TUIASI doctoral

CSD INTERNATIONAL CONFERENCE OF THE DOCTORAL SCHOOL

"GHEORGHE ASACHI"
TECHNICAL UNIVERSITY OF IASI, ROMANIA

5TH INTERNATIONAL CONFERENCE OF THE DOCTORAL SCHOOL

BOOK OF ABSTRACTS

18-20 MAY, 2022
IASI, ROMANIA

Excellence in Doctoral Studies through Innovation, Convergence and Interdisciplinarity

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5th International Conference

of the Doctoral School

"Gheorghe Asachi" Technical University of Iasi

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BOOK OF ABSTRACTS

May 18 – 20, 2022

IAŞI, ROMÂNIA

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- "Gheorghe Asachi" Technical University of Iasi, Romania
- Council for Doctoral University Studies, CSUD
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Conference Sections

- **Section 1.** Computers and information technology; Systems engineering
- **Section 2.** Chemistry; Chemical engineering; Environmental engineering
- **Section 3.** Civil engineering and installations
- **Section 4.** Electrical engineering; Energy engineering; Electronic engineering, telecommunications and information technology
- **Section 5.** Mechanical engineering; Industrial engineering; Materials engineering; Engineering and management

Organizer Message

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

At its fifth 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 (18th-20th of May, 2022) 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 CSD2022, wishing you a successful conference!

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General information

About our university

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

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

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

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

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

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

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

PLENARY CONFERENCES

THE SMART TEXTILES, FROM THE TRADITION TO THE ARTIFICIAL INTELLIGENCE

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Abstract:

The textile is known to be, in Europe a traditional industry that exists since ages, but with the globalization, this industry has migrated to the low incomes countries and in Europe only the high additional value products are currently produced now. In these products, the technical textiles leads the market, but with the crisis of the cellulosic fibers, and the COVID 19 it appears that the production of natural fibers and simple textile products must be relocated in European countries again.

In the textile industry many techniques have been initially developed at the end of the 18th to the middle of the 19th century, with the time these techniques have been improved in terms of reliability and production speed, but their principle are still plus minus the same since the very beginning.

Thanks to these techniques, spinning, weaving, knitting, sewing and embroidery, the textile industry has developed new products embedding, in the textile materials, new functionalities. It is what they are called "Smart Textile". These smart textiles are produced on the base of the traditional technologies but using specific material such as iron, gold, silver, glass, clay, carbon nano-tubes, etc. Using all the range of these transformation tools, the textile has developed new products for new applications in the field of health, personal protection, security, etc. As an example, lighting fabrics, new facial mask with better performance, sensors embedded into the textile, sensors printed on the textiles and so on… in addition to these development, the textile becomes connected in order to collect the date (from the sensor) and to send information to command the actuator that has been added to the structure. In order to be able to treat these data, it is obvious that the connection with the techniques of the artificial intelligence and the big data treatment is "a must" in order to use, in an optimum manner the data collected.

All these new developments will be the heart of this presentation.

CONCEPTS AND METHODOLOGIES FOR THE DEVELOPMENT OF AUTONOMOUS OFF-ROAD VEHICLES

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COLLABORATIVE INTERDISCIPLINARY RESEARCH WITH INDUSTRY – SUCCESS STORIES OF TUIASI

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Abstract:

Technical University Iasi is a university with an important entrepreneurial dimension, which cooperates with industry in many activities of research and development and also has an important dimension in technological transfer of its own innovation results. The Technological Transfer Center "Polytech" was accredited in 2020 by the Romanian Ministry of Research, Innovation and Digitalization. The Center offers business consulting, by identifying the technology transfer needs of the companies, offering a large portfolio of services to economic agents: evaluation, expertise, technological audit, technological monitoring, reports, analysis and forecast studies, technical information, technical consultancy, technology transfer advice, evaluation of innovation potential, assistance in purchasing products and services specific to the field of activity, providing specialized assistance for the restructuring, refurbishment and modernization of SMEs. On the other hand, the Center is ensuring the technical and legal support for companies to acquire patent licenses, carrying out market studies and research, feasibility studies and business plans, organizing, upon request, technological demonstration activities and identifying the financing schemes for the application of the research results to the beneficiaries. The center staff has a large experience in providing technical assistance to economic operators on the exploitation of their own intellectual property with direct effects on increasing economic competitiveness and the number of jobs. Finally, the Center is carrying out campaigns to promote the offer of products / technologies / services at local, regional, national and international level by organizing specific actions to promote the results of the common RDI activity (business meetings, presentation stands, participation in domestic and international fairs and exhibitions). The actual presentation is related to the RDI activity performed by Technical University Iasi in cooperation with two of its own start-up companies, in the domain of nano-technologies, bio-sensors and energy harvesting, and offers a new image upon the perspective of students and postdoc researchers to be immediately integrated in a creative activity, at industrial level, under the tutoring of university senior researchers.

STRUCTURAL INTEGRITY OF POLYMERIC COMPONENTS OBTAINED THROUGH ADDITIVE MANUFACTURING

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Abstract:

The additive manufacturing (AM) is part of Industry 4.0 technology. Now the AM is integrated in many industries due to limitless geometrical possibilities of the products and to relative reduced production time. Different AM techniques were developed for polymeric materials: Fused Deposition Modeling (FDM), Digital Light Procession (DLP), Selective Laser Sintering (SLS).

The relation between technological parameters and mechanical, fracture and geometrical properties is very important to be known. Extensive mechanical and fracture tests, for fully characterizing the properties of plastic components obtained by through AM were performed. In addition, in what extend the obtained properties belong to the material or to the technology used for fabrication represents a major concern.

The influence of manufacturing parameters (direction of printing, layer thickness, filament color, and so on) on the tensile strength, Young modulus and fracture toughness will be highlighted.

MARINE RENEWABLE ENERGY AND THE TRANSITION TO A LOW CARBON SOCIETY

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PHOTOVOLTAIC THERMAL HYBRID SOLAR COLLECTORS: STATE OF THE ART AND RECENT R&D ACTIVITIES

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Abstract:

Photovoltaic thermal hybrid solar collectors (PVT) are hybrid systems that combine two types of solar energy technologies: photovoltaic (PV) and thermal collectors. PVT collectors are solar microcogeneration systems, thermal and electrical energy are produced simultaneously. Furthermore, PVT collectors are more efficient than a photovoltaic panel (PV) and allows for greater autonomy. This paper gives an overview on Photovoltaic thermal hybrid solar collectors and their significant advantages and presents recent R&D activities carried out by INSA Strasbourg ICUBE.

SECTION 1.

Computers and information technology;

Systems engineering

COMPARISON OF CNN ARCHITECTURES FOR VISUAL SERVOING SYSTEMS

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Abstract:

Visual feedback control offers robotic systems advanced capabilities in overcoming high challenges in applications. The concept of visual servoing refers to the usage of image data in order to control the movement of a robotic system. There are two classical visual servoing techniques: pose-based visual servoing (PBVS) and image-based visual servoing (IBVS). PBVS uses the geometric model of the environment and camera calibration parameters in order to estimate the pose of an object relative to the camera. Image features are inputs of IBVS to estimate the needed motion trajectory between the current and the target image. These classical architectures present disadvantages such as the dependence on the camera parameters, in case of PBVS, or dealing with nonlinear transformations, in case of IBVS.
These limitations can be alleviated with the usage of visual servoing architectures based on Convolutional Neural Networks (CNN). The role of the neural network in this case is to extract relevant features from the input images and to generate useful information than can be used for the control law.
This paper addresses to IBVS. Our goal was to develop networks that approximate the camera velocities when receive as input a pair of images made on current and target layouts of the scene. In this context, we compare the performances of two architectures. One architecture is derived from a pre-trained AlexNet model, using transfer of learning for importing as much as possible initial values of the neural parameters. The second model uses an architecture reported with good results in the Visual Servoin domain, and it was trained from scratch. The networks were trained on 20.000 pair of images illustrating different initial and final layouts. The performed evaluation is based on statistical indices such as Root Mean Squared Error (RMSE) computed for training, validation and testing datasets. The experimental results indicate good approximation capabilities of the neural models and good generalization, as RMSE values results very small, for all linear and angular velocities. As expected, the best results were provided by the first model, due to a better initialization of the training parameters.

Keywords: Convolution Neural Network, Visual Servoing, Robotics, Deep Learning, Machine vision

SECURITY AND ENCRYPTION OF DATA USED IN CLOUD COMPUTING

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Abstract:

The doctoral thesis presents the topic of security and encryption of data used in cloud computing, addressing the issue of security and their maintenance by ensuring an effective protection system based on quantum theory. The aim of the research is to increase the security used in the cloud by applying data encryption techniques. The methodology for experimenting with the doctoral thesis is that a principle of quantum theory will be applied to develop a quantum signature cloud. Following the research, the main results are the development of a software system based on cloud technologies for business management in an organization and the development of a new type of cloud based on quantum signature.

The information for the secret services is the data and materials obtained by special means and which are of operational interest, each of them bringing new clarifying elements in relation to the previously accumulated knowledge. The measures for the protection of classified information shall be determined in relation to the classes and levels of secrecy of the information, the volume and medium of information, the quality, function and number of persons who have or may have access to information according to the security certificate and access authorization. compliance with the principle of knowledge needs, threats and risks and vulnerabilities that may affect the classified information. The transmission of classified information to the user will be carried out only if he has security certificates or access authorizations corresponding to the level of secrecy.

Telecommunications are the transmission, transmission and reception of signals, signals, writings, images, sounds or information of any kind by wire, radio, optical system, or other electromagnetic systems. Nowadays, wars are no longer on the battlefield, but at the information level, whoever has the information wins the battle. The information may be stored electronically on the computer, but may be attacked because the computer may be exploited illegally by computer fraud, computer fraud, damage to data or software, computer sabotage, unauthorized interception, unauthorized reproduction of software. protected and computer espionage by using an unauthorized computer.

In order to the information not to be compromised, three of its characteristics must be protected: confidentiality, integrity and availability.

Keywords: cloud computing, cryptography, data security, quantum theory, blockchain

DATA FUSION TECHNIQUES BASED ON INTERCONNECTED VEHICLE SENSORS

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Abstract:

Although the automotive industry has clearly expressed interest in autonomous vehicles for more than a decade, this concept is still far from being massively deployed on current roads. However, this topic is extremely hot, much research being performed towards achieving the desired outcome both by industry researchers and by researchers in the academia. The proper functioning of an autonomous vehicle requires the use of data from sensors that operate in a similar manner as the human senses, e.g., radars detect objects located at bigger distances, while optical cameras are mainly used to identify traffic participants, traffic signs, lanes, obstacles, etc. But, to obtain more accurate information regarding the environment and to decrease error effects, sensor data fusion is performed, which mainly combines data from several sensors to obtain a clearer overview of the surroundings. Moreover, one of the key factors in the development of autonomous vehicles is vehicle-to-vehicle (V2V) communication, which facilitates the exchange of information between vehicles. V2V communication enables the transmission of information from one vehicle to another that can include environmental data, e.g., decentralised environmental notification messages (DENM) containing information about road hazards or abnormal traffic situations, including their type and location.

Thus, this paper presents the concept and the implementation of sensor data fusion from different entities. Hence, by means of V2V communication, information is exchanged between different vehicles, suct that an ego vehicle has access to sensor data from other vehicles. Note that, for more efficient communication between different vehicles, the 5G technology was used, which allows data transfer at much higher speeds, has a much wider range, and more stable connections. In the developed application, the exchanged information is represented by primary data from radar and camera sensors, which is further processed before being passed on to the fusion framework.

Such a fusion algorithm based on sensor data from the ego vehicle and on data from other vehicles aims to create a comprehensive environment model of the surroundings. Thus, the approach can be used in functionalities developed to avoid congestions that are common in urban traffic and to avoid possible collisions.

Keywords: autonomous vehicle, sensors, sensor data fusion, V2V, 5G

COMPARISON OF LINEAR QUADRATIC REGULATOR AND MODEL PREDICTIVE CONTROL BASED ALGORITHMS IN CONTINUOUS PHARMACEUTICAL MANUFACTURING

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Abstract:

The Fourth Industrial Revolution (Industry 4.0) brings to the foreground the technology and automation of large-scale complex processes within cyber-physical systems (CPSs). This new concept refers to large-scale interconnected systems of heterogeneous components integrating computation with physical processes through data exchanges to intelligently monitor (from physical to cyber) and control (from cyber to physical) our environment. In this context, pharma production must adopt a new approach, from batch to continuous manufacturing to make it possible to integrate production through CPSs. This would bring several benefits to the pharmaceutical industry, from reducing production costs to increasing product quality as well as adapting the manufacturing process to the different types of tablets. A continuous-flow process will need time to start up and shut down, and can include other disturbances in its dynamics, which is why continuous manufacturing involves the use of both feedback and feedforward control to respond in real-time to disturbances in different units. Thus, in this paper, a new multivariable control technique is proposed for the production of pharmaceutical tablets. The linear quadratic regulator (LQR) method is a control strategy designed to provide optimal responses in terms of stability and robustness for a given plant. For the pharmaceutical process, this involves the centralized control of the main process units used in the dry granulation process (direct compaction) of the tablets. Moreover, to achieve the desired level of control using the LQR algorithm, a Luenberger observer must be designed to estimate the system states that cannot be measured. A comprehensive plant model is used to test the designed controller and to illustrate and analyse the obtained performances. Furthermore, a comparison of the obtained results with the ones obtained by a previously designed model predictive control algorithm is used to emphasize the advantages of the proposed control strategy. The obtained simulation results illustrate that the proposed control strategy is able to keep the outputs in the constrained set even in the presence of reference changes.

Keywords: Cyber physical system, continuous manufacturing, Industry 4.0, linear quadratic regulator, model predictive control

COMPARATIVE ANALYSIS BETWEEN 4G LTE AND 5G NR: AN EVALUATION OF CELLULAR COMMUNICATIONS FOR V2X TECHNOLOGY

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Abstract:

Cellular vehicle-to-everything (C-V2X) technologies are to allow vehicles to exchange information with each other, with the network, but also with other road users, based on secure, reliable, and high-capacity communications links. The use of C-V2X leads to improved road safety and traffic efficiency, over-the-air software updates, pollution reduction, remote driving, which in the end support the implementation of autonomous vehicles. The main cellular communication standards used within the C-V2X technology are the following: 4G Long-Term Evolution (LTE) and 5G New Radio (NR). The LTE-V2X was first developed under Release 14 (Rel. 14) and improvements have been made to it in Release 15. It was developed to increase road safety and reduce traffic congestion by periodically broadcasting a Cooperative Awareness Message (CAM), and thus informing participating vehicles about the condition of the vehicle that sent the message. The 5G-V2X was firstly introduced in Release 16 (Rel. 16), which was developed as a complement to LTE-V2X, not as a replacement for it. Its advantages are linked to the increase of reliability and capacity, decrease of latency, coming with some new use cases, such as: vehicle platooning, remote driving, and advanced driver assistance functionalities. Moreover, for V2X communication, different cast types are possible in addition to broadcasting, such as unicast that allow direct communication between a pair of user equipment (UEs), and multicast which involves sending a message from a UE to a set of group receivers. This paper presents a reliability assessment for LTE-V2X and 5G-V2X standards, by highlighting the differences and innovations introduced by 5G in C-V2X technologies. Thus, this paper follows both a theoretical analysis of cellular communications in V2X technology, through a comparative analysis of the contribution of each of them in relation to the offered technical specifications, and a practical part, where various performance indicators were validated using the Simu5G simulator, which can simulate wireless communication networks and network components with a behaviour close to that experienced in real-life.

