into digital formats with the help of technology and the Internet and this process can have multiple benefits for a business, such as reducing costs, increasing efficiency, improving customer experience, easier access to information and data and increased competitiveness. Companies will need to adapt their activities and processes to new digital technologies, and digitization may include implementing new technologies as well as revising organizational strategies and structures to match digital changes. Business digitization can be a complex and expensive process that requires a rigorous analysis of the company's needs, proper strategic planning and a well-trained team to implement new technologies, but digitization brings many benefits, such as increased operational efficiency, improved customer experience, improved customer experience. products and services, increasing revenues and improving the ability to make better and faster decisions becoming an essential factor for increasing the competitiveness of companies and for adapting to changes in the market.

Keywords: competitiveness, digitization, efficiency and effectiveness, factors in business, performance

ANALYSIS THE POSSIBILITY TO OBTAIN SHAPE MEMORY ALLOYS FROM POWDERS USING SOLAR ENERGY

Ana-Maria Hlipcă (Scripcariu), Nicanor Cimpoeșu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Materials Science and Engineering, 41 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ana-Maria Hlipcă (Scripcariu), ana-maria.scripcariu@staff.tuiasi.ro

PhD Supervisor: Professor Nicanor Cimpoesu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Shape memory alloys (SMAs) are a special class of materials that can perform mechanical work using different natural heat sources. The idea of the study is to obtain shape memory elements using concentrated solar heat for melting, heat treatment or sintering Nitinol/FeMnSi powders. Solar radiation represents a green and very important solution for many heat required systems. Collected right can reach very high temperatures in a large time window of the day. The temperatures can reach 1500-2000 °C in matter of seconds and high quantities of materials can be heated in very short periods. Solar radiation collected with a complex large metallic mirror, assisted by a heliostat, and focused with a concentrator was used to heat and melt NiTi powders at PROMES (PROcédés Matériaux et Energie Solaire) Solar energy facility from Font Romeu, France. The main applications are to use solar energy in metallis actuators production on earth using a concentrator or in space for aerospatial applications on facilities like ISS. The powders (mixture of Ni powders and Ti powders in 50.5 with respectively 49.5 wt% as a fisrts case and NiTi powders obtained from NiTi – 50.5-49.5 wt% alloys) were used at room temperature and atmospheric pressure in ceramic crucible with thicknesses of 1-2 mm. The heating system was completed with a trolley equipped with a support cooled by water that sustain the crucible with NiTi powders. Stages of the heating procedure using solar light are presented in the paper. Different exposure times and heating temperatures were used to obtained a final melted/sintered product. The preliminary results on the powders analysis (Optical Microscopy - OM, Scanning Electron Microscopy - SEM and Energy Dispersive Spectroscopy - EDS) and on the products obtained are given. Small temperatures registered by the thermocouple at the surface of the powders, 300- 400 °C, heat the powders to red colour and oxidize strongly the powders. The results are definetly preliminary and the procedure will deserve more attention as can be used for 3D printing applications.

Keywords: biodegradable materials, ZnMgTi alloy, mechanical properties

AN OVERVIEW OF RESIDUAL STRESSES IN HARD MATERIALS: STATE OF THE ART AND FUTURE DIRECTIONS

Ionel Iulian Hurja, Paul Doru Barsanescu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Mechanical Engineering,
61-63 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ionel Iulian Hurja, ionel-iulian.hurja@student.tuiasi.ro

PhD Supervisor: Professor Paul Doru Barsanescu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Residual stresses are inherent in all materials and can significantly influence the mechanical properties and performance of engineered components. In hard materials, such as ceramics and metals, residual stresses can have a profound effect on their mechanical behavior and resistance to deformation. This paper provides an overview of the current state of the art in residual stress research in hard materials and outlines future research directions. The purpose of this research is to review the current state of the art in residual stress analysis in hard materials and to identify the key challenges and opportunities for future research. The paper begins by placing the work in the context of the current research landscape and highlighting the importance of residual stress analysis in hard materials. The experimental methodology for residual stress analysis in hard materials is described, including the various techniques used to measure residual stresses, such as X-ray diffraction, neutron diffraction, and synchrotron radiation. The advantages and limitations of each technique are discussed, and examples of their application in hard materials are presented. The main results of recent research on residual stresses in hard materials are summarized, including studies on the effect of residual stresses on the mechanical properties and deformation behavior of ceramics and metals. The paper also highlights the importance of residual stress analysis in understanding the failure mechanisms of hard materials, such as fatigue and fracture. A short discussion of the challenges and opportunities for future research in this area is provided, including the need for improved understanding of the fundamental mechanisms underlying residual stress formation and the development of new experimental techniques for measuring residual stresses in hard materials. In conclusion, this paper provides a comprehensive overview of the current state of the art in residual stress analysis in hard materials and highlights the importance of this research for improving the mechanical performance and reliability of engineered components. The identified challenges and opportunities for future research will guide future work in this area and help to further advance the understanding of residual stresses in hard materials.

Keywords: ceramicshard materials, metals, residual stresses, state of the art

ENERGY RECOVERY FROM ICE WASTE HEAT USING THERMOELECTRIC GENERATORS

Tudor Iavnic, Dragoş Puiu, Aristotel Popescu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Mechanical Engineering
61-63 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Tudor Iavnic, tudor.iavnic@academic.tuiasi.ro

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

Abstract:

In recent times, people are paying more attention to pollution and global warming because of their harmful effects on the environment and human life. One of the main factors that influence the climate clanges is carbon dioxide (CO2) emissions. Scientists and researchers studied the sources of CO2 occurrence and proposed different methods to reduce its impact. Exhaust emissions from vehicle' internal combustion engines represent a factor with an important contribution to the atmospheric CO2 release. Even with recent technological improvements, the car engine efficiency is relatively low and a significant amount of the energy produced is lost as waste heat. Part of the waste heat energy may be recovered and converted into electricity to power some of the car systems, thus reducing the fuel consumption and potentially resulting in decreased CO2 emissions. Among the researched power generation technologies, one of the most advantageous in this situation is the thermoelectric generator (TEG). TEGs take advantage of Seebeck effect to convert low temperature heat into electricity using material similar to thermocouples. Some of the advantages of using thermo-electric generators are low impact on the environment, reliability, no maintenance and easely replaceable, the absence of mechanically moving components and near-silent operation. In addition, TEGs are suitable in environmentally sensitive applications and extended operational lifespan. The use of TEGs provides an eco-friendly solution that minimizes negative impact on the environment, while the absence of moving parts increases the durability and reliability of the system. Furthermore, the silent operation of TEGs reduces noise pollution and allows for their use in noise-sensitive environments, making them an ideal choice for a wide range of applications. The purpose of this paper is to provide a comprehensive overview of the TEG, including its operational principle, the experiments conducted to test it, the materials used in its construction, and the methods employed to improve its performance.

Keywords: low-temperature energy, reduced CO_2 emission, thermoelectric generator, waste heat

APPROCHING OF THE LINE CONCENTRATED CONTACT AS A QUARTER SPACE PROBLEM - A REVIEW

Alina Iovan-Dragomir, Spiridon Crețu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Mechanics,
61-63 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Iovan-Dragomir Alina, alina.iovan-dragomir@academic.tuiasi.ro

PhD Supervisor: Professor Crețu Spiridon
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Concentrated contact frequently occurs between machine elements, leading to the development of various forms of damage: abrasive wear, adhesive wear and seizure, as well as surface destruction through contact fatigue. Contact fatigue is a typical mode of damage to machine parts (bearings, gears, wheel-track contact, but also cams and valves) under strong and repeated Hertzian contact pressure. Most concentrated contact problems, where bodies touch at a point or a line, are well described and solved using the assumptions and equations of Hertz's theory. In the case of cylindrical bodies of finite length, Hertz's equations do not correctly describe the state of stresses arising at the boundary. These uncompensated stresses have to be taken into account in the geometrical and functional design of machine elements. In this paper, the main approaches referring to the state of stresses at the linear contact approached as a quarter-space are presented. By overlapping two elastic half-spaces, Hetenyi obtains a quarter-space. Hetenyi also offers a method for solving the problem of loading normal and tangential forces on the boundary of a quarter-space by overlapping an infinite number of half-spaces. Starting from the method proposed by Hetenyi in 1984, Keer et al. reduce the problem to solving two uncoupled integral equations. In 1990, Hanson and Keer formulated the problem as two coupled two-dimensional integral equations. The equations contain a logarithmic singularity that varies along the length of the edge of the quarter-space. These methods eliminate both tangential and normal stresses. Based on observations by Reusner that the influence of normal stress is so small that it can be neglected, de Mul proposes a mirroring of the pressure distribution with respect to the end plane, in order to cancel tangential stresses on finite free surfaces. In 2011, Guibault offered a better approximation solution by introducing a correction factor ψ, whereby he multiplies De Mul's virtual pressure distributions so as to achieve a supercorrection that includes the normal stress.