Keywords: C-V2X, 4G LTE, 5G NR, performance metrics, Simu5G

A BRIEF OVERVIEW OF FEDERATED LEARNING - A NEW PERSPECTIVE ON PRIVACY CHARACTER

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Abstract:

Nowadays, real-world systems increasingly use machine learning techniques to detect anomalies and make real-time decisions. Starting with the promulgation of the General Data Protection Regulation (GDPR), the main challenge for deep learning applications is related to the privacy and ownership of datasets. Thus, Google introduced recently the federated learning (FL) technique to offer support for high privacy-sensitive data, which makes FL a hot research topic today because data privacy became a critical societal concern. The initial works on FL were dedicated to mobile devices, but now this approach is used to improve the application's functionality and to preserve security and data confidentiality. FL is a distributed machine learning technique in which multiple devices (clients) collaboratively train a global model to solve issues where the first concern is data privacy.

The main objective of this paper is to explore the challenges and the advantages of FL by observing how this new concept can be used in the existing applications to obtain the desired results, especially to preserve the privacy character of the dataset. Thus, this paper provides a brief study of FL: an overview of this new topic, related works, a comparison with other machine learning techniques, an overview of algorithms that are currently used, and in the end some simulation results and new directions of research. The results were obtained using the MNIST dataset of handwritten digits to investigate the distributed behaviour of the FL algorithm and the federated averaging method. Also, TensorFlow was used as an interface for expressing machine learning algorithms for testing and evaluation. Firstly, an analysis of the client's model's performance versus the performance of the global model was performed. Secondly, the performance was analysed for different situations in which the dataset suffers modifications, with the objective of testing their influence on the global model. Through the performed analysis of the obtained results, it was figured out that FL would be beneficial for several applications in domains like automotive, 5G, robotics, medical, and others.

Keywords: federated averaging, federated learning, machine learning, privacy, TensorFlow

WHAT FACTORS INFLUENCE TECHNOLOGY ADOPTION IN EUROPE? A PANEL DATA APPROACH

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Abstract:

The technology, in particular the ICT (Information and Communications Technology) sector, have an increasing role in education in the latest years and are at the forefront of an innovative and inclusive society.
This paper depicts the factors that influence the digital sector in its various aspects. It takes into account classical socio-economic factors, such as GDP (Gross Domestic Product), employment, the population structure, as well as foreign direct investment, patents and graduates in STEM (Science, Technology, Engineering and Mathematics). The ICT sector is captured by several different variables: internet utilization, broadband take-up, the number of internet servers and the persons employed using computers.
The research is focused on the impact of technology on labour market and its challenges for the younger generation. This paper takes the first step of the analysis, the identification of the relevant factors in technology adoption, since the adoption at national level influence the available resources. The relevant indicators for this part of the analysis are the macro-economic ones at European level.
Based on panel data from Eurostat, World Bank and World Intellectual Property Organization covering 27 European countries between 2013 and 2019, the results were estimated using the panel data regressions, namely pooled regression and models with fixed and random effects. The results differ from one dependent variable to another both in number of significant independent variables and their positive or negative effect. In the case of the internet usage and coverage, the population structure plays a significant positive role; in the case of the internet infrastructure, the number of graduated in STEM and the employment rates have positive effects, while the share of rural population has a negative effect.
The results can be used by policy makers and public audience in their analysis of the ICT context in Europe and for taking informed policy measures for the digital sector in the future.

Keywords: Europe, ICT for development, OLS, panel data

ADVENT OF WASSERSTEIN GENERATIVE ADVERSARIAL NETWORKS WITH GRADIENT PENALTYFOR SYNTHESIZING AGRICULTURAL WEED IMAGES

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Abstract:

Data generation is deemed more than just data augmentation and is of primary importance in the context of training a deep neural network where large amount of training data is needed. This is a requirement in precision agriculture-based application of weed identification and removal, wherein weeds are to be identified under different environmental conditions during early stages of crop phenology. This training forms one of the most fundamental components for agricultural robots in later stages when the weeds need to be physically removed. Recently, there is a plethora of state-of-the-art methods, where certain deep learning techniques are employed to learn a model for the target assignment of weed classification and segmentation. However, these methods come with a prerequisite of a voluminous amount of image annotations for fulfilment of model training. In this experiment, we generated artificial weed images using Wasserstein Generative Adversarial Network (WGAN-GP) with Gradient Penalty. The scope of this work is to facilitate the segmentation experiment from the viewpoint of augmenting training images, thereby revoking the need for manual annotations. Among other Generative Adversarial Networks (GAN), WGAN comes with an advantage of trainability to the point of optimality. Making use of few subsets created out of true color as well as multispectral agricultural images, we are able to generate artificial weed samples as their synthesized coequals. To achieve this purpose, we employed a WGAN where the generative model was trained by conditioning the shape and spectra of the weed leaves. The output comprised of 3-band multispectral images. Quantitatively, the generated datasets have the following properties: (i) Demonstrated the model's capability of handling convergence problem of vanishing gradients through penalizing gradients with large norm values at the cost of longer computational time and generating realistic multi-spectral weed images, (ii) Handling of mode collapse problem, through compensating Wasserstein distance loss.

Keywords: Generative Adversarial Network (GAN), Gradient Penalty (GP), Semantic segmentation, Wasserstein Generative Adversarial Network (WGAN), Weed detection

CNN-BASED SEMANTIC SEGMENTATION FOR DETECTING THE SEGMENTS OF A ROBOT

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Abstract:

Technological evolution creates a scenario in which robots are part of human life and have the role of performing more and more tasks in their place. This evolution involves generalizing and expanding the set of tasks that can be performed by robots. The fulfilment of a task by a robot is intended to be performed even in the conditions in which unexpected events occur, events that would be easy to manage by humans.
In this context, machine vision systems can integrate neural networks that have the ability to learn some tasks and use the acquired knowledge to perform new similar tasks. A preliminary step for many intelligent methods is to identify the segments of the robot while observing it with an external visual sensor. In this paper, the identification of the segments is treated as a semantic segmentation problem and is solved using convolutional neural networks. The main advantage of convolutional neural networks is that they allow an end-to-end learning of the feature extractor and classifier, without requesting to define problem-dependent features. This semantic segmentation problem is difficult due to the positions in which the robot segments can be found after multiple translations or rotations. Also, in many applications, a high degree of accuracy is requested, in order to support an effective integration of the semantic maps into the next stages of learning.
To ensure a precise pixel-wise localization of all relevant segments of the robot, the semantic segmentation is solved with SegNet. SegNet includes an encoder part which extracts relevant features and a decoder part which constructs a map of labels having the same size as the input image. The neural network is initialized via transfer of learning from a pre-trained model and retrained on a problem - dependent dataset. The training dataset includes about 50000 images captured during different actions of the robot and the corresponding true label maps. The experimental results validate our proposed approach by generating a detection error close to 0 for all the segments of the robot.

Keywords: convolutional neural network, deep learning, feature extraction, segmentic segmentation, visual servoing

DEVELOPMENT OF A PROGRAMMABLE SYSTEM USED FOR THE PREPARATION OF A MIXTURE OF FLAMMABLE/EXPLOSIVE GASES

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Abstract:

In the field of research and experimental work a big concern was the preparation of known gas mixtures and their concentration. Gas mixtures with air can be produced through a large number of methods such as mechanical valves, electric valves, with the help of mass flow regulators, by indirect reading of the concentration by measuring the oxygen concentration as well as by applying the Daltons law of partial pressures. Yet each of these methods must be treated separately depending upon the given experimental circumstances. In addition, before any designs of a gas mixtures systems are made, a scientist must decide what concentrations, volumes, flow rates, accuracies and equilibrium times are required. Although gases and vapours usually act in a predictable manner, it is necessary to recognize deviations and to apply appropriate corrections. Is mandatory a determination of material resources and fabrication budged of the designed system to meet his needs. In physical experiments carried out in the laboratory activity it is necessary to use a system that reduce the concentration of known gases. The produced gas mixtures must be in the explosive range between lower explosive limit (known as LEL) and upper explosive limit (known as UEL) and with a 0,1 % volume of accuracy. The operation principle of the system is based on the mixing of two volumetric flows, controlled by a programmable microcontroller, at which the gases are stored and conveyed at atmospheric pressure with the help of cylindrical injectors, with a storage capacity of 10 cubic decimetres. These injectors are operated with stepper motors so that the gas circuit does not require valves of any kind and at the outlet there is a homogenization chamber, equipped with agitator and sensor dedicated to flammable/explosive gas and to confirm the programmed concentration.
As a short recap gas mixing and blending systems perform automatic gas mixing in order to generate accurate gas calibration standards, to create gaseous atmospheres or to produce gas mixtures for research or analytical production purposes.

Keywords: explosion, gas, microcontroller, stepper, sensor

AGILE APPROACHES TO DEVELOPING E-BUSINESS SOLUTIONS IN A SECURE CYBER ENVIRONMENT IN 2022

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Abstract:

Modernity is characterized by major transformations and evolutions, which have penetrated into the depths of all levels of human existence, in all economic, political and social spheres, thus significantly increasing the quality of life. The Information Society is the model of society in which the main good is information itself. Although the accelerated development of information and communication technologies (ICT) is the process behind the evolution of the information society, the new model of society means much more than technological progress. In the technological age, action plans and policies are being developed to meet the challenges, the most important technology being ICT, which allows information to be processed and conveyed in a revolutionary way. The information society is the ICT-based knowledge society. Information society technologies will evolve in the direction of being at the fingertips of the knowledge process, by generating, storing, and transmitting knowledge. Knowledge is the result of the information management process, thus promoting innovation, economic development, and decision-making in an efficient and transparent way. E-business is the basis of the new economy, of an information society that catalyses the future of an increasingly secure artificial intelligence for the development and use of new technologies of the future. The fracture between e-Services vs. e-Activities in the post-pandemic context is evidence of the emerging strategy, which will generate various opportunities for the ever-changing business environment:

- e-Applications (e-learning, e-working, e-banking, e-Services, e-Activities)
- Basic services (e-mail, file transfer, Virtual Private Network)
- Telecommunication networks (telephone lines, cable, radio, satellite, 4G, 5G, 6G)
- Emerging technologies in the e-Business sector (IoT, EoT, Cloud, Fog)

The technological infrastructure of the new economy, in constant need of ensuring all the principles related to cyber security, generates new e-business models, from e-commerce to the desideratum of the e-Government implementation strategy, through digitalization and computerization of public administration in Romania.

Keywords: cybersecurity, digital transformation, e-Business, emerging technologies, security of critical infrastructure

A SHORT SURVEY OF THE DEVELOPMENT AND APPLICATIONS OF SPIKING NEURAL NETWORKS OF HIGH BIOLOGICAL PLAUSIBILITY

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Abstract:

In biological world the brain uses spikes or impulses to process information and adapt. They are the pillars of perception and control providing the living creatures exceptional adaptation in the real environment, making them able to outperform the conventional robots in most of the aspects of life. For the last decades, natural intelligence served as a source of inspiration in the fields of neuroscience, electronics and computer science which made possible the development of improvements in the emerging hardware technologies and software paradigms. These enhancements rely on computing techniques inspired by the brain's mechanisms of information processing. Spiking neural networks (SNNs) are inspired from natural computing, modelling with high accuracy the interactions and processes between the synapses of the neurons focussing on low response time and energy efficiency. This novel paradigm of event-based processing opens new opportunities for discovering applications and developing efficient learning methods that should highlight the advantages of SNNs such as the large memory capacity and the fast adaptation, while preserving the easy-to-use and portability of the conventional computing architectures. In this paper, we review the developments of the past decades in the field of SNNs taking into consideration the bio-inspired applications in Robotics. We start with a brief history of the SNN and summarize the most common models of spiking neurons and methods to implement synaptic plasticity, followed by the presentation of the computational advantages and liabilities of SNNs. We also classify the SNNs according to the implemented learning rules and provide and explanation for each one. We present the applications suitable for using SNNs in terms of energy efficiency and response time and we briefly sweep through the existing platforms and simulation frameworks that provide an easy-to-use environment for SNNs simulation and exploration. The paper ends with conclusions that show predictions of future challenges and the emerging research topics which associated with the design and control of robots using SNNs.

Keywords: s Hebbian learning, neurorobotics, neuromorphic hardware, piking neural network, survey

SECTION 2.
Chemistry;
Chemical engineering;
Environmental engineering

DIFFUSION MODELS FOR CHITOSAN RELEASE FROM DIFFERENT TYPES OF MATRICES

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Abstract:

The controlled release of a component-matrix system is predominantly conducted by the diffusion process. To optimize the time required for a component-matrix design it is required to use a suitable mathematical model to characterize the system.
Mathematical modeling of some components release as drugs, cosmetic products, pesticides and fertilizers can be very useful to speed up product development and better understand the mechanisms which control the component release from diffusion-controlled delivery systems. In this work reservoir devices and matrix systems of different geometries are presented. These theoretical models can predict the dependency between different types of component-support interaction. The models presented take into account the geometry of the support, the porous or the compact structure of the support, the support-component interactions and the type of support-fluid medium contact (fixed bed, mixing vessels, etc.).
Various factors that influence the diffusion of the component released through the support have been considered. The support used can be cylindrical or spherical. The models take into account both the shape and the structure of the matrix, which can be compact or porous.
Development of a delivery system requires depth research until is reached the optimal configuration which can be scalable and suitable to be used in the industry. The obtained results will give information that can be useful in the formulation of materials with various uses. Due to the high diversity of needs in various fields of activity such as cosmetics, agriculture, oil, etc., numerous studies have been performed on biocompatible materials that may meet the requirements of selectivity, metabolism, biodegradability and bioavailability. Nowadays researchers have focused on the use of biodegradable polymers like chitosan due to their low cost and relatively easy production compared to synthetic polymers where the cost is high.
In this paper will discuss about characterization, properties and industry applications of the chitosan in compact and porous matrix, encapsulation process of different active substance, which highlights the necessity of using diffusion models for the life cycle development of a new product.

Keywords: controlled release, diffusion, mathematical modeling, polymer, porous matrix

NATURAL CARRIERS FOR BACTERIAL IMMOBILIZATION USED IN BIOREMEDIATION

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Abstract:

In the last few decades the environment has been drastically polluted due to the fast industrialization and anthropic activities. As a boomerang effect, different areas around the world started to shift their original state to one where life itself is continuously diminished, mostly resulting from hazardous circumstances (e.g., oil spills on land and water bodies, chemical plant explosions, cyanide, heavy metals and acid spills from mining exploitation). Although, scientists made a big leap in the environmental biotechnologies, developing and applying new ways to reconstruct polluted environments. Microorganisms have a key role in this processs due to their efficiency, friendly-environment effect and cheap cost of use.

Bioremediation started traditionally using just free cells as a decontaminating tool, however, in couple of years, immobilized microorganisms gained a lot of attention due to their higher stability, retention in time and biotransformation efficiency. Aforementioned immobilization can be realised either on natural carriers (e.g., sewage sludge, plant fibres, agricultural wastes, forestry residues, volcanic rocks, etc.) or synthetic carriers (e.g., polyurethane foam, polyvinyl alcohol, polystyrene, etc.). This new support matrials require a lot of attention along their making process, the final product for immobilization can shift its characteristics even by the slightest parameter modification.

The main goal of this paper is to summarize and bring in the spotlight the most relevant data regarding the microbial immobilization on specific natural carriers and its importance for environmental remediation. Following aspects can be considered the backbone of an efficient immobilization process, e.g., the feedstock (pretreated or transformed in conversion processes e.g., pyrolysis and HTC processes), the microorganisms that can be immobilized on carriers and the pollutants. Using specific microorganisms attached on natural materials we can trace the new capacities and limitation of this method. The literature reveals a new trend that arises in environmental biotechnology, for which natural/organic materials can be efficient carriers for microorganisms, considering that most microbial biofilm formation need a nutritive support and a protective matrix. Although there are few papers on bio-based materials and bacterial immobilization, a lack of knowledge still perseveres in relationship that establishes between the porous material and the bacterial biofilm. Especially in-situ studies require more attention due to their future perspectives in biotechnologies.

Keywords: carriers, feedstock, immobilization, microbial biofilm, porous materials, pollutant degradation

OPTIMIZATION OF PROCESS PARAMETERS FOR RETENTION OF Cd(II) IONS ADSORPTION FROM AQUEOUS SOLUTIONS ON CLAY MATERIALS

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Abstract:

Globally, heavy metal pollution is classified as serious environmental problem. Cd(II) ions are commonly encountered pollutants that are toxic to human life, even at low concentration and adsorption is one of the most suited process for this heavy metal ions removal from aqueous solutions. Clay materials have risen as potential options in contrast to conventional adsorbents in term of their immense surface area, pore size distribution, high adsorption capacity and chemical stabilities, available in large quantities in many region of the world, easy to prepare. The adsorption properties of clay in retention of Cd(II) from aqueous solutions have been studied in batch technique. The amount of adsorbed heavy metal ions was determined for the adsorption systems as a function of adsorbent dose, initial solution pH, initial Cd(II) ion concentration, contact time and temperature. The optained experimental results indicates that the highest adsorption efficiency of clay material was found at initial pH of 7.0 while the adsorbent dosage is 4.0 g/L. The adsorption equilibrium is very fast and was reach within 10 minutes of contact time and ambient temperature, which indicates that the adsorption of Cd(II) ions on clay material is an economic process. Under this conditions, the removal percent of Cd(II) ions is over 93% over the initial concentration range between 11.0 and 160.0 µg/ml Cd(II). Langmuir and Freundlich models were used to fit the equilibrium adsorption data and the statistical parameters depict a better and satisfactory correlation for Langmuir model. Kinetics analyses show that the maximum of adsorption was quickly reach and could be described by a pseudo-second order kinetic model. The thermodynamic parameters of the adsorption process (ΔG, ΔH and ΔH) were also evaluated from isotherms. The results of this study suggest that clay materials can be used as an excellent adsorbents for Cd(II) ions removal from industrial effluents and could be a promising future alternative for heavy metal retention processes.

Keywords: adsorption, cadmium ions, clay materials, heavy metals, toxic metal ions, water pollution

TAILORING NANOSTRUCTURES OF LAYERED DOUBLE HYDROXIDES FOR SPECIFIC APPLICATIONS IN NANOMEDICINE

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Abstract:

In last decades, researches in the field of nanostructured materials have focused on the structural complexity of these assemblies to obtain nanoarchitectures with complex properties and applicability in the most diverse fields. Nanostructured assemblies may be able to combine the properties of the components, but they can also develop their own characteristics. Nanomaterials are a branch of nanotechnology and are a priority in recent years due to the wide potential of their applications from electronics to agriculture, construction, medicine, catalysis, pharmacy and environmental protection, so the science of nanomaterials has become increasingly studied by to researchers. The 2-D nanostructures possess versatile physical-chemical properties that allow their use in different biomedical applications such as diagnosis, prevention but also the treatment of the specific diseases. An example of typical 2-D nanomaterials is the class of layer double hydroxides (LDHs). These nanomaterials are non-polluting and low-cost materials belonging to the class of anionic clays. The versatility of layered double hydroxides makes it possible to obtain new materials with remarkable properties capable of acting as advanced materials in many applications with global impact. The specific properties of LDHs such as high specific surface area, various chemical composition, ion exchange capacity, magnetic and optical properties, thermal stability, structural memory effect and formation of mixed oxides, are responsible for their applicability in various fields such as catalysis, environmental protection, industry, nanomedicine, pharmacy, cosmetics, biochemistry, biotechnology. These anionic clays have a wide applicability in many fields of interest due to their properties such as high physicochemical stability, low cytotoxicity or not at all, good biocompatibility with different biomolecules as well as the unique self-assembly property of the structure due to memory effect.
Herein, we present the newest results regarding the synthesis methods and characteristics of some of the LDHs and their heterostructures with nanoparticles of Cu, Zn or Au and biomolecules like gene, antibiotics, vitamins, enzyme. To synthesize the LDHs with specific compositions, for example MgAlLDH, ZnAlLDH, various synthesis procedures such as coprecipitation method, reconstruction method or hydrothermal method are used.

Keywords: 2-D nanomaterials, biomolecules, layered double hydroxides, nanoparticles, physical-chemical characteristics

SYNTHESIS AND LIQUID CRYSTALLINE PROPERTIES OF SOME SYMMETRIC SEVEN RINGS ISOPHTHALIC ACID DERIVATIVES WITH BENT-CORE MOLECULES

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Abstract:

Bent-core liquid crystals (BCLS) have been widely studied for the past 30 years due to the discovery of ferroelectric and antiferroelectric type of layers organization. Compared to classical calamitic liquid crystals, BCLS organized in smectic layers (related to the direction of polarization) depending on the direction of the applied electric field. This property along with the anisotropy in polarized light and orientation of molecules along the one or two axes of symmetry makes these molecules very attractive for such technical applications as: display devices, sensors, optical data storage and generally switching devices. However, the desired electro-optical properties are closely related to the structure of the bent molecules.

Following the classical steps in organic synthesis and purification, we obtained a new class of bent core compounds with liquid crystalline properties. In order to achieve the purposed structures, two types of intermediate compounds have been designed: a compound with a bent molecule, which acts as a center of symmetry and several alkylated calamitic mesogens that formed the arms of the bent-core molecules.

The core molecule was obtained by esterification of isophthaloyl dichloride with p-nitrophenol, TBAHS and K2CO3, followed by the reduction of nitro groups to 1,3-bis(4-nitrophenyl)isophthalat with SnCl2 x 2H2O in ethanol. The calamitic mesogens were obtained by diazotization of p-aminobenzyldehyde and coupling to phenol, followed by Williamson etherification with several alkyl bromide CnH2n+1Br (n= 6,7, 8, 10, 18). The final Schiff bases were synthetised by condensation reaction of corresponding amino and alkylated aldehyde derivatives. Purification were performed, namely recrystallization and / or chromatography in a mixture of suitable solvents. The confirmation of structures of intermediary compounds was done by 1H-NMR and 13C-NMR spectra. The structure of finale compounds was elucidated by FT-IR data that revealed all the characteristic absorption bands, confirming the reaction pathway. The mesomorphic properties of bent-core molecules were investigated by Differential Scanning Calorimetry (DSC) and Polarized Optical Microscopy (POM). All bent-core compounds presented enantiotropic mesomorfic behavior. Unfortunately, the isophtalic bent-core derivatives showed high melting and clearing temperatures, if compare to their resorcinol analogous reported before.

Keywords: bent-core, isophthalic acid derivatives, liquid crystals, organic synthesis, Schiff bases, symmetric molecule

REMOVAL OF Cu(II), Co(II) AND Zn(II) METAL IONS FROM AQUEOUS MEDIA USING BIOCHAR OBTAINED FROM ALGAE BIOMASS

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Abstract:

Heavy metal contamination is recognized as a major environmental concern due to its ubiquity and persistence. Because they are not biodegradable, there is a crucial need to develop techniques that should be efficient, economical, and rapidly deployable across a wide range of physical settings. The migration of pollutants in aqueous environments is the basis for the development of an important category of methods for their removal, in which biosorption plays an important role. Algae biomass has both a high biosorption capacity and environmentally tolerant characteristics. Biochar from algae biomass is rich in nutrients and is considered, from an economic point of view, a low cost method. In this study, the removal of Cu(II), Co(II) and Zn(II) ions from the aqueous solution was examined using two types of biochars obtained from algae biomass (Ulva lactuca sp.). The biochar samples were obtained by pyrolysis of algae biomass at two different temperatures (320 and 550oC), under limited oxygen conditions. Biosorption experiments were performed in batch systems, by varying the initial pH of the solution (2.0 - 6.5), the dose of biochar (4.0 - 32.0 g / L), the initial concentration (12 - 210 mg / L), contact time (5 - 180 min) and temperature (4 - 50 oC). Following the obtained results, the optimal conditions for the removal of Cu(II), Co(II) and Zn(II) metal ions on the two types of biochar were established. Isotherm and kinetic modeling of the experimental data demonstrates that the biosorption of metal ions from the aqueous solution on the biochar takes place predominantly through electrostatic interactions and that the efficiency of the biosorption process is strongly influenced by the nature of the biochar. According to experimental studies on biochars obtained from algae biomass, their use as a biosorbent material can be considered a favorable alternative for the removal of metal ions.

Keywords: algae biomass, aqueous media, biochars, biosorption, ions removal

REMOVAL OF Pb(II) IONS FROM AQUEOUS MEDIA BY ADSORPTION USING PET FIBERS FUNCTIONALIZED WITH ORANGE G DYE AS ADSORBENT

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Abstract:

Continuous development of industrial activities has determined the accumulation of heavy metals in water sources, and a significant degradation of the quality of ecosystems. This has negative consequences for a variety of living species, because heavy metals are non-biodegradable and are toxic, even at low concentration. In order to reduce the heavy concentration, numerous physico-chemical methods are now available for the removal of heavy metal ions from industrial effluents. Adsorption has been shown to be an effective and low-cost method for the removal of a large variety of heavy metal ions from aqueous solution, including Pb(II) ions. Among the significant advantages of adsorption, some of them, such as: removal efficiency, ease of operation, recovery of retained metal ions, low energy consumption, etc., are very relevant from a practical perspective. But all these advantages of adsorption processes largely depend on the nature of solid material used as the adsorbent. In this study, the adsorption of Pb(II) ions from aqueous media on polyethylene terephthalate (PET) fibers functionalized with Orgnge G dye was studied, as a function of initial Pb(II) ions concentration and contact time, in batch systems. To quantitatively evaluate these adsorption processes, the experimental data were modelled using Langmuir, Freundlich and Temkin isotherm models, and pseudo-first order, pseudo-second order and intra-particle diffusion models. The results obtained by isotherm and kinetic modeling indicate that the adsorption of Pb(II) ions on PET fibers functionalized with Orgnge G dye follow the Langmuir isotherm model and the pseudo-second order kinetic model. In addition, the maximum adsorption capacity for PET fibers after functionalization (46.65 mg Pb(II)/g) is comparable with the values obtained for other materials used as adsorbents for Pb(II) ions removal. The results included in this study will provide a clear image of the possibility of functionalization of PET fibers to obtain high-performance adsorbents for environmental decontamination.

Keywords: adsorption, aqueous media, functionalization, Pb(II) ions removal, PET fibers

THE USE OF THERMOGRAVIMETRIC ANALYSIS IN THE STUDY OF SUBLIMATION PROCESS

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Abstract:

The thermogravimetric analysis is a simple but very accurate method of measuring mass variation and temperature. The use of thermogravimetric analysis for the study of the sublimation process has experienced an intense development in recent years. Most researchers have used this technique to evaluate sublimation enthalpy and less sublimation rate and mass and heat transfer. In this study, thermogravimetric analysis is applied to evaluate the influence of temperature on the rate of the sublimation process. A comparative kinetic study of the sublimation process of caffeine (Fisher Chemical) and theophylline (Sigma Aldrich) was performed. The experimental determinations were performed with the Mettler Toledo TGA-SDTA851e equipment, at temperatures of: 80, 100, 120 and 140°C, the same amount of sample and the rate of the drive agent of 0.003 m/s. The sublimation process was evaluated for one hour. In order to verify the reproducibility of the obtained data, several recordings were made, for the same experimental conditions. The processing of the recorded thermogravimetric curves was performed with the STARe software version 9.10. It has been established that the mass loss velocity follows a zero-order kinetics. The kinetic parameters were calculated: activation energy and preexponential factor. It has been established that the rate of caffeine sublimation is 1.25 times higher than that of theophylline. Given that data on the evaluation of the sublimation process for caffeine and theophylline are found in the literature, they can be used as standards for the study of the sublimation of organometallic compounds often used as precursors for chemical vapor deposition (CVD). The development of this field, which involves chemical or physical deposition processes in thin film, is closely linked to maintaining control over the precursor feed rate.

Keywords: caffeine, kinetic study, sublimation process, theophylline

ECONOMIC AND ENVIRONMENTAL COST ANALYSIS OF FOOD WASTE RECOVERY ALTERNATIVES

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Abstract:

In order to live in better conditions, the population permanently used natural resources: animals, plants, trees, ores, coal, salt, oil, natural gas, water. The use of these primary natural resources can result in waste. The food industry is under increasing pressure to improve its environmental performance, both from consumers' perspective and legislative forums, which are also responding to consumers' pressures. About a third of globally produced food is lost or discarded. Food waste is a substantial loss of other resources such as land, water, energy and labor. Despite some progress, and some good food redistribution initiatives, too much food still end up in landfills. After being digested aerobically, they emit a lot of greenhouse gases that have a negative global impact on the population and the environment. Estimations show that 8-10% of global greenhouse gas emissions result from not consumed food.

In this study, we developed an analysis of food waste reuse efficiency of in the form of materials and energy by applying the Cost-Benefit Analysis (CBA). The selected boundaries for the two series of alternatives are: (i) recovery of food waste as compost used as soil amendments; (ii) combined processing of food waste for obtaining both compost and energy. The results obtained from the application of CBA have shown that the second alternative has a major advantage in terms of environmental benefits, widespread applicability and costs involved.

In conclusion, the application of the Cost-Benefit Analysis in this study has shown that a series of high costs, time required, materials and energy obtained from food waste and another set of key factors encourage the selection and application of food waste recovery technologies.