Keywords: concentrated contact, non-Hertz contact, quarter space

PHOSPHATE COATINGS SUITABLE FOR STEEL REBARS USED FOR REINFORCED CONCRETE

Petru Lazar, Alin Marian Cazac, Manuela Cristina Perju, Leandru Gheorghe Bujoreanu, Costica Bejinariu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Material Science and Engineering
41 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Costica Bejinariu, costica.bejinariu@yahoo.com

PhD Supervisor: Professor Costica Bejinariu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The paper aims to conduct a complex and multidisciplinary study in the field of materials science and engineering. It focuses on the thin superficial layers of OB 37 steel reinforcements used in reinforced concrete structures. The aim of the research will be to develop phosphated layers on OB 37 steel supports. This will enable us to obtain surfaces with anti-corrosion resistance and better adhesion between reinforcements and concrete compared to the use of untreated reinforcements. The topic is relevant to fundamental and applied research in the field of materials science and engineering. It aims to obtain layers with special properties imposed by the corrosion phenomenon of reinforcements used to reinforce concrete. The process of microcrystalline phosphating of OB 37 steels intended for reinforced concrete was designed in order to obtain thin layers of high porosity capable of allowing the insertion/embedding of solid lubricating structures, with the multiple action of improving processing characteristics and implicitly good corrosion properties. It compensates for the initial investment with high quality production and low consumption of materials. The technological process for the crystalline phosphating of steels intended for reinforced concrete involves going through several stages and phases that will be presented in this paper. In order to obtain a phosphate layer that will improve the corrosion resistance of OB 37 steel, as well as a layer that can be used as a substrate for future coatings, three solutions were prepared/applied, different from the point of view of the principal elements (MgCO3, Mn-Ni-Fe-Zn and Zn). The quantities of active substances used were calculated for one liter of phosphate solution, supplemented with distilled water. The phosphate layers were deposited by immersion of the samples in a phosphate solution at a temperature of 95 °C for 60 minutes. Before this, the sample's surface was prepared by immersion into a dregreasing solution, respective a pickling solution.

Keywords: concrete, manganese phosphate, magnesium phosphate, phosphate coatings, steel rebars, zinc phosphate

APPAREL CONSUMER'S COMPREHENSION TOWARDS SUSTAINABILITY

Irina-Elena Marin, Victoria Bocancea, Maria-Carmen Loghin

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

Corresponding author: Irina-Elena Marin, irina-elena.marin@student.tuiasi.ro

PhD Supervisor: Professor Maria – Carmen Loghin
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The fashion industry is already well known for its damaging environmental impact. Over the years, those negative influences have gained momentum, and the consequences lie ahead, in terms of climate change and even human health damage. Since outcomes have become increasingly more visible to the naked eye, concerns revolving around prevention and diminishing the harm that the apparel industry is capable of doing started to take form at the European Commission level. According to the Circular Economy Action Plan, manufacturers are encouraged to adopt a sustainable product policy framework within their current practice, which will lead to improving several key elements of a product, such as durability, reparability, or reusability. Based on this approach, not only that the updated products will possess a diminished environmental impact, but in the long term, the consumption rate and pace concerning garment items can be reduced. Thus, consumers will benefit from more sustainable apparel items, in terms of durability. Consequently, the purchasing rate for new clothing, coming from the need to replace the old items, will decrease. Less than 1% of the global amount of textile products is recycled into new items. This fact highlights the outcome of massive consumption, but it mostly emphasises inefficient post-consumer textile waste management. Considering the fact that the apparel industry is sustained by two main parties – producers and consumers - for the paradigm shift to unfold successfully, sustained effort is demanded from both sides. Shaping the consumer's behaviour, based on the ideal traits that researchers establish, is not sufficient, and is even unattainable at first. It is imperative to mention that the information campaigns designed to catch the public eye may not be relevant to some consumers, but might have a major impact on others. This study is based on a public survey, addressed to apparel consumers. The aim is to identify, not only the concrete level of knowledge that consumers have in regard to fashion sustainability but also the main reasons behind the purchasing process. Nonetheless, valuable pieces of information were obtained concerning post-consumer apparel waste, from a consumer's perspective.

Keywords: apparel industry, consumer's awareness, environmental impact, post-consumer apparel waste, sustainable behaviour

RESEARCH ON SUSTAINABILITY IN THE PHARMACEUTICAL INDUSTRY FROM THE PERSPECTIVE OF MANAGERS

Laura-Crina Coca Mirăuțe, 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 Coca, laura-crina.miraute@student.tuiasi.ro

PhD Supervisor: Professor Marius Pislaru
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Sustainability in the pharmaceutical industry is a topic of great interest nowadays, especially in terms of environmental sustainability, because in the chemical field keeping the environment clean and taking care of it is a big challenge. Working in the pharmaceutical industry is quite a difficult one considering that the output of the work practically cures or maybe even saves lives which means that it must be treated with great responsibility. At the same time, in order for a company in this field to be sustainable, it must ensure a certain number of employees to whom it must provide a work environment that meets the requirements. From other perspectives, it can also be an environment with an increased risk of toxicity, which makes it difficult to maintain or even recruit employees. From an economic regard, we are also talking about a field in which the machines used in the technological production process, materials and raw materials, but also labor is expensive. By combining these three dimensions, the relationship between each of them makes a bearable, fair and viable society, which in turn creates a sustainable society. Thus, the concept of sustainability will only be realized by unifying those different aspects that first assign equal importance to each dimension. Regarding the quantification of the impact of flows, the study of the academic literature shows the existence of several methods of measuring the economic, social and environmental aspects at the firm level: Life Cycle Assessment-LCA, Life Cycle Costing-LCC, Social Life Cycle Assessment-SLCA.The aim of the research is to determine the degree of sustainability of a pharmaceutical company, from the perspective of its managers, from a social, economic and environmental regard. By talking with them, we find out what are the challenges in this industry, what is their vision of the concept of sustainability and how well it is recognized and implemented at the company level. Following this study, we find out which of the three dimensions predominates in this industry and where the greatest effort is needed for it to be on an upward slope in terms of sustainability.

Keywords: economic, environmental, sustainability, social, pharmaceutical industry

IDENTIFICATION OF DEFECTS ON STAINLESS STEELS CUTTING KNIVES USED IN WOODWORKING INDUSTRY

Sebastian Mistreanu, Cimpoeșu Ramona, Oana Rusu, Daniela Lucia Chicet, Vasile Manole, Nicanor Cimpoeșu

"Gheorghe Asachi" Technical University of Iasi, Romania, Department of Materials Science, 44 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Sebastian Mistreanu, sebastian.mistreanu@student.tuiasi.ro

PhD Supervisor: Professor Nicanor Cimpoesu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Stainless steel are metallic materials with many applications based on their high corrosion resistance in different environments. Having a good understanding of wood properties is crucial for achieving success in woodworking. Failure to comprehend how to interpret the direction of the grain can lead to a great deal of frustration when attempting to join or plane wood, potentially ruining an otherwise beautiful piece of lumber. In addition, the direction of the grain can have a significant impact on certain milling and shaping operations, such as creating moldings. The use of wood that has been dried too quickly or insufficiently can result in unfavorable outcomes, either during the woodworking process or shortly thereafter, which could be even more problematic. Different cutting tools made of stainless steel and used in woodworking process were analyzed after usage in different operations using optical microscopy (OM) for macroscopic inspection, scanning electron microscopy (SEM – VegaTescan LMH II) for microscopic analysis and energy dispersive spectroscopy (EDS detector from Bruker). Shape and dimension of the defects was established among with the corrosion of the elements during the usage of a cooling liquid. Hardening solutions of the cutting blade are given based on literature. Few repairing solutions of the mechanical defects are given in the paper in order to improve the cutting tool lifetime cycle. Stainless steel tools have become increasingly popular in woodworking due to their durability, resistance to corrosion, and low maintenance requirements. These qualities make them ideal for use in environments where moisture or humidity is present, which can cause rust and corrosion on traditional steel tools. Stainless steel also maintains its sharpness for longer periods of time, resulting in less downtime for sharpening or replacement. Additionally, stainless steel tools are non-reactive, which means they won't react with acidic woods or other materials that can cause staining or discoloration. With proper care and maintenance, stainless steel tools can last for many years, making them a worthwhile investment for any woodworking enthusiast or professional.