Keywords: benefits, composting, costs, energy food waste

THE ANTIMICROBIAL ACTION OF NANOEMULSIONS BASED ON ESSENTIAL OILS

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Abstract:

In the context of the multidrug resistance era, the synthesis of essential oils attracts the interest of researchers in multidisciplinary fields through their biomimetic and synergistic potential.
The idea of an adjuvant in antimicrobial treatment or at least in addition to background treatment that not only does not promote the appearance of resistant bacteria but fights multidrug resistance by rebalancing the basal cellular metabolism only aligns with the goals of contemporary medicine with technological progress in nanotechnology.
There are several formulations of nanoemulsions based on essential oils with a dermal and mucosal application whose effectiveness has been proven, but our question is whether we could address such nanoemulsions in the oral mucosa. Studies on oral pathogens demonstrate their bactericidal and bacteriostatic effect but there remain several elements that need to be analyzed and on which the academic community must focus to provide an answer, elements that will be presented and discussed in this review.
However, the formulation of new preparations and the upgrading of therapeutic strategies with such solutions can only be achieved following a concrete, clear analysis of the results of research to date and the identification of areas and disadvantages that require in-depth research and development.
This paper summarizes the results of a review of the literature on the formulation of emulsions and nanoemulsions based on essential oils and the antimicrobial activity of these essential oils, sprinkled in places with some observations on the potential use on tissues other than dermal especially the mucosa of the oral cavity.
Oral applications of nanoemulsions are still a new topic in biomedical research and for their development, we have identified the need to evaluate concentrations and cytotoxic potential on the oral mucosa. It also needs to identify the therapeutic potential in the treatment of peri-implantitis due to the sensitivity of bacteria such as porphyromonas gingivalis on compounds extracted from essential oils, as well as applications in the therapy of oral cancer and digestive tract mucosa.

Keywords: antimicrobial activity, essential oils, nanoemulsions, nanotechnology

USING OF HEC-RAS MODEL FOR HYDRAULIC ANALYSIS OF THE RIVER BAHLUEȚ

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Abstract:

In this study, the flow characteristics of the Bahlueț River are presented using the HEC-RAS model to analyze the hydraulic behavior of this system. To extract the necessary information for modelling, 3 computational profiles were established for the input data. For each chosen profile the HEC-RAS software calculates the flow characteristics: terrain profiles, flow velocity in the river, accumulated water volume, flow rates as well as the limnimetric key. Based on the obtained results it is possible to locate areas with high, low and constant flow characteristics. Sectors with wide or narrow sections can be identified allowing floodplain estimation. It was observed that some flow characteristics, such as water velocity and volume of water accumulation in the river, increase with the water level in the river. Hydraulic simulation was performed for 1%, 5%, 10%, 20% flood recurrence scenarios over a period of time with heavy rainfall. In terms of input data, the HEC-RAS model required a flow of data, observed at the Cârjoaia and Târgu Frumos rain gauge and hydrometric stations, knowledge about the topography of the watershed using a digital terrain model with a certain resolution, a land use map of the study area, soil map, as well as other information that will ultimately lead to valuable results. The simulation provides very useful information, for decision makers, such as height, velocity and flow time. These results can be used as a tool for flood risk mapping. Flood modelling using HEC-RAS 6.0 provides the possibility to visualise the flooded area boundaries with the different maximum heights recorded during the flood event. Not surprisingly, a simple model can be very close to the real results when working at the level of detail and taking into account all parameters influencing the rainfall-flow process.

Keywords: flow, HEC-RAS, profile, velocity, volume

A COMPARATIVE STUDY ON THE EFFICIENCY OF BIOPESTICIDES FROM SPONTANEOUS FLORA AGAINST DEPOSIT PESTS

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Abstract:

As the population has become more aware of the quality of agricultural products, and of the content of substances with undesirable effects that they may contain, more and more research is being done to partially or completely replace pesticides. Many studies have confirmed the effectiveness of plant extracts in controlling crop and storage pests. Plant-derived biopesticides are reported to be effective in controlling various harmful insects through numerous mechanisms of action. This paper presents a comparative study that highlights the effectiveness of alcoholic and hydroalcoholic extracts from spontaneous flora of the species Orignum vulgare and Arthemisia absinthium, as a source of substances with insecticidal effect. To obtain the vegetal extracts, two extraction methods were used: a modern, "green" one (ultrasound assisted extraction) and a conventional one (maceration). For an increased efficiency, we also considered combining the two extraction methods. The ultrasound assisted extractions were performed in an ultrasonic bath, with a frequency of 35 kHz and power 320 W, at a temperature of 60 °C, for 30 minutes, after which it was left to macerate at a temperature of 22±2 °C for 9 days to increase the degree of extraction. The extraction efficiency and also, the content of polyphenols and flavonoids were higher for the hydroalcoholic extracts, which is also confirmed by the efficiency of the applied hydroalcoholic treatment on pests which was slightly higher in the case of treatments using a 1: 1 hydroalcoholic extract. The highest efficiency of the biopesticides obtained from the species Orignum vulgare and Arthemisia absinthium was achieved after 168 hours from the first administration of the raw extracts. The experiments were performed in duplicate, considering also the control sample, on 20 individuals of the species Achantoscelides obsoletus. In conclusion, the hydroalcoholic extracts (1:1) of the species Origanum vulgare showed a mortality rate of 72.5%, compared to 62.5% in the case of the species Artemisia absinthium. On the other side, the alcoholic extracts (96% ethanol) of Origanum vulgare showed a mortality rate of 70%, compared to 55% for the species Artemisia absinthium.

Keywords: Achantoscelides obsoletus, alcoholic extracts, Artemisia absinthium, biopesticides, hydroalcholic extract, Origanum vulgare

QUANTITATIVE STUDY OF THE MELT DEGRADABILITY OF MODIFIED AND UNMODIFIED RENEWABLE POLYESTERS

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Abstract:

Renewable polyesters are polymers of practical interest even for the 2050 perspective both as a raw materials source and for mechanical recycling. However, these polymers grades have a major deficiency generated, mainly, by the susceptibility to hydrolysis amplified by thermo-mechanical conditions. The purpose of the paper was to identify a quantitative factor for quantifying the melt degradability of renewable polyesters used in the manufacture of single and multilayer films. Afterwards, this parameter will be used for mechanical recycling according to the defects dilution principle, of pre-consumer waste resulted from this fabrication. In the degradability study the following polymers were used: polylactic acid (PLA), mineral filler PLA (TF-PLA) and PLA modified with thermoplastic elastomer (TE-PLA). The degradation study was performed on both dry and wet state of the three materials, in extensional flowing regime from an indexer device. The influence of the variable melting flow conditions on the fluidity and the melt flow resistance was studied. For this purpose, a Dynisco Polymer Test indexer was used by varying the temperature between 1800C and 2400C and the load from 2.16 kg to 10 kg. By considering the dependence of the studied properties on the values of the molecular weight and through reporting. For each studied properties, the values for the wet state to the dry those the degradation factors, for each situation, were identified. According to the obtained degradation factors, the hydrolysis generates the decrease of the molecular weight mainly at low temperatures, below 190^0C and at low values shear stress values. The result is plausible if it is considered the time required for the hydrolysis of the macromolecules and at high temperatures the water can leave the system. The hydrolytic degradability in melt processing conditions is accentuated by the presence of mineral fillers or of thermoplastic elastomer. The values of the identified degradation factors allow quantitative assessments on the destruction process produced by each studied factor. These factors can be calculated for any situation of practical interest in which quantitative estimates of the destruction of polymers and polymeric materials are required.

Keywords: degradation, degradation factor, fluidity, melt processing, renewable polyester, shear stress

WINDOWS WASTE GLASS CAPITALIZATION FOR OBTAINING MATERIALS WITH IMPOSED PROPERTIES

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Abstract:

The impact of waste glass on the characteristics of novel composite materials was examined in this study. The density and mechanical properties of the samples were examined in order to determine the impact of waste glass (WG) concentration. The river aggregate was replaced with WG in various ratios in our experiments.
The waste from the Piatra Neamt factory was crushed and sieved to get a size that was comparable to natural aggregates. The concrete class C16/20 was utilized, with 2, 4, and 10 wt. percent WG added. The resultant material was evaluated for density, consistency, air content, absorbability, compressive strength, and other factors. In a concrete station laboratory, all tests were carried out in line with the established norm.
The density of the resulting materials reduced as the WG content increased. The densities were lower than the witness sample, ranging from 2334 to 2379 kg/m^3. The findings show that adding glass debris to concrete has a negative impact on its characteristics. With the addition of WG, the mixture became less homogenous, with asperities on the surface. Because of the differential in density between WG and natural coarse aggregate, the fresh density of WG concrete dropped as the percentage of WG increased. The concrete samples containing 10% WG obtained the lowest scores. The findings show that adding waste to concrete has a detrimental impact on its qualities, however the percentage drop in strength was maximum 14 % for concrete with 10% WG, and 7 percent for concrete with 4% WG. When compared to double glazing waste, the foiled WG had lower values. The addition of WG aggregate decreased compressive strength in the experiment, although the final values were within Romanian standards' limits. This study shown that WG aggregate can be used as a natural aggregate substitute. For the WG % used, the losses in characteristics were not significant. Capitalization of window glass waste as a partial replacement for coarse aggregate resulted in significant economic and environmental benefits. Future research is needed before the use of WG in industrial application.

Keywords: composite materials, glass waste, properties, waste dosage

DRUG-LOADED ELECTROSPUN NANOFIBROUS MEMBRANE WITH POTENTIAL ANTIMICROBIAL ACTIVITY

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Abstract:

Electrospinning, a versatile nanofiber processing technique, has acquired considerable attention over conventional nanofiber fabrication methods owing to its inherent advantages, such as reasonable control over fiber dimensions, scalability, process convenience, and applicability towards an extensive array of materials. Electrospinning has been revolutionized as an efficient process to prepare nanofibers from polymer solutions. It is a highly scalable process with a range of parameters which can be tuned to affect the outcome of the fiber properties. Therefore, proper control of these parameters is necessary to achieve the desired fiber morphologies and diameters. Complex polymer nanostructures are of particular interest due to their tunable physicochemical properties such as catalytic activity, high sensitivity, electrical and thermal conductivity, scattering properties. Achieving a nanostructuring of a polymer matrix is a fundamental challenge for the field of polymeric materials science and nanotechnology. In this study, we present a concise introduction to the electrospinning technique and its application in drug delivery. The electrospun nanofibres were obtained from polyester-based polymers which are biodegradable and biocompatible and therefore suitable as drug delivery systems. They were loaded with a model hydrophobic drug and the drug release kinetics was investigated in PBS at pH 7.4 and 37°C over time. The morphological properties of the drug free and drug-loaded electrospun fibers were analysed by SEM. The obtained results showed that these electrospun fibers have a smooth surface and that their size is in the nanometric range.

Keywords: antimicrobial activity, electrospinning, electrospun nanofibers, polyesters

CHITOSAN BASED THERMOSETTING RESINS

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Abstract:

Chitosan is a polysaccharide with impressive structural possibilities of chemical and mechanical modifications to obtain derivative materials having new properties and applications. Chitosan is a linear copolymer consisting of D-glucosamine and N-acetyl-D-glucosamine units connected by β-1,4 linkages, obtained after partial deacetylation of chitin and as the degree of deacetylation can vary therefore, also the molecular weights. However, the processing of chitosan under different conditions than weakly acidic solutions continues to be a challenge. Chitosan is obtained from chitin, the most abundant amino-polysaccharide biopolymer, an abundant and cheap source, being found especially in the exoskeleton of crustaceans, insects, mostly coming from the seafood processing industry as waste. Due to its biocompatibility, biodegradability and non-toxicity, it has huge potential for various developments. In consequence, chitosan is considerably more versatile than cellulose by its functionality: amino groups from the deacetylated units at C-2, acetamide at C-2, and hydroxyl groups at C-3 and C-6 positions. It is the most important chitin derivative and can replace toxic and non-degradable compounds in many applications, especially biomedical, drug delivery, but, also, for cosmetics, water purification, composites or self-healing materials.

Our recent studies focused on the use of chitosan in the production of thermosetting resins. Five crosslinking formulations have been developed in which, the chitosan molar ratio was varied and correlated with the reaction enthalpy and the performances of the 3D synthesized materials. The reactivity studies were followed by in situ methods, using FTIR and DSC analysis. All five proposed formulations showed very good reactivity. The thermal and mechanical properties of the materials were tested by DMA, tensile tests and Shore D analysis. The chitosan-based 3D materials showed very high glass transition values, high thermal stability, storage moduli, etc. All these performances, together with the natural origin of the formulations components, make these systems feasible for industrial applications.

Keywords: chitosan, glass transition, reactivity, storage moduli, thermosetting resins

DOUBLE-LAYERD HYDROXIDES (LDH) AND AgNP / LDH NANOSTRUCTURED ASSEMBLIES: SYNTHESIS, PHYSICO-CHEMICAL PROPERTIES STUDIES AND CYTOTOXICITY TESTS

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Abstract:

Layered double hydroxides (LDH), also known as anionic clays, which are promissing layered materials, due to their interesting properties, such as facile synthesis procedures, unique 2-D layered structure, uniform distribution of different metal cations in the brucite layer, specific nature of the intercalated anions in the interspce, or their ability to intercalate different type of anions (organic, biomolecules, and even genes), joined by their high biocompatibility.

This work presents ZnLDH and MgLDH and their ensembles with silver nanoparticles (AgNP). Moreover, we are going to discuss here the complex physical -chemical properties of the synthesized nanostructures. Advanced characterization techniques, such as, X-Ray diffraction, UV-Vis spectroscopy and FESEM microscopy were used in this study. It was found that we succeed to fabricate well-crystallized LDH owning an ordered layered structure that join the optical response of the LDH to that of the nano-sized silver. Further, our results reveal that AgNP/LDH assemblies have a superior cytotoxic behavior compared to LDH precursor MgAlLDH and ZnAlLDH at a concentration of Ag less than 3%.

Keywords: layered double hydroxides, nanocytotoxicity, physical-chemical properties, silver nanoparticles

TAILORING THE STRUCTURAL PROPERTIES OF ZnLDH SUBSTITUTED WITH Ga BY USING XRD AND TG/DTG ANALYSIS

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Abstract:

In recent years, researchers have described two-dimensional (2D) inorganic nanomaterials as strong points in the fields of nanotechnology, with wide applications in current fields (biomedicine, photocatalysis, electrochemistry, etc.) due to their specific properties. In order to improve the catalytic and electrochemical properties of layered double hydroxides (LDH), it is necessary to replace them with different metals. In this study, we report the investigation of the change in the structural properties of ZnAlLDH and ZnGaLDH following their thermal decomposition by calcination at 7500C and 9250C as a result of the formation of mixed metal oxides (MMO) composed of metal oxide and spinel phases. LDHs containing zinc and Al/Ga in the layers with a cation ratio of 3/1 were synthesized by the co-precipitation method at constant pH. Changes in the structural characteristics of ZnMeLDHs when aluminium was replaced by gallium and of mixed oxide derivatives were assessed by X-ray diffraction (XRD) and thermogravimetric analysis (TG/DTG). The results of the XRD analysis for ZnAlLDH and ZnGaLDH show a single LDH phase without any impurity, indicating slight differences between samples prepared with different trivalent cations, in relation to the higher volume of Ga compared to Al due to the different cationic rays. After the calcination, the LDH structure collapsed and the characteristic XRD reflections of the mixed oxides were obtained. The XRD results revealed the formation of ZnO/ZnAl2O4/ZnGa2O4 and ZnO /Ga2O3/ZnGa2O4 nanoscale assemblies derived from ZnMe (Me = Al/Ga). The results of the thermal analysis show that the mass loss reported in terms of moles was almost similar for ZnAlLDH and ZnGaLDH.
In conclusion, results show that both the composition of LDHs and the calcination temperature are important parameters that can be used to tailor the structural characteristics of the evolved mixed oxides.