Keywords: cutting knives, microscopic analysis, milling, shaping, stainless steel

AREAS AND CRITERIA OF QUALITY ASSURANCE OF THE PRE-UNIVERSITY EDUCATION PROCESS AND SYSTEM IN ROMANIA

Gabriela-Livia Mitrea-Curpanaru

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Industrial Design and Business Management, 59A Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Curpănaru Gabriela-Livia, gabriela-livia.curpanaru@student.tuiasi.ro

PhD Supervisor: Professor Silvia Avasilcai
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The main areas and criteria of quality assurance of the process and system of pre-university education in Romania are institutional capacity, educational effectiveness and quality management. Institutional capacity refers to the internal organization and available infrastructure. Educational effectiveness consists in the mobilization of resources in order to obtain the expected learning results. The mechanisms for ensuring the quality of education involve two types of evaluation. The internal evaluation of quality is carried out by the Commission for evaluation and quality assurance at the level of each organization providing education in Romania. The external quality assessment is carried out by two main institutions depending on the level of education: the Romanian Agency for Quality Assurance in Pre-University Education and the Romanian Agency for Quality Assurance in Higher Education. The successful achievement of education quality management is conditioned by the observance of clear performance criteria. These criteria are determined by different reference models in the field, such as total quality management, the SCQM model, the Baldrige excellence model, the EFQM model (European Foundation for Quality Manangement), the management excellence model (MEG), Six Sigma, the FMEA, the balanced scoreboard model, the SERVQUAL model, the multidimensional model of quality in education, the integrated model of quality management, the model of quality assurance in education through the implementation of e-learning and blended learning. The education quality models were analyzed based on several criteria: identification of characteristic elements, exploration of ways to capitalize on the models at the level of the school institution, highlighting the advantages and disadvantages. The analysis of the representative models in the field of education quality led to the elaboration of a new approach to conceptualize the management of the quality of education in close connection with the novelty aspects of the standards related to the online school. The integrated model for quality assurance in the context of online education is based on the capitalization of all the components of the educational process in close accordance with the integration of educational technologies.

Keywords: areas and criteria, educational effectiveness, institutional capacity, quality assurance, quality management

TREATMENT AND CHARACTERIZATION OF COSMETO-TEXTILES 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, 59A 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.com

PhD Supervisor: Professor Mirela Blaga
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

In recent years, our concern about hygiene has increased, so many studies have been conducted to improve the antimicrobial properties of textiles. Since many antimicrobial agents are avoided because of their possible harmful effects, the use of inorganic nanoparticles seems to be a satisfactory alternative. The aim of this study is to develop antimicrobial textiles that can prevent the spread of different types of bacterial acne. The innovation consists in the use of bioactive compounds (freeze-dried plant extracts) mixed with blue clay to obtain functionalized textiles. Since blue clay is known for its high concentration of trace elements that contribute to increased antibacterial activity, the main features of this method are to reduce the risk of bacterial development, disinfect the skin and achieve a potential tissue regeneration effect. The development of textiles with improved antimicrobial activity and increased efficiency in curing certain forms of acne is therefore desirable. Laboratory experiments were conducted on the technological processes of deposition of dispersions of bioactive compounds with blue clay on textile materials. Thus, two types of fabrics (one made of 100% polyester, and one made of 100% cotton - chosen for their wide availability, low initial cost and the multiple properties they possess) were functionalized using the scarfing process (impregnation with dispersion only, impregnation with dispersion and, after drying, impregnation with Itobinder AG 20g/L and impregnation with dispersion modified with Itobinder AG 20g/L). The pH of the treated textiles was measured along with the fomaldehyde concentration to determine whether these textiles were safe from an ecotoxicological point of view. In addition to the above two physicochemical analyses, the antimicrobial activity of the treated textiles was also evaluated. Additional studies are being conducted to test and validate the product: toxicity tests on various primary cells and macrophages, and in vitro wound infection tests.

Keywords: acne, antibacterial, blue clay, functionalized textiles, formaldehyde

WALKING ROBOT LEG BASED ON THE SCOTCH YOKE MECHANISM

Claudia-Ana Morar[1], Ioan-Alexandru Doroftei[1], Ioan Doroftei[1], Marius Hăgan[2]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Mechanical Engineering, 43 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]"Gheorghe Asachi" Technical University of Iasi, Faculty of Electronics, Telecommunications and Information Technology, 11 Carol I Blvd., 700506, Iasi, Romania

Corresponding author: Claudia-Ana Morar, claudiana.morar@student.tuiasi.ro

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

Abstract:

The development of precision agriculture as a component of the fourth industrial revolution (Industry 4.0) involves the design of autonomous or semi-autonomous agricultural robots that are able to serve the requirements of a market of organic agricultural products and the relaunch of agricultural prosumers, such as small farms or peasant households. In this paper, the leg mechanism of a mobile robot for agricultural applications will be discussed. Two structural leg solutions, based on the Scotch Yoke mechanism, will be discussed and compared. The design criteria of the leg are related to the work requirements of a walking robot intended for agricultural operations. The Scotch Yoke mechanism is less common as a technical solution for the design of robot legs, however, some applications, such as those of robots with static sequential walking this mechanism offers some advantages that are highlighted in this work. A condition that the kinematics of the agricultural robot's leg must meet is that of gravitational decoupling; the Scotch Yoke mechanism carries out the reciprocal conversion of the rotation-translation movements, which allows the fulfillment of the gravitational decoupling condition only under certain conditions, and this shortcoming is solved by using a worm mechanism that transmits the rotation movement generated by the actuator to the crank of the Scotch Yoke mechanism. This type of leg is optimal for moving the robot in narrow spaces such as rows of corn or potato crops and it also has a minimal influence on the environment. This paper also presents the notion of the displacement area filling factor, which is defined as the ratio between the active area of the robotic platform and the area occupied by the robot when all legs are in contact with the ground. The robot leg based on the Scotch Yoke mechanism is optimal for the design of walking robots with static and sequential walking and covers the work requirements for such a robots.

Keywords: agricultural robot, gravitational decoupling, precision agriculture, scotch yoke mechanism, robot leg

APPLICATIONS OF AXIOMATIC DESIGN IN THE PROJECT MANAGEMENT OF NEW PRODUCT DEVELOPMENT – CURRENT STATE

Mihaela Nicolau

"Gheorghe Asachi" Technical University of Iasi, Romania, Department of Machine Manufacturing Technology
59A Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Nicolau Mihaela, mihaela.nicolau@student@tuiasi.ro

PhD Supervisor: Professor Oana Dodun
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The article describes results of Axiomatic Design applications research conducted in project management of new product development as it currently stands based on publicly available materials. In 1991, N.P.Suh introduced the concept of Axiomatic Design as a better approach to the design of products, systems, and processes. Since then, the concept has been utilized in many applications. As any professional undertaken is typically accomplished following the project management processes, the researcher conducted an investigation of significant public literature available on the topic, namely the application of Axiomatic Design to Project Management of New Product Development. Product development or product design are often used interchangeably and there are multiple approaches for New Product Development, such as Agile or Waterfall, depending to product characteristics, such as whether the product is a hardware, software, or a service. Project Management, as defined in PMBOK Guide, 6th Edition, issued by Project Management Institute, is a collection of processes tailored to fit the application. The research focused on process design, and it was less focused on product design. Special attention was given to applications to business processes. Results of the investigation indicated that although many authors suggested the application of Axiomatic Design to project management to be useful and lead to improvements of projects' success and business's Return-on-Investment, very little has been developed in this area. The most notably reference can be made in regard to scheduling of work, for which Axiomatic Design is well suited. The researcher concludes that, except for scheduling activities according to product requirements, a uniform approach to all processes used in Project Management could be difficult and a personalized approach is more appropriate depending on company's internal organization of work. It will be beneficial to either project management practitioner or any business manager to have a framework easy to utilize in designing processes as needed for the successful completion of any project.