Keywords: layered double hydroxides, mixed oxides, structural properties, thermogravimetric analysis, X-Ray diffraction

DIFFUSION CONTROLLED RELEASE FROM A POLYMERIC MATRIX

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Abstract:

Controlled release systems are generally classified based on their physico-chemical, pharmaceutical or clinical appearance. They can also be classified according to the release mechanism and preparation methods such as: physical systems, chemical systems and biological systems.
The release of drugs in stages or in distribution could be beneficial when treating many classes of drugs, such as anti-inflammatory agents, antibiotics, chemotherapeutic drugs, steroids, hormones and vaccines. The ability to control medication can be an important factor, especially when traditional oral or injectable formulations are difficult to distribute. In some cases, a slow release of a water-soluble drug or a rapid release of low-solubility drugs may be needed.
Different types of mass transport processes may be involved in controlling the release of the drug from a dosage form. This could include diffusion of water into the system, diffusion of the drug out of the device, dissolution of the drug, swelling of the polymers, erosion of the anterior matrix, osmotic effects and other phenomena. If several of these processes occur in a sequence and one of the processes is much slower than all the others, this is the step of limiting the rate for the entire sequence.
Diffuse mass transport is almost always involved in controlling the release of the drug from a dosage form. Drug diffusion is the predominant step in combination with polymer swelling or polymer degradation / matrix erosion. Diffusion mass transport is almost always involved in the controlled release of drugs from a dosage form.
The ideal system for administering the drug should be inert or biodegradable, biocompatible, mechanically resistant, comfortable for the patient, able to obtain high drug loads, safe from accidental release, easy to administer and remove, and easy to manufacture and sterilize.
The aim of this work is to highlight some models for drug release from polymeric matrix and mass transfer limitation effects. Predictions of drug release profiles by mechanistic models are useful for understanding mechanisms and designing drug release particles.

Keywords: composite, diffusion, drug release, polymer matrix

THE EFFECT OF TEMPERATURE ON THE PREPARATION OF HYDROCALUMITE UNDER MICROWAVE IRRADIATION FROM ALUMINUM SALINE SLAG

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Abstract:

Secondary Aluminum Production (SAP) is based in one of the most interesting properties of aluminum: this metal can be recycled an infinite number of times without losing its properties and quality compared to aluminum produced from bauxite by combination of Bayer and Hall–Héroult processes (Primary Aluminum Production). Different types of wastes are generated during primary and secondary aluminum production, but one of the most hazardous one is salt cake, which contains a large amount of aluminum, which can be recovered by acid or alkali extraction processe and the extraction solutions can then be used as sources in the preparation of compounds based on this metal, such as zeolites and Layered Double Hydroxides (LDHs).

LDHs are anionic clays with a general formula $[M(II)1\text{-}xM(III)x(OH)_2]x+[An\text{-}]x/n\bullet mH_2O$, where M(II) and M(III) are divalent and trivalent cations and A is the interlayer anion. When the divalent cation is Ca^{2+}, the trivalent cation is Al3+, and the anion is chloride, the LDH is called hydrocalumite ($Ca_2Al(OH)_6Cl\bullet 2H_2O$). The effect of the reaction temperature on the properties of hydrocalumite prepared under microwave (MW) irradiation has now been studied. The solids were prepared by the coprecipitation method from an Al^{3+} solution obtained after treating an aluminum slag with aqueous NaOH under reflux conditions and the subsequent removal of silicon species by precipitation upon addition of HCl up to pH = 1. Characterization of the obtained solid was carried out by powder X-ray diffraction, thermal analysis, infrared spectroscopy, elemental chemical analysis, electron microscopy and N2 adsorption–desorption at –196°C. The results showed that the use of the extracted aluminum solution allowed the obtention of hydrocalumite by the coprecipitation method and that the temperature of the MW ageing treatment had a large effect on the formation of side phases, in addition to hydrocalumite.

Keywords: aluminum recovery, hydrocalumite, layered double hydroxide, microwaves ageing, crystallinity, saline slag

ACHIEVEMENTS AND LIMITS ON THE CHEMICAL CHARACTERIZATION BY NON-DESTRUCTIVE TECHNIQUES OF MEDIEVAL SILVER COINS ON THE TERRITORY OF MOLDOVA

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Abstract:

The coins represent one of the most important categories of the cultural heritage of Romania, as every museum has significant numismatic collections of great value and diversity. According to international standards, in terms of quality, the numismatic fund constitutes, along with the European fine art, the most intrinsic value of cultural heritage. The museum collections include hundreds of medieval coin hoards, which are important sources for reconstructing the political, economic and social history, not only from a local point of view, but also from a broader perspective, the Southeastern and Central European one. The quantity, quality, and purity of the alloy as well as the stability of the weight of coins represented true barometers of the power and prestige of the states in the international arena or in public perception. Acknowledging the impressive number of coins, we choose as chronological interval the period of the 16th and 17th centuries. Spatially, the territory of the historical Moldavia covers the entire issue referred to in the present research. The paper presents experimental results obtained by combining non-invasive techniques (optical microscopy - OM, fluorescence spectroscopy X - XRF) in determining the degree of degradation of the composition and structural characterization of silver coins belonging to the treasury of Iasi, dating from the 16th and 17th centuries.
In this paper there are analyzed by non-destructive methods, coins from nine locations, archaeological pieces from the Moldavia's History Museum - "Moldova" National Museum Complex of Iasi. After analyzing the numismatic inventory, the nature of the composite materials has been identified. A study of the surface analysis of metal artifacts (optical microscopy) were observed physical damage processes (cracking, fragmentation, grinding or erosion) chemically altering generated by the soil conditions. The arrangement of the elements in the corrosion crusts is achieved by XRF determinations directly on the artifacts or by SEM-EDX surface assessments. Following investigations by XRF analyzes were obtained important data regarding the chemical composition and fakes determination. These data have been introduced into a database.

Keywords: degree of degradation, hoard of coins, MO, numismatics, XRF

EFFECT OF pH ON THE H-B-E FERMENTATION BY *Clostridium carboxidivorans* CARRIED OUT IN A CONTINUOUS STIRRED TANK BIOREACTOR

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Abstract:

The increasing concerns regarding climate change, fossil resource fluctuating price/availability and the energy suppling stability have reinforced the need for alternative fuel resources. Use of synthesis gas - syngas, mainly composed of CO, CO_2, N_2, H_2 - to produce fuel/chemicals via biotechnological route could likely be an option to address part of this challenge, it also making it possible to valorise waste products such as biomass residues and non-biogenic residues (e.g. plastic waste). Syngas fermentation offers a pathway for sustainable synthesis of fuels and chemicals with lots of advantages over catalytic syngas conversion. This technique also makes it possible to use exhaust gases from certain industries (e.g. steelworks), thus further reducing environmental pollution. *Clostridium carboxidivorans* is a bacterium able to grow using CO or CO_2 + H_2 as a source of C and energy. This bacterium is able to convert syngas into products for industrial applications such as acids (acetic acid, butyric acid and hexanoic acid) and solvents (ethanol, butanol and ethanol).
This contribution reports the assessment of the growth kinetics of *C. carboxidivorans* by using CO as carbon/energy source. Tests were carried out in a well-mixed reactor operated continuously with respect to both gas and liquid phases under controlled pH. The conversion process was characterized under steady-state conditions in terms of concentration of cells, acids, and alcohols. Preliminary results regarded tests carried out in the bioreactor operated under selected conditions in particular the effect of pH variation as a function of fresh liquid flow rate was analysed, while maintaining a constant gas flow rate pure CO (99,79%).
The fermentation performance was expressed in terms of final concentrations of cells, acids and alcohols. Results pointed out that the pH affected the fermentation performance. It looks like that there is no optimal pH to maximize all the fermentation indicators (concentrations of alcohols, production rate) at the same time.

Keywords: *Clostridium carboxdivorans*, CSTR, dilution rate, pH, Syngas fermentation

RESEARCH ON THE DISPERSION OF THE CONCENTRATION OF VOLATILE ORGANIC COMPOUNDS GENERATED BY INDUSTRIAL ACTIVITIES IN THE VICINITY OF RESIDENTIAL AREAS

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Abstract:

The volatile organic compounds produced by industrial activities are substances harmful to human health and the environment, playing an important role in terms of environmental quality but especially air quality. In addition to the negative effects of volatile organic compounds on the environment such as the photochemical formation of ozone in the soil, the increase in the global greenhouse effect, the thinning of the ozone layer, there are a number of serious negative effects on human health such as skin and eye irritations. , mucous membranes, respiratory tract, central nervous system damage, central nervous system depression, damage to certain internal organs such as liver, kidneys, lungs, carcinogenic effects and other negative effects.

The paper presents a case study carried out at an economic operator whose object of activity is, among others, the treatment and coating of metals, where an automated painting installation emits high concentrations of volatile organic compounds into the atmosphere.

The case study was conducted using an atmospheric dispersion model (MDA), which is a mathematical simulation of how pollutants are released into the atmosphere. MDAs are used to estimate the concentration of air pollutants emitted by industrial activity or car traffic in the wind direction.

The atmospheric dispersion model is made by the Gaussian Model, which is based on the assumption that the concentration of the cloud of polluting air in any wind direction has an independent Gaussian distribution, both horizontally and vertically, and is one of the most accurate and relevant dispersion patterns.

Over the course of several years, measurements of volatile organic compounds have been carried out on the chimney of the paint plant, the main objective of which was to disperse the concentrations of volatile organic compounds into the environment using dispersion simulation software. (AUSTAL View), to view the area of spread of the pollutant and the degree of damage to the population in the residential area under study.

Keywords: dispersion, emissions, pollution, software, volatile organic compounds

HIGHLY SENSITIVE ELECTROCHEMICAL SENSOR BASED ON POLY (3,4-ETHYLENEDIOXYTHIOPHENE) AND Pt NANOPARTICLES FOR BIOLOGICALLY ACTIVE COMPOUNDS DETERMINATION

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Abstract:

In the medical area, novel diagnostic tools are essential for the prompt evaluation of the patients' health status. Electrochemical sensors found their usefulness as analytical devices, efficiently monitoring biologically active compounds from both simulated synthetic samples and real samples (serum, urine). The aim of this study is to develop an electrochemical sensor with applications in the electroanalysis of neurotransmitters and their precursors (dopamine, epinephrine and tyrosine). Neurotransmitters disorders were discovered to be associated with various neurological dysfunctions such as Alzheimer disease, Parkinson disease, autism, schizophrenia and depression, therefore tracking of catecholamines levels in the organism remains an important aspect for clinical applications. To this purpose, the sensor was prepared by modifying a glassy carbon electrode surface with a hybrid material composed of a conductive polymeric matrix (poly(3,4-ethylenedioxythiophene), PEDOT), which incorporates inorganic fillers (metallic nanoparticles). The present work proposes a comparison between classical electrochemical polymerization methods (potentiostatic and galvanostatic methods) and innovative electrodeposition procedures (sinusoidal voltages and sinusoidal current methods) in terms of enhanced surface roughness and electroactive surface area. Sinusoidal voltage procedure implemented for the in-situ electrodeposition of Pt nanoparticles (PtNPs) ensures a proper incorporation of metallic nanoparticles within the conductive polymeric matrix, thus enhancing the analytical performance of the sensor. Cyclic voltammetry, differential pulse voltammetry, chronoamperometry and electrochemical impedance spectroscopy were employed to investigate the electrochemical behavior of the analyte and the electrocatalytic properties of PEDOT-PtNPs sensing material.

The study of electrocatalytic activity and electrochemical properties of the composite material demonstrates the electrochemical sensor efficiency in the analysis of biologically active compounds by evaluating analytical performance figures of merit such as linear response range, limit of detection, sensitivity, repeatability and reproducibility. Moreover, the interference study investigates the influence of interfering species like ascorbic acid and uric acid, in order to assess the sensor selectivity towards a specific analyte in a complex medium. Preliminary results pointed out the good analytical performance of the PEDOT-PtNPs based sensor towards the detection of tyrosine in terms of wide linear response range and low detection limit.

Keywords: dopamine, electrochemical sensor, epinephrine, poly (3,4-ethylenedioxythiophene), Pt nanoparticles, tyrosine;

PRELIMINARY RESULTS OF MICROALGAE GROWTH/PROCESSING AIMED AT ANTINFLAMMATORY/ANTIOXIDANT PRODUCTION

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Abstract:

CO_2 biofixation by photosynthetic microorganisms is an appropriate strategy to mitigate CO2 emissions via a sustainable path. Photosynthetic microorganisms employment according to the biorefinery approach is expected to provide a sound solution to the shortfall of commodities. Photosynthetic organisms utilize sunlight energy to convert water and CO_2 into biomass. Microalgae have been considered as miniature factories for sustainable production of biofuels, value-added products and food ingredients. Microalgae cultivation is the key step to boost one macromolecule productivity over another. Cultivation strategies requires to be investigated and operating variables must be selected according to target product: light exposition and frequency, nutrients concentration (e.g nitrogen), CO_2 supply strategy and operation temperature must be considered. Selection of the strains characterized by competitive potentiality to produce target molecules is a key issue for a successful microalgal exploitation process. The present contribution reports the preliminary results of a research programme carried out at the Università degli Studi di Napoli Federico II as partner of the Horizon 2020 "ALGAE4IBD - From nature to bedside - algae based bio compound for prevention and treatment of inflammation, pain and IBD" project n. 101000501 aimed at the exploitation of microalgae to provide products for Inflammatory Bowel Disease. More than 100 strains from the Algal Collection of University of Federico II of Naples (ACUF) are investigated. Stain growth is carried out in photobioreactors sparged with air eventually CO2 supplemented, under continuous led irradiation. Data of strain growth and extraction process will be presented for two strains. The strains belong to the Chlorophyta division and Trebouxiophyceae class: Pseudococcomixa simplex (strain as 048 of the ACUF) and Stichococcus bacillaris (strain 058). Biomass productivity has been used as indicator for the growth. The effect of the CO_2 concentration in the air stream is investigated for P. simplex: air and 2% CO2. Fluorimetric and oxygraphy analysis has been used to assess photosynthetic efficiency during cultivation and optimal light exposition.