Keywords: axiomatic design, new product development, project management, product design, process design

SOFT ROBOTICS – A SURVEY OF THE STATE OF THE ART

Adrian Onea, Ioan Doroftei

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Mechanical Engineering, 43 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Adrian Onea, adrian.onea@student.tuiasi.ro

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

Abstract:

Recent advancements in flexible robotics have shown how robots are becoming more adaptable, versatile, and useful in various fields, including production, medicine, and space exploration. The technology is designed to be elastic and adapt to new situations and interact with objects of different shapes and sizes. One of the latest findings in the field of flexible robotics is biodegradable artificial muscles. These muscles are made of biodegradable materials that can be implanted in the body to provide support and restore mobility to patients who have lost muscle function due to injury or disease. Another breakthrough is the development of smart electronic skin that can sense pressure, temperature, and humidity like human skin. This technology is particularly useful in the development of wearable electronics and flexible tactile sensors, which have a wide range of applications, including smart robots, human-computer interaction, and prosthetics. Additionally, ultra-soft and highly stretchable implantable sensors have been developed, which can monitor the body's internal electrical activity, temperature, and pressure. Flexible robots are considered one of the most promising technologies of the 21st century due to their potential to revolutionize various industries. For example, in the field of medicine, flexible robots can be used for minimally invasive surgeries, which reduce the risk of complications and shorten recovery time for patients. In space exploration, flexible robots can be used to explore harsh environments that are too dangerous for humans to access, such as deep space and other planets. In summary, the latest findings in flexible robotics have shown significant progress in the development of biodegradable artificial muscles, smart electronic skin, and ultra-soft and highly stretchable implantable sensors. These technologies have the potential to revolutionize various industries, including medicine and space exploration, and are considered one of the most promising technologies of the 21st century.

Keywords: flexible actuators, flexible robotics, flexible electronics, stretchable sensors

INVESTIGATION ON BRAKE PAD WEAR EMISSIONS

Cătălin Osoeanu, Daniela Lucia Chicet, Nicanor Cimpoesu, Costică Bejinariu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Materials Science and Engineering, 41 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Cătălin Osoeanu, catalin.osoeanu@student.tuiasi.ro

PhD Supervisor: Professor Costică Bejinariu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The pollution of the environment and the health concerns related to particulate matter (PM) released by the usage of vehicles have shown increasing attention in past years. The sources are exhaust, and non-exhaust emissions. The first category is heavily researched and regulated within the EU, being the main subject of the European Emission Standard, currently at the Euro 6 level. The emissions caused by vehicles, from sources other than exhaust systems, that can be either particles from brake systems, clutches, tires, suspension, the road itself, or material deposited on the road surface that is getting airborne due to traffic induced turbulence, account for almost half of the total emissions in the urban environment, for which the vehicles are responsible. From this category, the brake pad emissions gather 55% of the total PM released in the atmosphere. The purpose of the report will be to assess the different types of the brake pads, that are currently on the market. There are four main types of brake pads that are used on vehicles: semi-metallic, non-asbestos organic (NAO), low-metallic NAO, and ceramic. Scanning electron microscopy and light microscopy will be used for structural characterization and insigths on chemical composition will be taken with a Energy dispersive spectrometer (EDS). After the wear cycle, the dust resulted in the testing can be analyzed both from a physical perspective (mass, shape, particle size etc.), as well as from the perspective of the chemical composition. The most important chemical components found in brake wear emissions are Fe, Cu, Pb, Zn. The effect on the disk brake wear can also be quantified from a physical perspective, analyzing the brake disk wear on an electronic microscope in the search of threads and micro cracks on the disk surface. Limiting and regulating the brake pad emissions will have an important benefit in protecting the health of the population and lowering the impact on the environment.

Keywords: brake pad, emission, pollution, health, NAO

BODY STIFFNESS INFLUENCE ON VEHICLE HOOD MODAL RESPONSE - A GENERAL OVERVIEW

Valerian Pinzaru

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Mechanical Engineering
61-63 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Valerian Pinzaru, valerian.pinzaru@student.tuiasi.ro

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

Abstract:

Vehicle hood systems need to satisfy a variety of requirements as: lightweighting, aerodynamics, durability, pedestrian safety etc. Automotive engineers are continuesly challenged to offer a proper hood design that can withstand to all mentioned performances. The challenge is even harder as long as some of the requirements are conflincting one with another. On one side the hood should be flexible enough to collapse in on itself during an impact, thereby protecting passengers and pedestrians from severe injuries, and, on another hand should be stiff enough to withstand dynamic solicitations and fatigue. The scope of the research is to point out the way in which body stiffness can affect the dynamic response of the hood in order to make predictions on vibrational durability performance of the hood system. The theoretical part of the research will be focused on the identification of the natural frequencies, mode shapes and damping characteristics of a hood system trough a modal analysis simulation. Different configurations of the simulation will be realized by varying the stiffness of the hood interfaces on body as: hinges, maintain bumpers and latches. Design parameters will be proposed to improve hood resistance to vibrations and external forces. The second part of the research will include an experimental modal analysis by using a shaker excitation technique and measuring the hood dynamic response with triaxial accelerometers. Three different configurations will be used for the experiment: minimum, nominal, and maximum stiffness configuration. The test support consists of a vehicle front unit equipped with a hood and mounted on six degrees of fredoom multi axial simulation table which allows excitations on all three directions. A sinusoidal signal will be used as an excitation technique. Final conclusions will be made on order one parameters that influence the hood dynamic response due to an excitation and correlation study will be performed to validate the consistency of the simulation model. Overall, the results will be used to quantify the dynamic response of the hood and identify optimum design parameters for an improved durability performance.

Keywords: durability, hood, stiffness, modal, response

ORGANIZATIONAL INNOVATION - PROPOSED ADDITION TO DELONE AND McLEAN MODEL

Ștefana-Cătălina Pohonțu-Dragomir, Ionuț-Viorel Herghiligiu, Adrian Vîlcu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Industrial Design and Business Management, 21 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: Ștefana-Cătălina Pohonțu-Dragomir, stefana-catalina.pohontu-dragomir@student.tuiasi.ro

PhD Supervisor: Professor Ionuț-Viorel Herghiligiu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Placing the work in the general context of the research: The DeLone and McLean multidimensional model, both in its initial and updated form, is, without a doubt, one of the most used units for measuring the success of an informational system. Our proposal is to analyze the pillar of the net benefits in a granular way. Thus, our intention is to highlight the impact of the concept of organizational innovation.
The purpose of the research carried out: The goal is to bring to the attention of specialists, both researchers and practitioners, the existing gaps within the success measurement model.
Description of experimentation methodology: Following the exhaustive consultation of the specialized literature, both theoretical and empirical studies, we notice that the taxonomy of the updated model includes the pillar of net benefits as its final concept. One of the often-mentioned net benefits, both in theory and in practice, is the idea of organizational innovation.
Description of main results: Our proposal consists of the following: completing the model by adding the concept of organizational innovation, transforming the newly completed model into a circular one, and creating a flow of continuous development.
Short discussion: The act of innovating at the organizational level, implicitly the result, the organizational innovation, involves a boomerang effect, because the dimensions of the model - information, system, and services - are directly influenced. The completion of the model through the concept of organizational innovation, which has become part of the circular model, exponentially favors the success of the information system.
Short conclusion: The main contribution of the authors is represented by the following actions: to look for the gap existing inside the model, to find this lack, to propose a completion of the model, to contextualize the completion of the model, and to verify and validate the completion of the model.

Keywords: DeLone & McLean model, information system, cuccess model, organizational innovation, net benefits

EXPERIMENTAL STUDIES ON HYBRID SOLAR SYSTEMS

Alexandru Radu[1], Konstantinos Papakostas[2], Ana-Georgiana Lupu[1], Aristotel Popescu[1]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Mechanical Engineering,
61-63 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]School of Mechanical Engineering, Aristotle University of Thessaloniki, Greece

Corresponding author: Radu Alexandru, alexandru.radu@student.tuiasi.ro

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

Abstract:

In the last few decades, the scientific community and decision makers have made major changes in both energy sector and environmental protection. The forecast scenarios on main fossil fuels, given the known reserves and foreseeable imminent depletion towards the end of this century, triggered investments in scientific research and technologies development to use energy from renewable sources and to increase efficiency of energy usage. The biggest challenge in implementing renewable energy sources is the intermittent nature of supply. Referring only to solar and wind energy, they generate electricity only when the sun shines or the wind blows. Thus, energy storage or hybridization methods must be identified and developed in order to have access to energy during periods without wind or sun. An interesting solution stems from cogeneration, a technological process of simultaneous production of electricity and thermal energy. In the area of solar energy direct conversion in electrical energy, the photovoltaic modules perform better in low temperature operation, which contradicts with environmental thermal conditions of sunny days. An obvious solution is PV module cooling, with a twofold effect: higher PV conversion efficiency and extraction of thermal energy from panel waste heat, thus simultaneous production of electricity and thermal energy. The present paper describes experimental work performed on monocrystalline Si-based PV modules that are cooled with a copper heat exchanger and a liquid cooling agent. The heat exchanger has similar geometric characteristics as the PV module and includes large rectangular cross-sections that ensure laminar flow conditions for the coolant. Comparison of conversion efficiencies are made for the case cooled and uncooled PV modules, as well as total solar energy conversion efficiency increase due to consideration of supplemental thermal energy obtained during the hybrid cogeneration process. Results show an electrical conversion efficiency increase of about 5%, whereas the total efficiency (electrical and thermal) increase is about 40%.