Keywords: antioxidants, cultivation strategy, microalgae, photobioreactor

REMOVAL OF CHLOROPHENOLS FROM AQUEOUS SOLUTIONS BY PHOTOCATALYTIC OXIDATION

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Abstract:

2,4-dichlorophenol belongs to the category of persistent organic pollutants and has a high toxic potential for aquatic life and human health. Among the many methods of removing 2,4-dichlorophenol from wastewater, advanced oxidation processes are the most widely used due to their simplicity and efficiency. Photocatalytic oxidation has been intensively studied for the removal of several categories of persistent organic pollutants from aqueous solutions, and the results showed that the efficiency of the process depends on the adopted photocatalytic system and the optimization of its operating parameters. Therefore, the purpose of this paper is to study the operating parameters of a UV photocatalytic reactor equipped with a TiO2/stainless steel photocatalytic membrane used for the photocatalytic oxidation of 2,4-dichlorophenol in aqueous solutions. The results showed that the pH of the working solution has a significant influence on the efficiency of photocatalytic oxidation. Thus, the removal efficiency of 2,4-dichlorophenol increases with the decrease of the pH of the initial working solution. The rate of the photocatalytic oxidation process is approximately twice as high at pH 3 than at pH 7 for the same initial concentration of 2,4 -dichlorophenol. This result is due to the direct connection between the concentration of hydrogen ions and the hydroxyl radicals present in the aqueous solution during the photocatalytic oxidation process. Thus, the higher the acidity of the working solution, the higher the concentration of hydroxyl radicals generated in the system, and therefore the organic substrate will be degraded faster. The results also showed that the molar ratio of hydrogen peroxide/2,4-dichlorophenol is another important parameter of the photocatalytic oxidation process. Thus, in all experiments, the highest efficiency was obtained for a stoichiometric hydrogen peroxide/2,4-dichlorophenol molar ratio. The decrease in the rate of photocatalytic oxidation at molar ratios over stoichiometry is due to the secondary reaction between excess hydrogen peroxide and hydroxyl radicals on the catalyst surface. This leads to competition between the organic substrate and excess hydrogen peroxide for hydroxyl radicals. The initial concentration of 2,4-dichlorophenol also influences the rate of photocatalytic oxidation, which decreases as the initial concentration of 2,4-dichlorophenol in the working solution increases.

Keywords: 2,4-dichlorphenol, aqueous solutions, photocatalytic membrane, photocatalytic oxidation, titanium dioxide

PERSPECTIVE STUDIES ON HEAT GENERATION OF MAGNETIC NANOCRYSTALS

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Abstract:

Heat generation by magnetic nanoparticles while exposed to an alternating magnetic field (AMF) has become an exhaustively studied topic in nowadays research, given the application in many fields as biomedicine or catalysis. Notably, the amount of heat that can be generated by these nanoparticles derives directly from their magnetic nature emphasizing the need for their prior investigation, such that, tuning composition, shape and size which will strongly influence on their future heating performance. For the quantification of the conversion of electromagnetic energy into heat during the measurement under AMF, SAR (specific absorption rate) is calculated. Alas, the experimental determination of the heating capabilities using calorimetric devices is the most common one though not yet fully standardised. This situation is therefore causing difficulties in the understanding and making the comparison of the obtained experimental data in different labs a rather challenging task. Herein, we address encountered difficulties and detail some practical insights arising from calorimetric measurements of magnetic aqueous suspensions of Fe_3O_4/γ-Fe_2O_3, $CoFe_2O_4$, $MnFe_2O_4$ nanocrystals synthesized by co-precipitation method and with various sizes, and characterised by means of X-ray diffraction, transmission electron microscopy and Raman spectroscopy. Calorimetric measurements were performed at different frequencies from 56 kHz to 382 kHz, and intensities from 16 mT to 50 mT of the alternating magnetic field in order to quantify the heat released by the nanoparticles using concentrations ranging from 1 mg to 20 mg/mL. We aim to correlate the obtained SAR values with the magnetic properties registered. This paper presents perspective studies with the aim to encourage for the utilization of the magnetic nanocrystals for the heat generation as a promising, prospective and efficient way for manifold purposes.

Keywords: magnetic hyperthermia, magnetic heating, magnetic nanomaterials

THE DEPENDENCE OF THE RACEMIC NUCLEATION EFFICIENCY ON THE CHEMICAL CHARACTERISTICS OF THE PDLA MACROMOLECULES

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Abstract:

Nowdays, the interest of the car manufacturers has been directed towards the renewable materials with improved functional properties, that can be used for serial production of durable 3D printed automotive parts, not only for prototypes and limited series. The previous own results on this subject led to the conclusion that the durability of poly(lactic acid) (PLA) for 3D printed automotive parts can be increased by controlling the morphology with the help controlled crystallization by incorporating nucleation agents or by racemic crystallization which follow a stereocomplexation process. The aim of the paper was to identify the influence of branching degree of the stereocomplexing poly (D-lactide) (PLDA) on the racemic crystallization of poly (L-lactide) (PLLA) in a melt compounding procedure for getting a 3D printable new compound designed for durable automotive parts. The melt compounding was made at various ratios of the 3D printing PLLA grade and branched PLDA. The stereocomplexation was studied by Fourier Transform-Infrared Spectroscopy in the Attenuated Total Reflectance mode (FTIR-ATR), considering only the spectral ranges of the functional groups changed because of the racemic nucleation, namely: -C=O, -CH3 and -C-CH3 (directly involved into the process) and -CH, -CH_2, -C-O-C, -OH and -C-C (the adjacent ones). The stereocomplexation was also estimated by studying the morphology (SEM) and the thermal (HDT) and mechanical (stress-strain) behavior of the new compounds. All the obtained results sustain the idea that, the branched PDLA with lower molecular weight (Mw) improve the racemic nucleation but not in such extent to generate important changes of the functional properties. These results are following those from, according to which the racemic crystallization depends on the Mw value and on the dextro sequences content of the stereocomplexing polymer. The new conclusions are explicable if the possibility to control the arrangement of the macromolecules involved in the stereocomplexation mechanism is considered. Therefore, the racemic nucleation magnitude can be done with the help of the PDLA branched chains. The further works will continue to complete the formulation in order to ensure the functional properties required for applications in 3D printed automotive items of the new obtained compounds.

Keywords: 3D printing, automotive, branched macromolecules, durability, racemic nucleation, renewable polymers

EXTRACTION TECHNIQUES AND SPECTROPHOTOMETRIC STUDIES ON *Datura innoxia* DRY BIOMASS

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Abstract:

Higher plants represent a rich source of bioactive compounds, primary and secondary metabolites, but only a few components are bioactive. The characterization of constituents requires techniques which must offer good sensitivity, selectivity and structural information. The most abundant groups of secondary metabolites from natural sources are represented by phenolic compounds, terpenes and alkaloids. The interest in determining as many bioactive compounds as possible in plants has been created the need for rapid, efficient, and economical extraction methods. To isolate secondary metabolites from plants is important to use an appropriate extraction method to obtain the maximum number or, ideally, all these compounds present in the samples. The key for efficient extraction is selection of an appropriate extraction method. Failure in this concern could lead to the loss or destruction of the target compounds during the preparation step. For this study we select Datura innoxia plant (Solanaceae family) which is well known for synthesizing a number of tropane alkaloids and for its importance as a source of drugs in medicine and pharmacology. Datura innoxia plant was cultivated in pedoclimatic conditions specific to the soil in Romania. It is a perennial, dicotyledonous woody plant growing in the form of bushes reaching up to a height of 90 – 100 cm. This study was designed to identify the chemical constituents (alkaloids) and evaluation of tropane alkaloids, especially hyoscine of dry extracts biomass using as preparative tools Soxhlet extraction technique and as analytical techniques UV-Visible Spectrophotometry. Leaves, flowers, fruits, stem and root was extracted in ethanol and 1-butanol. A hyoscine standard was prepared to plot a calibration graph and all results are given as hyoscine equivalent (hyoscine, µg/g, dry weight). The results shows that hyoscine was identified in all vegetative organs with higher concentration in 1-butanol versus ethanol. Different hyoscine content of Datura inoxia dry biomass varies greatly depending on the place of growing, plant part concerned, and selection or purity of the solvents.

Keywords: dry biomass, hyoscine, secondary metabolites, Soxhlet extraction, spectrophotometry

COMPARATIVE ASSESSMENT OF MAJOR AND TRACE ELEMENTS IN SOME MINERAL WATERS FROM SLĂNIC MOLDOVA

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Abstract:

There is interest in the characterization and valorization of mineral waters in Slănic Moldova, as they are a source of essential elements and have an important therapeutic potential. In this context, more information on trace elements and the possibility to monitor the quality of mineral waters through precise, fast and environmentally friendly instrumental methods are needed.

The aim of this work was to scan seven different mineral water springs (1 bis, 5, 10, 14, 15, Sonda 2 and Sf. Spiridon) from Slănic Moldova resort, in order to determine their fingerprint within 24 hours after sampling. All samples were stored in cold, dark cabinets (4 °C), no chemicals were added to preserve the water, as it is supposed to be used in human consumption.

For the selected mineral waters, major components (Na, K, Mg, Ca, Cl-, SO42-, NO3-, NO2-, HCO3-, CO2) as well as trace elements (Al, Fe, B, Li, Cr, Mn, Ni, Cu, Zn, Se, Sr, Ag, Cd, Ba, Pb, Be, V, Co, Ga, As, Rb, Cs, Hg, Tl, U) were determinated using an inductively coupled plasma mass spectrometer (Agilent 7500cx ICP-MS) and HACH DR3900 UV-Vis spectrophotometer.

Major and minor elements found in the mineral water samples were compared with the limits established by World Health Organization, European and Romanian Standard for Mineral Water qualitative evaluation, as a screening method before undertaking complex analyses, using efficient methods.

The analyses results shows that all the trace elements, including heavy or radioactive metals, are present within the maximum permissible limits for natural mineral waters.

The variety of mineral water constituents detected by both methods ICP-MS and UV-VIS spectrophotometry shows a complex composition specific for each spring.

The novelty of our study is the highlighting of 20 new trace elements, thus completing the information on the composition of these mineral waters and their potential to be used for the treatment and amelioration of some diseases.

Keywords: chemical characterization, ICP-MS, mineral waters, UV-Vis

STUDIES ON THE BEHAVIOR OF *Brassica napus* L. CULTIVATED ON CADMIUM POLLUTED SOIL

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Abstract:

Various anthropogenic activities (e.g. mining, batteries and electronics manufacturing, pesticides and fertilizers, fossil fuels burning, waste disposal etc.) lead to the release of heavy metals, such as cadmium, into the soil. The presence of cadmium in soil can generate negative impacts on the environment and human health because of its high solubility, mobility, high half-time and bioaccumulation along the food chain. Several plants possess the ability to tolerate and remove heavy metals from soil. *Brassica napus* L. (rapeseed), which belongs to the Brassicaceae family, being a widely cultivated plant worldwide, with a vegetation period between 270-300 days. Rapeseed is a biennial herbaceous plant, with pivoting roots, highly adaptable under variable environmental conditions. Literature studies reported the rapeseed as a suitable plant for phytoremediation of soils polluted with cadmium, nickel, chromium and lead. In this context, in our study we have tested the tolerance of *Brassica napus* L. to the toxicity of cadmium ions in the soil at different concentrations (10 mg/kg, 50 mg/kg, 100 mg/kg, 200 mg/kg). The experiments were carried out in triplicate in pots (height 13 cm, inner diameter 14.5 cm) containing 600 grams of peat soil. The plants were grown during 11th of September until 20th of October 2021 in greenhouse conditions. After 40 days, the roots and shoots length were measured and the chlorophyll and carotenoids contents were also determined. The results showed that, at a cadmium concentration in soil of 10 mg/kg, the tolerance index was 84.78% for roots, and 99.60% for shoots, respectively, while at a concentration of 200 mg/kg, the tolerance index was 67.47% for roots, and 89.19% for shoots. Also in case of chlorophyll a, b and carotenoids contents, a decreased with 20.94% for chlorophyll a, 27.04% for chlorophyll b and respectively, 30.08% for carotenoids was observed at the highest cadmium concentration (200 mg/kg). In conclusion, *Brassica napus* L. may develop a good cadmium tolerance in the range of Cd(II) concentrations tested, with no significant effects on morphological and physiological state of rapeseed. Therefore, it may be used as a potential accumulator for phytoremediation of moderated cadmium polluted soil.

Keywords: cadmium, chlorophyll content, potential of phytoremediation, rapeseed, tolerance index

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AN APPROACH OF RECYCLING TEXTILE WASTE WITH INDUSTRIAL APPLICATIONS

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Abstract:

The fashion industry generates a great volume of waste caused by mass production, as fast fashion creates a demand for around 80 billion new garments every year. A high percentage of the discarded garments are disposed in land fields, instead of being recycled. Environmentally laws issued all over the world are trying to take care about pollution resulted from the huge amount of textile waste. In order to reduse this negative impact, the proposed study will explore metods or strategies to recycle natural and syntetic textile waste, from pre or post-production. The industrial methods used to recycle textile waste evaluated are: textile recycling to cellulose, separation and conversion of textile waste from wool-polyester and cotton-polyester blends. Associated Recyclability Potential Index (RPI) will be determined. In the recycling paper processes, cellulosic fibers cannot be indefinitely converted to new fibers as the pulping and regeneration process usually reduces the degree of polymerization, and subsequently diminish the mechanics of the fibers. The mixture of natural and synthetic fibers in the blended textiles are difficult to separate in the recycling process. Some methods to separate textile waste use selective digestion of wool fibers from wool-polyester mixtures. Other applications use the keratinize in a two step process, with addition of a reducing agent. The polyester fibers are recovered after the process. It can be seen that, after the process, the natural fibers are decomposed and the polyester fabric is in good conditions, being possible to use for new garment production. The keratin hydrolysate can be used as nutrient for microbial mediums or as fertilizer in agriculture, following the concepts of circular economy. The pre-consumer waste is by far, easier to recycle versus the post-consumer waste, due to the large variety of materials involved. The mixture of natural and synthetic fibers in the blended textiles are difficult to separate in the recycling process. Cradle to Grave life cycle create a very high amount of waste, and reuse-repair-remanufacturing-recycle methods can help on the long run, the global economy.

Keywords: cotton-polyester blends, environmental strategies, recycling, textile waste, wool-polyester blends

MALEATED OLEFINIC HOMOPOLYMERS AND COPOLYMERS AS INTERFACE AGENTS FOR NEW STARCH-BASED COMPOUNDS

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Abstract:

The replacement of the tertiary carbon with the renewable those is of interest even for the 2050 perspective when all the polymeric materials requirements will be insured by those based on renewable polymers, mechanically recycled grades, and less of types obtained using conventional origin polymers. The aim of the work was to identify efficient possibilities to compatibilized the incompatible compounds of corn starch (S) with poly (ε-caprolactone) (PCL), both biodegradable polymers, but one of renewable origin and the other from conventional resources. The studied S-PCL compatibilizer blends were obtained by a classical melt compounding procedure. Two types of grafted polyolefins were used as compatibilizers namely, a grafted homopolymer (PE-g-MA) and a grafted copolymer (EVA-g-MA), both with a comparable degree of maleinization of approx.1.2%. So binary compounds that have shown mechanical properties of interest in preliminary selection tests were compatibilized with a 2.5% - 10% interface agent and the compatibilization efficiency was highlighted by studying the dependency on the composition of the morphology (XRD, SEM), thermal (DSC) and mechanical properties (stress-strain curves). The noticed compatibility effect was explained by the hydrogen bonds established between the macromolecular chains of the two polymers and compatibilizers. These bonds were thought to be generated by the electrostatic attraction between the hydroxyl proton from the starch and the non-participating electron pairs of oxygen from the carboxylic, carbonylic, or the chain oxygen from compatibilizers or PCL. The obtained results demonstrated a better compatibility efficiency for the maleated olefinic copolymer which generated for example a single melting maximum, the lack of morphological defects as voids, the disappearance of diffraction peaks characterizing the individual components, etc. The better compatibilization efficiency of the grafted copolymer, (EVA-g-MA), most probably can be explained by the high content of carboxyl groups of EVA of the consequence of the vinyl acetate sequence from the macromolecules (18 wt.% VA). In this way much more hydrogen bond between it and the two polymeric components of the compound was possible to be establised. The study will continue to deepen the mechanism by which the selected interface agent act and improve the formulation to reach functional properties of practical interest.

Keywords: compatibilizer, grafted polyolefins, interface, melt compounding, starch, renewable

DEVELOPMENT OF A SMART DRUG DELIVERY MESOPOROUS SILICA SYSTEMS FOR DIABETES MELLITUS

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Abstract:

Diabetes is one of the five severe chronic diseases for which the World Health Organization (WHO) supports programs to streamline therapy to increase the quality of life for diabetics and reduce the incidence of this metabolic disease, currently affecting over 9% of the world's population. Type 2 non-insulin dependent diabetes mellitus is the most common form of diabetes that affects more than 90% of diabetic patients and is characterized by insulin resistance, β-pancreatic cells dysfunction, and increased hepatic glucose synthesis. MCM-41 type mesoporous silica has a high specific surface area (>1000 m^2/g), large pore volume, and high hosting capacity for molecules. Two types of mesoporous silica matrix (MCM-41 and MCM-48) were synthesized by ultrasound process using an ultrasonic generator - Vibra Cell TM, operating in a pulse mode (3/1 s on/off cycle), at a constant temperature of 25°C. The white solid product was recovered by filtration, washed several times with deionized water, and dried at 50°C. To remove the surfactant and create porosity, the powders were calcined in air at 550°C with a heating rate of 1°C/min for a period of 6 hours. The loading of metformin hydrochloride was carried out from both aqueous solutions and alcoholic solutions followed by solvent evaporation. The obtained powders were characterized texturally by BET (Brunauer-Emmett-Teller) surface area analysis measurements, the average pore diameter was estimated using the desorption branch of the isotherm and the Barrett-Joyner-Halenda model, and the metformin loading degree in the nanoporous matrix was determined by the HPLC method at λ=235 nm. The IR spectra were also recorded for the substance, the simple matrices, and the loaded mesoporous silica systems using a Bruker FTIR spectrometer. In vitro dissolution tests were performed using an SR 8 Plus Series Dissolution Station. The development of this new metformin silicate delivery system improves and optimizes the biopharmaceutical properties of the drug while maximizing the benefits.

Keywords: diabetes, MCM-41, MCM-48, mesoporous silica, metformin

APPLICATION OF DIFFERENT TYPES OF RESIDUAL BIOMASS FOR RETAINING OF SOME EMERGING POLLUTANTS FROM INDUSTRIAL EFFLUENTS

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Abstract:

The integrated water management has as main objective to minimize the water use, if possible, or to reuse it (by regeneration and recycling of water, when possible). The development of new processes and the optimization of existing ones with the aim of saving water, materials and energy must be one of the first steps of water management in order to find the best solution which must be a balance of economical success, technological progress, environmental protection and social acceptance. The water resource quality is usually evaluated by both qualitative and quantitative standard criteria, which lead to constraints and restrictive levels for water quality indicators (e.g. dissolved-oxygen concentration, temperature, turbidity, COD, BOD, persistent organics such as organic dyes, heavy metals, etc.). To respect the imposed qualitative limits of different potential water resources, there are required some water treatments and/or effluent treatment providing maximum treatment at minimum cost. Engineering responsibility for water and effluent treatment begins with determination of the level of treatment desirable and extends to system design and operation.
The aim of this work is to sumarize in an easy and clear manner the contribution of some special adsorptive materials, i.e. residual biomass wastes such as woody wastes, residual microbial and algae-based wastes, used as adsorbent/biosorbent for retaining of a few emerging pollutants (e.g. organic dyes and heavy metals) from different aqueous effluents (wastewaters). Thus the special attention is accorded to "the accumulation of emerging polluting species at an interface, especially solid/liquid such as solid/water phase" which is commonly identified by the adsorption, chemiosorption, or biosorption process (active or passive process) in association with its mechanism, kinetics and thermodynamic aspects, retaining performance and the influence of several process operating parameters like pH, residual biomass dosage, initial pollutant concentration, temperature, contact time, type of emerging pollutant, type of biosorbent and its activation form (living, or died one).
The reported data from the scientific literature underline that the abovementioned adsorptive materials based on residual biomass are considered as efficient biosorbents useful, especially in static operating system, in the case of effluents with moderate concentrations of emerging pollutants (e.g., organic dyes and heavy metals).

Keywords: effluent treatment performance, heavy metals, lignocellulosic and algae-based wastes, organic dyes, residual microbial biomass

STUDIES ON THE BIODEGRADATION OF SOME EMERGING PHARMACEUTICAL POLLUTANTS FROM AQUEOUS FLUXES

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Abstract:

The presence of emerging pharmaceutical pollutants in the environment is a major world-wide concern. Several pharmaceuticals extensively used in human and veterinary medicine are disposed of unchanged or in the form of active metabolites in high percentages and are continuously discharged into the environment. The study of the contamination of aqueous media by emerging organic pollutants, such as residual molecules of pharmaceuticals is of high relevance due to the negative impacts on both the development of living organisms and ecosystems, and on human health. Substances contained in pharmaceuticals can have a long half-life in the environment, so they can accumulate to detectable and biologically active levels. These generally include analgesics and anti-inflammatories, hypolipidemic drugs, anti-epileptics, antibiotics and β-blockers. Considering the impact of pharmaceutical wastewater on the environment, it is essential to give particular attention to the purification of aqueous fluxes from the pharmaceutical industry by various techniques, such as biological treatment to effectively degrade these micropollutants. An effective method for achieving depollution of aqueous fluxes contaminated with emerging pharmaceutical compounds is bioremediation, as an environmentally friendly biotechnological method of treating wastes, pollutants and toxic materials present in environmental compartments. The bioremediation process involves the use of living or non-living biomass to remove, degrade or transform pollutants into other forms less toxic to the environment. Biotechnological approaches have emerged as promising tools for the removal of micropollutants, including active pharmaceutical compounds. Several of these are based on the use of specific micro-organisms with significant degradation capacity, in particular bacteria and fungi. The broad degradation capacity of fungi and their enzymes, as well as their involvement in the transformation and mineralisation of several organic pollutants, make them potential agents for bioremediation processes. In this context, the paper aims to examine relevant literature studies, which focus on analysing the importance of removing emerging drug-like pollutants from aqueous media and highlighting novel developments in the biodegradation of these compounds.

Keywords: biodegradability, emerging pollutants, ecological impact, microorganisms, pharmaceutical compounds

APPLICATION OF RESPONSE SURFACE METHOD FOR OPTIMIZATION OF ERIOCHROME BLACK T REMOVAL BY ADSORPTION

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Abstract:

The Response Surface Methodology (RSM) was used in this study to optimize eriochrome black T adsorption on commercial activated carbon. The process parameters considered for optimization were the adsorbent concentration (Z1, g/L), time (Z2, min.) and dye concentration (Z3, mg/L). Based on the Design of Experiments methodology, two sets of experiments, one static and one dynamic, were planned and carried out. The design included a total of 15 experiments for each set, as well as three replications at the center point.

The batch adsorption experiments were carried out at room temperature, with no pH adjustments. Dye retention was checked by measuring the absorbance of the eriochrome black T solution at 535 nm. It was observed that the hydrodynamic conditions (static vs. dynamic) affected the transport of the dye from the liquid phase to and through the hydrodynamic boundary layer that surrounds the adsorbent particles and had a significant influence on the removal efficiency. During the experimental phase, a maximum removal efficiency of 63.01% was obtained in static conditions, while the maximum achieved in dynamic conditions was 78.18%.

The experimental results were analyzed and interpreted using the MINITAB 17.1.0 software suite. Statistical models (linear, factorial, quadratic, and cubic) were developed to describe the interaction of the selected process parameters in static and dynamic conditions. 3-D response surface plots and two-dimensional contour plots were used to highlight the parameters' influence on process efficiency.

The RSM analysis of the interaction between process parameters and their influence on retention yield resulted in an increase of removal efficiency to 91.13% in static conditions and to 100% percent in dynamic conditions, demonstrating the optimization ability to improve performance. According to response surface methodology, the optimal values of the considered variables are: Z1 = 8.774 (g/L), Z2 = 65.375 (min.) and Z3 = 0.0325 (mg/L) for static conditions, respectively Z1 = 8.774 (g/L), Z2 = 65.375 (min.) and Z3 = 2.4464 (mg/L) for dynamic conditions.

Keywords: active carbon, adsorption, eriochrome black T, optimization, Response Surface Methodology

WALNUT (*Juglans regia* L.) - PRESENT AND PERSPECTIVES ON PHYTOSANITARY ACTIVITY

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Abstract:

Walnut (Juglans regia L.) is the most widespread walnut in the world. The benefits of walnuts are due to the presence of phytochemicals such as flavonoids, carotenoids, alkaloids, polyphenols, juglone, etc.
In addition to the many benefits that walnut has on our health (antibacterial, antioxidant), it also has important phytosanitary and insecticidal properties. Walnuts can be used because of their plant-friendly properties in the form of biopesticides that are safe and can be a viable, inexpensive and cleaner alternative to synthetic products that can be harmful to the environment.
All parts of the plant (bark, leaves, dried and green schell of the fruit, septum, kernel) are important. Depending on the component of the plant, the concentration of the extract and the type of extraction solvent, a different antifungal, insecticidal and antibacterial potential is observed.
The antifungal action has been studied in extracts from walnut bark and green walnut shell. Walnut bark extracts had better results in inhibiting the growth of certain fungi than green bark extracts.
Pathogenic fungi are responsible for crop damage in both pre-harvest and post-harvest stages.
Several studies have shown antifungal activity on Aspergillus niger, Alternalia alternata, Trichoderma virens, Geotrichum candidum and Fusarium solani.
Walnut leaf extracts have an antibacterial effect at much lower concentrations than green bark extracts. Walnut kernel and septum extracts inhibit gram-positive bacteria at much lower concentrations than walnut leaf extracts. Walnut bark extract has antibacterial effects similar to walnut kernels. Walnut leaf extracts have the weakest antibacterial action.
In conclusion, all the component parts of walnut are important and represent a real phytosanitary and antibacterial potential. One direction of research is to use walnut extracts as an antifungal treatment for the diseases of these crops, considering that in Romania 230,000 ha of vines, 196,000 ha of fruit trees and 256,000 ha of vegetable crops are exploited. Another perspective would be the study of the capacity of bioaccumulation of heavy metals in the aerial parts of the walnut, few studies being directed in this direction.

Keywords: antibacterial activity, antifungal, crops, dried walnut, extracts, green shell walnut, insecticide

OPTIMIZATION OF EXPERIMENTAL PARAMETERS FOR BIOSORPTION OF Zn(II) IONS FROM AQUEOUS SOLUTIONS USING *Saccharomyces cerevisiae*

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Abstract:

In recent years, heavy metal pollution has become an increasingly serious problem. With the ever-increasing progress of modern technology, there is also the danger of causing profound changes to the environment. Although many methods of removing metal ions, including ion exchange, chemical precipitation, adsorption, etc., are available, biological adsorption (biosorbtion) processes based on an adsorbent derived from waste and natural bio-materials have several important benefits. Zinc is one the most abundant essential trace elements in the human body. It is a constituent of all cells, and several enzymes depend upon it as a cofactor. Concern has arisen because of the intimate connection of zinc with cadmium in the geosphere and biosphere. The results may of laboratory tests on animals indicate, however, that the metabolism of humans may be affected (for example their mineral and enzyme budget), especially of children and patients already suffering from irregular metabolism. Yeast *Saccharomyces cerevisiae* is one of the economic biosorbents obtained as a by-product of the fermentation industry, which is widely applied to remove metals from aqueous solutions. The widespread application of yeast in winemaking and other fields of traditional biotechnology soon pushed these microorganisms to the forefront of cellular genetic, biochemical and biological research and advanced studies in the fields of physiology, genomics and evolutionary biology. The aim of this study was to remove zinc ions from aqueous solutions using yeast *Saccharomyces cerevisiae*. The experiments were performed in batch systems, and the influence of some important experimental parameters (such as initial solution pH, yeast dosage, initial Zn(II) ions concentration and contact time) on the biosorption efficiency was examined. The modelling of the experimental results was done using three isotherm models (Langmuir, Freundlich and Temkin) and three kinetics models (pseudo-first order, pseudo-second order, intra-particle diffusion). The results of this study suggest that *Saccharomyces cerevisiae* may be an excellent biomass for removing Zn(II) ions from aqueous solutions, and this could be an alternative solution for the sustainable recovery of this biomass.

Keywords: biosorption, heavy metals, *Saccharomyces cerevisiae* biomass, zinc ions

COMPARATIVE STUDIES OF PHYSICAL AND THERMAL PROPERTIES OF COOKING OILS AND USED COOKING OILS

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Abstract:

Improperly disposal of used cooking oil (UCO) produced in households, canteens or restaurants can cause significant environmental problems through water and soil pollution. UCO collection brings important benefits in terms of protection of water sources, living organisms, but also sewerage systems. The most important use of UCO is in the production of biofuel, yet the recent concerns of researchers are also directed to other applications, for example, the production of hydrogen and its direct combustion for electricity generation. Another area of interest is the use of UCO in obtaining value-added products: biopolymers, asphalt, detergents, lubricants, etc. The main problem in the efficient use of UCO is the heterogeneity and content of impurities, so their characterization is an important issue. The main purpose of this study is the physical and thermal characterization of two types of used cooking oils: palm oil and sunflower oil. The used palm oil taken from the canteen of the Tudor Vladimirescu campus in Iasi and the sunflower oil obtained from household consumers, was passed through a five-plate filter, with a filtration area of 0.0324 m^2. The kv (m^3/m^2) and kt (m^2/s) constants were calculated from the filtration equation, at constant pressure, which shows the variation of the specific filtration capacity over time. Density, viscosity, refractive index and thermal capacity were determined for cooking oil (CO) and UCO. The TGA and DSC techniques were applied to evaluate the main thermal characteristics: the onset temperature of the thermal decomposition, the percentage of mass loss under constant temperature conditions and the melting and crystallization peaks. The physical properties of used sunflower oil compared to those of the original oil change less than the properties of used palm oil. One possible explanation would be that it has been reused less often by household consumers than in the canteen. The study showed better thermal stability under constant temperature conditions of palm oil compared to sunflower oil. It was also found that the percentage of mass loss under constant temperature conditions for UCO is twice as high as that obtained for CO.