Keywords: cogeneration, cooling, energy efficiency, useful thermal energy, photovoltaic conversion

RECOMMENDATIONS ON CLOTHING PRODUCTS FUNCTIONAL-ADAPTIVE FOR PEOPLE WITH AMPUTATIONS

Aliona Raru[1], Elena Florea-Burduja[2]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Industrial Design and Business Management, 29 Mangeron Blvd., 700050, Iasi, Romania
[2]"Technical University of Moldova, Faculty of Design, 4 Academician Sergiu Rădăuțanu Street , MD-2000, Chișinău, Republic of Moldova

Corresponding author: Aliona Raru, aliona.raru@student.tuiasi.ro

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

Abstract:

Functional-adaptive clothing products are clothing products that perform the role of improving functional deficiencies, camouflaging structural deficiencies and increasing the quality of life of people with disabilities. Amputation is the severing and removal of a limb or part of it, a mammary gland or any protruding part of the body affected by trauma, prolonged constriction or surgery, used to control pain or a pathological process. The loss of a part of the body has a strong impact on patients. People with amputation face a complex set of tasks and problems that need to be solved. The theme timeliness is determined by the growing number of people with amputations and their increased interest in their appearance. This paper aims to identify the problems generated by the disability arising as a result of amputation of a part of the body, specific problems that could be solved by assigning specific functionalities to clothing products, as well as to find constructive solutions for specific types of clothing products. The model used in the research process is the decision-centered model that involves going through the following successive steps: identifying the problem that requires a solution, addressing the problem and finding the set of possible solutions, choosing the solution considered optimal. The methods used to report the problem include documentation in the area under investigation. They turn to specialized literature, patents, scientific articles, discussions with other colleagues and specialists in related fields, discussions with specialists in the medical field. As a result, the stages of the process of designing functional-adaptive products for people with amputations were established, the areas of use of functional-adaptive clothing products, existing situations-problems, proposed solutions to solve problems. The results of the study will be used in the process of developing model systems and identifying constructive solutions specific to functional – adaptive clothing products for people with amputations.

Keywords: constructive elements, functionality, limb amputations, mastectomy, necessity

EVALUATION OF EXPERIMENTAL FE-MN BASED ALLOYS AS BIODEGRADABLE MATERIALS

Ana-Maria Roman, Nicanor Cimpoeșu

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

Corresponding author: Ana-Maria Roman, ana-maria.roman@academic.tuiasi.ro

PhD Supervisor: Professor Nicanor Cimpoesu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The field of biodegradable materials is revolutionizing biomedical engineering by improving tissue healing techniques. Ideally, these types of implants are designed to completely degrade after a certain time required to heal a tissue. This eliminates medical complications that may occur in the long -term and additional surgery. To this end, a number of new properties and ways of improving them are constantly being pursued. Publications in the literature present research on biocompatibility, mechanical properties and control over the degradation process to achieve better results in response to tissue healing. Current research distinguishes three main classes of biodegradable alloys, based on Mg, Zn and Fe. In this paper, the authors propose several Fe-Mn-Si based alloys in cast and hot-rolled state for biodegradability study. The in vitro tests consisted of immersing the samples in physiological solutions, Ringer's and SBF for different time intervals, 1 day, 3 days up to 14 days at 37 °C in a thermostatically controlled enclosure. After immersion, the samples were cleaned in an ultrasonic bath in technical alcohol for 60 minutes each. A pH meter equipped with a probe inserted into the immersion liquid for 72 h was used to evaluate the corrosion behavior through pH variation due to reactions between the liquid medium and the metal. Corrosion rates were calculated after mass loss and using cyclic and linear potentiometry. Samples were subjected to dynamic mechanical analyzes (DMA) and evaluated before and after immersion. Surface morphology was analysed using atomic force microscopy (AFM) for initial samples and after DMA. The chemical composition was studied for the initial samples and after each immersion interval using energy dispersive spectroscopy (EDS). Scanning electron microscopy (SEM) was used for structural characterization of the initial alloys and to show the effect of corrosion on the metal surface. FT-IR and nano-FTIR experiments were performed to identify and confirm corrosion compounds formed on the surface. A solid-state transformation was recorded using differential scanning calorimetry (DSC) upon cooling with M_s temperature close to human body temperature, encouraging the potential of this material for medical applications. Following the results, it was found that a smart biodegradable Fe-based alloy can be applied in the medical field with an appropriate thermomechanical treatment to modify the transformation temperatures.

Keywords: FeMn alloy, biodegradable materials, corrosion, in vitro

EMPHASIZING SHAPE MEMORY EFFECT IN FILAMENTS AND 3D PRINTED SPECIMENS OF RECYCLED POLYETHILENE GLYCOL

Ștefan Dumitru Sava, Nicoleta Monica Lohan, Bogdan Pricop, Radu-Ioachim Comăneci, 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: Ștefan Dumitru Sava: stefan-dumitru.sava@student.tuiasi.ro

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

Abstract:

Recycling polymeric waste and especially polyethylene represents one of mankind's major concerns, due to the huge trash amounts accumulated in the oceans. Following our previous study on recycled polyethylene terephthalate (R-PET) the present work was focused on recycled polyethylene glycol (R-PEG). R-PEG pellets were used to produce filament for 3D printing. Specimens with "dog bone" and parallelepiped geometries were printed for tensile testing and thermal analysis, respectively. Both the filament and the printed specimens experienced shape memory effect (SME) by recovering their straight configuration during heating, after being bent with 900 at room temperature. The specimens cut from the filament were able to recover their shapes during several bending-heating cooling cycles. In addition, the filament samples were able to develop work-generating SME, since they partially recovered their straight shape, with a load fastened at their free end. The load was tens of times heavier than the filament sample. Both SME repeatability for tens of cycles and the capacity to develop work-generating SME were missing at R-PET testing. On fragments cut from the filament and from 3D printed specimens differential scanning calorimetry (DSC) tests were performed under Ar protective atmosphere, with a heating rate of 100C/ min. On DSC thermograms a glass transition was emphasized which can represent the mechanism of SME occurrence. Dynamic Mechanical Analysis (DMA) was performed on parallelepipedic specimens which were dynamically bent by means of a dual cantilever specimen holder while being heated under an Ar atmosphere. DMA thermograms revealed a storage modulus increase at around 700C, which can explain R-PEG's capacity to develop work-generating SME. Tensile tests revealed a typical failure curve with a necking region followed by 3D printed specimens' failure at much lower stress values. All these results demonstrate the feasibility of the idea to recycle PEG waste by transforming it into cheap low density actuators able to develop work-generating SME or into thermal sensors.

Keywords: glass transition, shape memory polymer, shape memory effect, tensile testing, work generation

THEORETICAL RESEARCH INTO QUALITY IMPACT ON MANUFACTURING ORGANIZATIONS

Ioana-Alexandra Sbîrcea, Cristina-Elena Ungureanu, Rebecca Ana Maria Chiriţă

University Politehnica of Bucharest, Doctoral School of Entrepreneurship, Business Engineering and Management, 313 Splaiul Independenței Blvd., sector 6, 060042, Bucharest, Romania

Corresponding author: Ioana-Alexandra Sbîrcea, ioanaalexandrasbircea@gmail.com

PhD Supervisor: Professor Elena Fleacă
University Politehnica of Bucharest, Romania

Abstract:

In business, quality has proven to be difficult to define. Many individuals associate quality with some degree of greatness or natural superiority, while others see it as simply the absence of manufacturing flaws. The American National Standards Institute (ANSI) and the American Society for Quality Control (ASQC) established the official definition of quality in 1978. It is defined as "the entirety of features and characteristics of a product or service that bear on its ability to satisfy given needs." It has long been recognized that regardless of the size of the business, quality is the key to competitiveness in the global market. Competitiveness means possessing the capability to make the right goods and services of the right quality, at the right price, and at the right time. In terms of qualities connected to the production process, manufacturing quality is clearly defined. Quality is a trait of the industrial system in this sense. Thus, the methods used to "produce" and "control" quality in manufacturing are management of operations and quality control. The complete system of rules, regulations, and guidelines put in place by a company to attain and uphold quality is referred to as quality assurance. Quality engineering, quality control, and quality management are the three main components of quality assurance. Quality is a crucial element in all processes in production. For instance, comprehensive market research is required to ascertain consumer wants and specify functional specifications for product designers. According to the survey, either the management and parent company internally or the customer externally provide these businesses with the motivation to implement quality control. Due to a lack of technical understanding, the industries are not using six sigma methodologies or capability studies. The capacity to measure product specification fulfilment, the convenience of use of the technique, and the ability to address pressing quality and productivity issues are the three considerations that these companies consider when choosing a quality control approach.

Keywords: manufacturing quality, six sigma, quality, quality control, quality system

THE USE OF NANO AND MICROPARTICLES IN SHIELDING MATERIALS AGAINST IONIZING RADIATION

Jolanta Sobczak[1], Gaweł Żyła[2]

[1]Rzeszów University of Technology, Doctoral School, 12 Powstańców Warszawy Street, 35-959, Rzeszów, Poland
[2]Rzeszów University of Technology, Department of Physics and Medical Engineering, Faculty of Mathematics and Applied Physics, 6 Powstańców Warszawy Street, 35-959, Rzeszów, Poland

Corresponding author: Jolanta Sobczak, d569@stud.prz.edu.pl

PhD Supervisor: Professor Gaweł Żyła
Rzeszow University of Technology, Poland

Abstract:

The implementation of nanoparticles in various types of materials is an indisputably emerging trend in contemporary materials engineering. In particular, the design of new composite materials with their addition allows for overcoming the limitations of already known and traditional construction solutions. Depending on the selection of the main component, as well as all kind of additive in the form of nanomatter, the range of applications of nanocomposites is wide, including medicine, industry, electronics, construction, and many others. Due to the carcinogenicity, as well as the penetration of gamma and X-ray radiation, scientists have been tempted to propose composite materials with the addition of micro and nanomatter to suppress the harmful beam and thus being an alternative to currently accepted solutions. The concept of composite materials, apart from proper shielding properties against ionizing radiation, would also provide other desirable physicochemical properties. It is known, that conventional radiation shielding materials cannot always be produced in the geometries, which would be suitable for various applications. The current state of the literature shows, that nanosized elements with high atomic number and density (both pure metals and their oxides) such as bismuth, lead, tungsten and iron are included in the composition of proposed shielding composites. The research include particle concentration, their size, photon energies. It is believed, that the particle size and the amount of the filler has its effect on multiple scattering and attenuation of the incident radiation beam. Despite possessing unique properties, nanomaterials tend to combine into agglomerates, which translates into uneven distribution and may lead to deterioration of the protective properties. Core–shell microcapsules with adjusted materials of the core and the shell hold great potential in this regard. The designed composites are based on polymers (including silicone foams, silicone rubber, high-density polyethylene, isophthalic polyester, polyaniline), glass, concrete, bandages and cellulose fibers. In this paper briefly presented gather up-to-date research about nano and microcomposites used as shields against X-ray and gamma radiation, which were both simulated and experimentally examined. Based on this, the linear and mass absorption coefficient of designed nanocomposites were summarized.

Keywords: nanoparticles, microparticles, ionizing radiation, shielding materials, X-ray

GREENWASHING IN FASHION: MISLEADING SUSTAINABLE PRACTICES

Iuliana Streba, Antonela Curteza

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

Corresponding author: Iuliana Streba, iuliana.streba@student.tuiasi.ro

PhD Supervisor: Professor Antonela Curteza
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

It is very well-known that fashion industry is a massive contributor to negative environmental and social impacts. While some fashion players are taking sustainability issues very seriously, others are choosing the path toward misleading about its environmental credentials. The number of fashion goods and services that claim to be sustainable, eco-friendly, carbon-neutral and so on, has exploded. The global rise of interest in pursuing sustainable practices has generated in a rise of "fake" actions and facts that companies report on the environmental and social impacts of their business activities. In a number of cases companies have resorted to the practice of providing inaccurate disclosures regarding sustainability as part of their corporate communications and sustainability reporting—commonly referred to as "greenwashing". Unfortunately, nowadays greenwashing is everywhere. Lately, there has been this raising sustainability and greenwashing awareness and which is developing further every year. Equally, raising awareness among consumers promoted change in some companies, while in others was an atractive strategy for marketers for promoting more and more misleading campains. On a frequent basis there appears more and more technological improvements in artificial intelligence which can be used with the means to rapidly and accurately analyze large volumes of text-based information, such as that contained in sustainability reports. In this paper we are: 1) defining the different varieties of greenwashing by different actors that have been mentioned in the academic literature, 2) presenting some of the actual tools to support the assessment of diverse green claims by any actor, 3) assesing greenwashing with the help of Artificial Intelligence and Machine Learning and, as well, 4) highlighting the instruments available for consumers to spot sustainable brands from the greenwashing ones. The article intends to open avenues for further research which can be used to create broader theoretical models regarding: 1) clear differentiation of sustainable practices versus greenwashing, 2) ways of standardization in terms of definitions of the terminology with the clear standardization of measuring sustainability for any given product, labelling process, corporate communications and their sustainability reports, and 3) how can those be used to lead to a more sustainable fashion industry.

Keywords: artificial intelligence, fashion industry, greenwashing, sustainability, sustainability reporting

RESEARCH ON BIODEGRADABLE MATERIALS BASED ON ZnMgTi

Alexandra-Tamara Sutic, Ana-Maria Roman, Romeu Chelariu, Nicanor Cimpoesu

"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 Sutic, alexandra-tamara.sutic@student.tuiasi.ro

PhD Supervisor: Professor Nicanor Cimpoesu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

Biodegradable materials, by definition, change their chemical and potentially physical form upon contact with the biological environment. Worldwide, considerable work is being done by several researchers for developing biodegradable polymers leading to the manufacturing of biodegradable polymer composites for various engineering applications. As a new kind of biodegradable metal, Zn possesses promising features, i.e. suitable biodegradability and biocompatibility, lower energy consumption for melting, better recyclability, and processing size tolerance. Such features provide some new insights for manufacturing medical implants. With the increasing demand for innovative therapies, biodegradable magnesium has attracted more and more attention, which could avoid secondary surgery and reduce complications. Titanium biomaterials are most commonly used for medical applications due to their exceptional characteristics such as high corrosion resistance and biocompatibility. Medical implants made of biodegradable metallic materials are increasingly gaining interest within the biomaterials field because of their superior mechanical properties and biodegradation rates compared to polymeric materials. Biodegradable metals (BMs) gradually degrade in vivo by releasing corrosion products once exposed to the physiological environment in the body. In recent years, three classes of BMs have been extensively investigated, including magnesium (Mg)-based, iron (Fe)-based, and zinc (Zn)-based BMs. Among these three BMs, Mg-based materials have undergone the most clinical trials. However, Mg-based BMs generally exhibit faster degradation rates, which may not match the healing periods for bone tissue, while Fe-based BMs exhibit slower and less complete in vivo degradation. Zn-based BMs are now considered a new class of BMs due to their intermediate degradation rates, which fall between those of Mg-based and Fe-based BMs, thus requiring extensive research to validate their suitability for biomedical applications. In the present study, recent research and development on Zn-based BMs are reviewed in conjunction with discussion of their advantages and limitations in relation to existing BMs. The underlying roles of alloy composition, microstructure, and processing technique on the mechanical and corrosion properties of Zn-based BMs are also discussed.

Keywords: biodegradable materials, mechanical properties, ZnMgTi alloy

EMBROIDERY TECHNOLOGY FOR E-TEXTILES

Andreea Talpă, Maria Carmen Loghin, Alice Mătăşel

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Industrial Design and Business Management, 29 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:

Through the incorporation of electronics, clothing has begun to transform into a fresh category of high-tech products as a result of evolving technologies and global digitalization. Emerging technologies like electronic textiles demand innovative design strategies that transcend conventional industrial lines. The development of technology has impacted the textile sector. Technologies and manufacturing methods underwent substantial change. Globally, the textile industry is regarded as one of the most polluting, necessitating the development of specific environmental rules. In the textile industry, several techniques were first created between the end of the 18th and the middle of the 19th century. Over the years, these techniques improved in terms of durability and manufacturing speed, but their basic idea has remained constant either way from the start. The textile industry has created new products that include new functionality in the textile materials as a result of various procedures, including spinning, weaving, knitting, sewing, and embroidery. They are referred to as smart textiles or e-textile. These types of textiles are made utilizing unique materials or fiber, such as iron, gold, silver, glass, clay, and carbon nanotubes, but they are built on the foundation of conventional technology. The textile industry has created new products for new applications in the areas of security, personal protection, and medical care using the whole spectrum of these transformation instruments. E-textiles are an emerging field of multidisciplinary study that calls for fresh design strategies. To find a breakthrough in the creation of wearable electronic devices, this field brings together experts in electronics, computer science, microsystems, and fabrics. Among the multitude of technologies present on the market (clothing, communication, information, healthcare monitoring, military, sensors, magnetic shielding, etc.), electronic textiles play an essential part. This article presents the principles of E-textiles and emphasizes the basic procedures, potential uses, and primary materials to construct wearable E-textiles. Along with the advantages and disadvantages of the wearable E-textiles that are covered in this article, stability, the efficiency of wearable electronic textiles, and reusability are explored as well.

Keywords: e-textile, embroidery techniques, embroidered fiber, textile industry, wearable technology

CHARACTERISTICS OF STAINLESS STEEL USED FOR PERSONAL PROTECTIVE EQUIPMENT IN THE FOOD INDUSTRY

George Daniel Tanasievici, Alin Marian Cazac, Nicanor Cimpoesu, Costica Bejinariu

"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Materials Science and Engineering, 41 Prof. D. Mangeron Blvd., 700050, Iasi, Romania

Corresponding author: George Daniel Tanasievici, daniel-george.tanasievici@academic.tuiasi.ro

PhD Supervisor: Professor Costică Bejinariu
"Gheorghe Asachi" Technical University of Iasi, Romania

Abstract:

The food industry is an area where the risks of accidents at work can manifest themselves in various forms, and personal protective equipment is an important segment in their prevention because they can be a barrier between risks and workers. Based on previous studies, the limitations of stainless steels in the design of personal protective equipment are identified so that they maintain their function as a physical barrier between danger and performer, to protect the body according to the directions in which the dangerous factor can act and to meets the requirements of ergonomics and maintenance of health. The characteristics of stainless steels in terms of hardness, corrosion resistance, elasticity, thermal conductivity, resistance to acids and alkaline solutions are advantageous properties that can be used to find optimal solutions in the production of personal protective equipment. Currently, more than 200 types of stainless steels are known, which are used in all fields of activity: food, medical, chemical, construction, automotive, naval, aerospace, etc. As stainless steel is a low-carbon steel that contains at least 11% chromium, this addition of chromium gives the steel its unique properties of stainless steel and corrosion resistance. The presence of chromium allows the formation of an extremely thin hard, invisible layer of chromium oxide on the steel surface, resistant to the action of corrosive media, capable of self-repair in case of mechanical or chemical alteration. The paper is also a review of studies on the properties of stainless steels in correlation with the maintenance of protective functions against risk factors acting on the human body. Based on previous studies, the limitations of stainless steels in the design of personal protective equipment are identified so that they maintain their function as a physical barrier between danger and performer, to protect the body according to the directions in which the dangerous factor can act and to meets the requirements of ergonomics and maintenance of health. At the end of the paper, study ideas are proposed on improving the structure and obtaining more efficient characteristics of these types of steels.

Keywords: characteristics, corrosive media, personal protective equipment, stainless steel, resistant

FINITE DIFFERENCE METHOD FOR SOLVING THE TWO-DIMENSIONAL LAPLACE EQUATION IN CURVILINEAR COORDINATES

Gabriel-Dumitru Tcaciuc, Aristotel Popescu

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

Corresponding author: Gabriel-Dumitru Tcaciuc, gabriel-dumitru.tcaciuc@academic.tuiasi.ro

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

Abstract:

The paper presents a numerical method for solving the two-dimensional Laplace equation in curvilinear coordinates using a finite difference scheme. Laplace equation is a differential equation used to describe various physical phenomena studied within different branches of engineering. The two-dimensional Laplace equation has analytic solutions only for simple shaped domains and simple boundary conditions (first and second kind). Even so, the results are usually complicated to interpret and use. The present paper proposes a method to solve the equation for domains bounded by complex inner and outer curves. The boundary curves are defined by a set of points from which the equations of curves are approximated by using Fourier series. The domain is generated by blending the two curves using a blending function. The results are a set of continuous parametric equations which are defining the domain in angle and radius variables. Following a method presented in the literature, the Laplace equations is transformed from Cartesian coordinates to curvilinear coordinates, as the Fourier series is easily differentiable. Next, the new Laplace equation is approximated using the finite difference method and a MATLAB code is developed to solve the system of linear equation using successive over-relaxation method (SOR). The presented method is used to simulate steady two-dimensional heat conduction in a polygonal shape domain, with uniform and non-uniform Dirichlet boundary conditions. Results are compared with the finite volume method from ANSYS, which is found to provide a good agreement. A notable advantage of the present method is the need for only two boundary conditions, for inner and outer boundaries, which can be prescribed by any type of function. Also, the method can be easily extended to three dimensions, by extruding the two-dimensional domain, which increases its range of engineering applicability. Also, with minimal changes, the proposed method can be applied to irregularly shaped domains, but observing two restrictions: boundary curves do not overlap or intersect and the domain description has to be continuous.

Keywords: curvilinear coordinates, finite difference method, Fourier series, heat conduction, Laplace equation

FINITE DIFFERENCE METHOD FOR SOLVING THE TWO-DIMENSIONAL LAPLACE EQUATION IN CURVILINEAR COORDINATES

Gabriel-Dumitru Tcaciuc, Aristotel Popescu

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

Corresponding author: Gabriel-Dumitru Tcaciuc, gabriel-dumitru.tcaciuc@academic.tuiasi.ro

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

Abstract:

The paper presents a numerical method for solving the two-dimensional Laplace equation in curvilinear coordinates using a finite difference scheme. Laplace equation is a differential equation used to describe various physical phenomena studied within different branches of engineering. The two-dimensional Laplace equation has analytic solutions only for simple shaped domains and simple boundary conditions (first and second kind). Even so, the results are usually complicated to interpret and use. The present paper proposes a method to solve the equation for domains bounded by complex inner and outer curves. The boundary curves are defined by a set of points from which the equations of curves are approximated by using Fourier series. The domain is generated by blending the two curves using a blending function. The results are a set of continuous parametric equations which are defining the domain in angle and radius variables. Following a method presented in the literature, the Laplace equations is transformed from Cartesian coordinates to curvilinear coordinates, as the Fourier series is easily differentiable. Next, the new Laplace equation is approximated using the finite difference method and a MATLAB code is developed to solve the system of linear equation using successive over-relaxation method (SOR). The presented method is used to simulate steady two-dimensional heat conduction in a polygonal shape domain, with uniform and non-uniform Dirichlet boundary conditions. Results are compared with the finite volume method from ANSYS, which is found to provide a good agreement. A notable advantage of the present method is the need for only two boundary conditions, for inner and outer boundaries, which can be prescribed by any type of function. Also, the method can be easily extended to three dimensions, by extruding the two-dimensional domain, which increases its range of engineering applicability. Also, with minimal changes, the proposed method can be applied to irregularly shaped domains, but observing two restrictions: boundary curves do not overlap or intersect and the domain description has to be continuous.

Keywords: curvilinear coordinates, finite difference method, Fourier series, heat conduction, Laplace equation

EXPERIMENTAL STUDY OF THE SHAPE MEMORY EFFECT IN THE CASE OF A NITI ALLOY WIRE SUBJECTED TO STRETCHING WITH VARIABLE LOADS

Adrian Petru Teodoriu[1], Ioan Doroftei[2], Leandru Gheorghe Bujoreanu[1]

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

Corresponding author: Adrian Petru Teodoriu, adrian-petru.teodoriu@student.tuiasi.ro

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

Abstract:

Shape memory alloys (SMAs) are metallic materials with the capacity to sustain rather large deformations in order to induce the cold shape (martensitic state), and to return to their original, "memorized" hot shape when heated (in the austenitic state). In the case of SMA wires, deformation involves elongation while shape recovery requires the contraction back to the unstretched length accompanied by the return to the original hot shape. The goal of this work is to experimentally study the behavior of a NiTi SMA wire under different temperatures and loading conditions. Considering that SMA commercial applications include actuators, control valves, circuit-board edge connectors, couplings and medical devices, the present study aims to report new features of SMA wires that might be useful in the development of new practical uses of work-generating shape memory effect (SME). For this purpose, a device was designed which can be used for the characterization of the mechanical behavior of different SMA wires, within future comparative studies. Our experimental device comprises a weight suspended at the end of an SMA wire at room temperature (RT), where the wire is martensitic (soft), by means of a pulley. Applying voltage at the ends of the SMA wire, produces heat, by the Joule effect, that changes the wire's state to austenitic (hard), contracts the wire at the unstretched length and lifts the weight. When the heat is removed, the wire cools down to RT and becomes stretched again while the weight descends. Because it can lift more weight during heating than it is required to stretch the wire to indicate the cold shape, the material has the potential to develop work. The wire used was a NITINOL alloy produced by Kellog's Laboratory (USA) with a 0.35 mm diameter, and 560 mm long. The measurements were harvested using thermocouple K type and linear resistive transducer. The obtained information was collected by means of an interface and processed as graphs.

Keywords: actuator, experimental device, memory effect, shape Memory Alloy, work generating shape

MODULATING FABRICS STIFFNESS - INVESTIGATION OF CELLULOSE STRUCTURE SURFACE MODIFICATION

Claudia Iuliana Udrescu[1,2], Carmen Maria Loghin[1], Savin-Dorin Ionesi[1], Roberto Pisano[2]

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Industrial Design and Bisness Management, 29 Prof. D. Mangeron Blvd., 700050, Iasi, Romania
[2]"Politecnico di Torino, Department of Applied Science and Technology, Corso Duca degli Abruzzi, 24, Turin, 10129, Italy

Corresponding author: Claudia Iuliana Udrescu, claudia-iuliana.udrescu@student.tuiasi.ro

PhD Supervisor: Professor Carmen Maria Loghin
"Gheorghe Asachi" Technical University of Iasi, Romania
Professor Roberto Pisano, "Politecnico di Torino, Italy

Abstract:

When produced, the textile materials can be considered a structure with a high degree of flexibility and softness. From a perspective of complete automation of the textile manufacturing process, the characteristics listed above might be considered as an obstacle and in particular as regards the employment of industrial robots in the process of making garments. Starting from the early stages, quality control in industrial production processes has used statistical methods to evaluate various sources of variability. For example, the Design of Experiments (DOE) is a method through which the input factors of a given process are modified to observe and document the effects on the final output. The purpose of this study is to highlight how the various treatments carried out on textile fabrics lead to surface modification, particularly how thermal treatment applied to a natural type of fibre structure, but with different characteristics, alters the fabric's native properties. In this study, the fabric's mechanical properties variability has been considered as a consequence of the thermal treatment practised. The type of thermal treatment and various parameters were planned since the final effect intended to be obtained on the cellulosic materials investigated was reducing their flexibility. Related to the experimental tests fulfilled, the thermal treatment and various concentrations of hand-builder were arranged to transform flexible materials into rigid ones. The results posterior to the tensile test highlighted how the finishing process impact fabric properties. Concerning the Loose-type cotton fabric, treatment with a solution at a different ratio of hand-building finish in an aqueous solution of hand builders downgraded the stiffness of the sample. Conversely, in the case of Tight-type cotton fabric, the solution concentration has a direct implication on the deformation caused by small stresses. Furthermore, it can be assumed that the textile fabric structure can be considered an essential role in this characterized thermal finishing also confirmed by the DOE analyses accomplished.

Keywords: actuator, experimental device, memory effect, shape Memory Alloy, work generating shape

VUCA FACTORS INFLUENCING STAKEHOLDER RELATIONSHIP MANAGEMENT DEVELOPMENT: A SYSTEMATIC LITERATURE REVIEW

Cristina-Elena Ungureanu, Ioana-Alexandra Sbîrcea, Rebecca Ana Maria Chiriţă

University Politehnica of Bucharest, Doctoral School of Entrepreneurship, Business Engineering and Management, 313 Splaiul Independenței Blvd., 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 term VUCA (volatility – uncertainty – complexity – ambiguity) accurately describes nowadays' high pace society in which changes reshape organisational management structures and impact stakeholder relationship management networks. As such, the influence of the VUCA phenomenon demands a closer evaluation in some of the industries where it had a high impact. This paper aims to provide the reader with a systematic literature review on the VUCA aspects which influence the development of stakeholder relationship management in specific industries, as well as provide a list of factors that influence organisational management evolution. The papers in scope for this study were selected if they considered the perceived impact stemming from VUCA factors. For this purpose, over 40 academic studies have been identified and analysed against inclusion and exclusion criteria. By using these criteria, papers were gathered from sources such as Emerald Insights, Elsevier, MDPI, De Gruyter, and IEEE in order to perform the literature analysis. Some of the factors that influence stakeholder relationship management include the perceived impact of engineering education, leadership adaptability and resilience, learning agility, a culture of innovation, perceive importance of systemic approaches, perceived ability of businesses to drive excellence, and other factors. While the method of conducting a systematic literature review can be perceived to be a foundational activity as part of the academic research process and make use of existing practices, this paper's novelty brings to the attention of researchers in the fields of stakeholder relationship management, organisational management, and the related themes, the importance that the VUCA phenomenon still holds in multiple industries and continues to build. By further continuing to research and analyse into the effects of VUCA, organisations can continue to develop so as to better respond to the challenges heading their way, such as those coming from their competition, society pressure to respond to needs and expectations, as well as to react to demand for more sustainable environments.

Keywords: engineering education, organisational management, leadership, stakeholder relationship management, systematic literature review, VUCA

TYPES OF LOADS ON BRIDGES - GENERAL REVIEW AND VEHICLES LOADS

Adi-Mihăiță Velniciuc

[1]"Gheorghe Asachi" Technical University of Iasi, Romania, Faculty of Mechanical Engineering,
61-63 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:

A bridge is a structure that provides a way to pass over a river, highway, and various obstacles. They are commonly used in cities and highway systems because they provide good efficiency for transport systems and travel between different cities and countries. Bridges are always subjected to different types of loads, which can be divided into three big categories: vertical loads, transversal loads, and longitudinal loads. For the first category, representative loads include dead loads, live loads, and impact. The second category is described by loads such as earthquakes, wind, centrifugal force, and lateral shock. Longitudinal loads are often described by loads like friction, wind, thermal, earthquakes, and braking. By knowing all these types of loads, the constructor can perform various stress calculations to determine the reliability degree of the analyzed bridge. Based on the correctness of these calculations, the bridge can be exploited in safe conditions for a specified period of time. The goal of this paper is to describe all types of loads that can appear in bridges. The primary function of a bridge is to have good performance under heavy loads represented by cars, trucks, trains and occasionally tanks. The ability of a bridge to withstand these loads is crucial to ensure the safety of the users and the longevity of the structure. Nowadays, the finite element methods (FEM) are highly used because of their capacity to simulate and evaluate the structure's efficiency before the beginning of the construction process and after that. We aim to develop future research and perform different types of stress calculations on the Octav Băncilă passage in Iași (Romania). Finite element analysis will be performed on vehicle loads generated by cars and trucks, which act on the bridge structure, simulating different loading scenarios. Based on the results of the stress calculations, we will establish the reliability degree of the bridge and higlight the dangerous sections of the structure.

Keywords: cars, finite element, stress, trucks, loads, reliability, vehicle

HYBRID MODELS BASED ON ARTIFICIAL INTELLIGENCE FOR MAINTENANCE MANAGEMENT

Adrian Vîlcu, Mădălina Laura Veleșcu, Ștefana Cătălina Pohonțu-Dragomir

[1]"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

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

Abstract:

The current research is part of the maintenance management field (MM) and proposes new concepts, models and analysis techniques for the operational safety of technical systems according to technological flow and operating time parameters. Thus, the first theoretical novelty is the proposal of Breakevent Point Maintenance Management (BPMM), through which critical values of reliability and maintainability parameters calculated according to quality and production policies are identified. Another theoretical innovation is the proposal of a new metric for the technical resilience parameter - the technical utility coefficient. For each technical proposal, a complete research methodology was created, which includes a literature study on the studied issue, hybrid modelling based on elements of artificial intelligence - neural networks, fuzzy systems, and genetic algorithms combined with mathematical and experimental techniques. If the present studies in this field analyzes the maintenance management parameters in individual mode, the current research performs an integrated analysis of all Safety in Operation parameters in a unique model correlated with two technological factors – production and quality. The BPMM method technically and economically validates the operation of equipment under the conditions imposed by the thresholds for the four parameters – security in operation, reliability, availability and maintenance. The relevance, scope and intensity of research and applications in the field of neural networks, genetic algorithms and fuzzy systems - directions united in the phrase Artificial Intelligence - are beyond any doubt. In the last ten years, the field has been in unprecedented development following the combination of models with algorithmic and statistical tools and with soft and hard implementation means. In this sense, specific soft computing tools were developed for the BPMM that practically combines AI techniques with mathematical algorithms and statistical approaches. The results of the research are found in new conceptual proposals in the field of MM, the implementation of new software tools based on mathematical and experimental algorithms, hybridized with AI techniques and new practical methodologies, easy to use both in academic and industrial environments.

Keywords: AI models, maintenance management, technical reliability, technical resilience, MTTR, MTBF

Some key figures:

- ✓ 154 papers
- ✓ participants from 9 countries (authors and co-authors)
- ✓ 28 universities, research and development institutes, companies

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