Keywords: palm oil, physical and thermal properties, sunflower oil, used cooking oil

CARBON NANO/MICROSTRUCTURES PREPARED THROUGH PYROLYTIC PROCESSING OF BIOMASS WASTE

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Abstract:

One of the critical goals of scientific community is to design innovative bio-based value chains by developing new biorefining techniques, optimising feedstock use and creating a favourable climate to accelerate market acceptance of bio-based products. In this context, the efficient use of resources and largely waste valorisation as renewable raw materials for conversion into a wide diversity of bio-based products (chemicals, materials, food ingredients, energy and advanced biofuels) is a significant step. The main objective of the PhD thesis is to valorize biomass wastes into value-added new materials with potential applications ranging from environmental remediation to optoelectronics.

In this work, carbonaceous structures were prepared through pyrolytic processing of biomass wastes. The process parameters were investigated in order to provide reliable and repetitive conversion paths of carbonaceous structures ranging from nanometric carbon with a specific structural configuration and high PL emission to larger and highly porous carbonaceous particles with micrometric to millimetric dimensional characteristics. The experimental tests provided information regarding the pretreatments of the feedstock (particle size distribution, moisture content), the parameters of the pyrolytic process (temperature and time of the thermal exposure) as well as on final steps including the water flooding procedure, dimensional selection and drying, purification and re-dispersion in various solvents.

The experimental design is able to provide carbonaceous structures as follows: nanometric carbon with intense excitation wavelength dependent blue luminescence and a typical structural configuration consisting of a defect rich graphitic core which is surface decorated with various functional groups and/or highly porous carbonaceous matrix with µm to mm range. The resulted nanometric structure were morpho-structurally investigated through FT-IR, Raman spectroscopy, DLS dimensional analysis, AFM and HR-TEM. The intense photoluminescent (PL) emission of the prepared carbon dots dispersed in various solvents (water, chloroform, EtOH and acetone) was investigated through Fluorescence spectroscopy. The porous carbonaceous structures were investigated through FT-IR, Raman spectroscopy, BET and TEM.

Considering the chemical and structural properties of new bio-based generated materials some applications were proposed accordingly.

Keywords: applications, biomass waste, chemical and structural characterisation, porous carbon materials, pyrolysis

BIOSORBENTS BASED ON THE VEGETAL RESIDUAL BIOMASS FOR THE RECOVERY OF CHEMICAL POLLUTANT FROM AQUEOUS MEDIA

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Abstract:

Biomass is the most abundant renewable resource on the planet. In recent decades, there has been a considerable increase in interest in capitalizing on an increasing number of biomass species with applications in various fields. One of the directions for the recovery of residual biomass from industrial processes is as a biosorbent for the retention of polluting chemical species in the aqueous environment. Biosorption is a promising technology for the removal of ionic metals and dyes from industrial effluents and natural waters.
In this context, the aim of this study is to test the biosorptive properties of lavender waste and other plant residues (Primula veris, Achillea millefolium, Origanum vulgare and Artemisia absinthium) resulting from extraction processes in order to retain the reactive Orange 16 textile dye and copper ions in a batch system of aqueous solutions. To determine the biosorption potential of vegetal waste, the influence of certain physical parameters was investigated, such as: temperature, solution pH, quantity of biosorbent, concentration of dye or metal ions and phase contact time. Also, the biosorption isotherms were drawn, which show the influence of temperature and the initial concentration of the dye and metal ions on the process and which allow the calculation of the quantitative parameters characteristic of the process.
The results optained are very promising to further large scale biosorption studies, they confirm the fact that biosorbents based on the vegetal residual biomass can be considered as suitable biosorbents for retain organic dyes and metallic ions present in aqueous solutions in moderate concentrations.
In this context, the study of biosorption processes can be continue with the modeling of the sorption isotherms of Orange 16 textile dye and Cu (II) ions, thermodynamic calculations and kinetic studies to establish the biosorption mechanism and to identify the optimal conditions of use for industrial processes.

Keywords: biosorption, metal ions, organic dye, vegetal waste

AIR QUALITY MONITORING IN THE LAST DECADE IN ROMANIA: DYNAMIC AND STATISTICS

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Abstract:

Air, by easily changing its quality, can produce countless changes in all ecosystems and result in human health risks. This environmental factor can very quickly transport various pollutants into various environment, which can have a significant impact on quality, having a negative effect on health as well. Therefore, it is very important to constantly monitor, maintain and improve air quality, as regulated by international standards. From this perspective, this paper aims to assess the air quality in the period of 2011-2020 (10 years) by collecting, examining, and interpreting statistics of a series of data that are based on Environmental Protection Agencies Reports for four cities in Romania, respectively Brasov, Iasi, Cluj Napoca and Timisoara. This data refers to the values recorded by three monitoring stations located at various points in each city, in the last 10 years. To highlight the evolution of air quality and its dynamic, a series of graphs were elaborated. The dynamic of the main pollutants (PM2.5, CO and As) considered for each city under evaluation and their concentrations, both the average and the maximum and minimum recorded for each year, together with the standard deviations and the aggregate index for each city were represented. For the statistical analysis stage, the ANOVA software is used, a tool known by specialists in statistical interpretation which can compare two or more samples, analyzing the fluctuations that are generated by the recorded values. To obtain valid results it is necessary to sort and combine the information so that the data is organized in two columns or a table, depending on two types of variables (dependent and independent). Following the results generated by ANOVA, abnormal situations and large variations were registered in the case of the city of Iasi, especially for PM2.5, for the other cities no significant variations were highlighted. Thus, by monitoring and evaluating air quality, extremely important activities, depending on the degree of impact can be proposed a series of improvement measures.

Keywords: air quality, ANOVA, environmental impact, pollutant dynamics

METHODS FOR MAGNESIUM ADSORBENT SYNTESIS FOR CONGO RED REMOVAL

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Abstract:

Textile, printing, plastics, cosmetics, and other industries utilize more organic dyes, causing major environmental problems by discharging its as industrial effluents. As a result, it's critical to design techniques for effective dyes removal from wastewater. Photocatalysis, adsorption, and coagulation are some of the most often employed processes. Because of its simplicity and low cost of operation, high efficiency, and low energy consumption, adsorption is the most practical approach for wastewater treatment. As a result, developing effective adsorbents is critical for improving the adsorption process. The activated carbon, clays, zeolites, metal oxides, and hydroxides have been studied for the removal of dyes; but, several of these adsorbents have disadvantages such as low adsorption capacity, high cost, or ineffective recycling. Metal oxides have been intensively studied because of their wide applications as adsorbents and/or catalysts. Magnesium oxide is the most interesting of them because it is inexpensive, stable, harmless, and environmentally benign. Due to its higth surface area, low cost, relative safety, and minimal environmental toxicity, magnesium adsorbents have gotten a lot of interest for removing dye from wastewater. In this paper is recommend employing magnesium adsorbent in hydroxide form because MgO is formed by thermal decomposition of magnesium hydroxide or carbonate. It is possible to synthetize different sort of Mg(OH)2 function of precursors or the synthesis conditions. Magnesium hydroxide has a variety of morphologies and particle sizes and frequently performs well. Magnesium nitrate and magnesium sulphate solution 0.5 M and ammoniac or sodium hydroxide solution were utilized to improve the adsorption efficiency of Mg(OH)2 particles for the removal of dye molecules like Congo red (CR). Different materials were produced as a function of molarity and alkali excess, and their adsorption capability for CR was examined using SEM, XRD, EDAX, and BET. The synthesised sample's adsorption removal could be as high as 94 % at 20 °C. On the as-synthesised materials, Congo red adsorption followed the Langmuir adsorption model. The adsorbent was regenerated using calcination, and the regeneration efficiency was maintained for up to five regeneration cycles.

Keywords: adsorbent, dye, magnesium hydroxide, synthesis, removal

INVESTIGATIONS ON EXTRACTS OF INDIGENOUS SPONTANEOUS FLORA OF *Galium verum* L. AND THEIR POTENTIAL AS A BIOACTIVE INGREDIENTS SOURCE FOR DERMATO-COSMETIC PRODUCTS

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Abstract:
The synchrony between the requirements of the dermato-cosmetics industry and the advantages of natural active ingredients have led to a successful new dialog between chemical engineering and pharmaco-medical researchers, resulting in new research directions for the benefit of dermato-cosmetics products' users. Thus, intensive research investigates spontaneous flora species that prove a huge potential as a source for natural bio-active ingredients with beneficial action in skin damage.
The indigenous flora in Romania offers countless plant resources, and species of Galium verum are already in the attention of multidisciplinary research teams.
In Romania there are identified about 38 species, six of them with yellow flowers. Among these there are investigations and mentions of almost ten of them. Galium verum is the best known and the most present in published scientific papers.
Extraction techniques described so far for Galium species investigates different methodologies and give similar results in terms of abundance in bioactive compounds. Therefore, due to its content rich in active ingredients with important pharmacological activities and in order to reach a high quality, safe and efficient extract, chemical engineering protocols are continuously optimizing.
Also considering the abundant presence of Galium species, the present paper aims to explore the processing of the aerial part of Galium verum in order to be included in a new dermato-cosmetic formula. For this purpose, a set of conventional and unconventional extraction methods with variable parameters have been achieved, using vegetal material obtained by dried Galium verum plant from indigenous source.
Thus, the results of a multidirectional investigation related to the optimization of the extraction methods from Galium verum are presented, as well as the formulation of a dermato-cosmetic product based on the selected optimum extract, confirming the potential of the plant as a source of bioactive ingredients with antioxidant, protective and reparatory action for skin health and beauty.

Keywords: antioxidant, biologically active compound, dermatocosmetics, extraction, *Galium verum* L.

EXPERIMENTAL STUDIES ON PHYTOREMEDIATION OF SOILS POLLUTED WITH LEAD USING AGRICULTURAL PLANTS

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Abstract:

Contamination of agricultural soils with heavy metals has become a global concern, due to their ability to accumulate in agricultural land and crops, as well as major production losses. Among heavy metals, Pb(II) is considered one of the most toxic contaminants with significant threats to the ecosystem and human health, even at low levels of exposure. Therefore, the need to develop an efficient and sustainable method for the removal of this contaminant is of paramount importance. In this sense, phytoremediation is a cost-effective technique, with fewer side effects than chemical and physical approaches, successfully applied for environmental decontamination. In this regard, the phytotoxic response of the plants *Zea mays* L., *Triticum aestivum* L. and *Medicago sativa* L. subjected to synthetic contamination with Pb(II) solutions in the concentration range of 50-1000 mg/kg was investigated. The toxicity of metal ions on plant development was tested taking into account the main indicators of growth of plant components and their phenological observations. The test results showed that the presence of Pb(II) ions at a concentration of 1000 mg/kg in the soil did not significantly influence the growth and development of the three agricultural plants, maintaining an approximately constant ratio of plant length compared to the control sample, during the experimental period. With the increase of the metal concentration in the soil, a decrease in the number and length of secondary roots was observed, due to the fact that the root system is the first to come into contact with metal ions. The biomass production of the selected plants is affected to a low degree, which indicates a good tolerance to lead; a high degree of growth and a large amount of biomass are considered factors that favor the removal of heavy metals from polluted soils. In view of these preliminary results, *Zea mays* L., *Triticum aestivum* L. and *Medicago sativa* L. can be considered as potential hyperaccumulators applied in phytoremediation of lead-contaminated soils, and the biomass obtained could be used as a secondary source of Pb(II).

Keywords: : lead, *Medicago sativa* L., phytoremediation, *Triticum aestivum* L., *Zea mays* L

REFERENCE VALUES AND REFERENCE CORRELATIONS FOR THE THERMAL CONDUCTIVITY OF FLUIDS AND SOLIDS

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Abstract:

Reference values and reference correlations for the thermal conductivity of fluids and solids provide low-uncertainty, internationally accepted data that can be used to validate the operation of absolute instruments, or calibrate equipment that operate in a relative way. Values and correlations are characterized as reference ones, only once they have been thoroughly examined and approved by qualified bodies. In the case of the thermal conductivity of fluids (gases and liquids), there exist several reference data, that are characterized by low uncertainty; however, the same is not true for solid materials. There are few reference values/ correlations available for solids, and most of them are not of low-uncertainty and cover narrow temperature ranges.

Our group has been measuring the thermal conductivity of reference and candidate reference solids using the Transient Hot-Wire (THW) technique with an absolute uncertainty of as low as 1%, and most of these measurements have already been employed in the development of reference correlations.

The THW technique is based on the transient heating of a thin metallic wire in contact with the sample. The thermal conductivity is obtained from the observation of its temperature rise. One of the main difficulties with the application of the method on solids is the contact resistance from the layer of air existing between the wire and the sample.

The present work attempts to solve this issue, by employing, for the first time, solid materials in which the wire is directly immersed, while they are melted. In this way, once the material solidifies, its contact with the wire is excellent. The materials that we have chosen to work with are Phase Change Materials (PCMs). These are beneficial in that they are inexpensive, safe to handle and easily accessible in high purity. Finally, because of their relatively low melting points, their thermal conductivity can be measured in both the liquid and solid phases, thus providing a full spectrum of low-uncertainty values for the materials' thermal conductivity. Hence, we propose these PCMs as candidate reference materials.

Keywords: reference correlations, reference materials, reference values, thermal conductivity, transient Hot-Wire

SECTION 3.

Civil engineering and installations

BIO BASED LEVELING SCREED - AN ECO - SUSTAINABLE SOLUTION FOR CONSTRUCTION INDUSTRY

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Abstract:

In the current energy crisis, the focus on identifying eco-sustainable solutions for the construction industry is growing significantly. The materials used, the assembly technologies and the labor force are the main costs that are found in the final price of a new construction or in the rehabilitation of the old buildings. However, the interest in reducing costs must be accompanied equally by the concern to reduce the impact of human activities on natural ecosystems. For certain structural elements, such as beams and columns made of reinforced concrete, no technological solutions to use ecological materials have been identified yet to obtain similar properties. For levelling screeds, however, variants such as pearlitic or polystyrene have been highlighted that can reduce costs but the impact on the environment remains debatable.

The paper presents a possible technical solution for making levelling screeds based on biodegradable plant material obtained from the stem of the hemp. Two main advantages are claimed by the presented solution as follows: capitalization of a by-product resulting from agricultural activities which impresses a strong circular economy character for the basic raw material used and the second advantage lies in the possibility of eliminating labor and the need for additional materials as separate stages of work to achieve the finished layer of the floor because the cast screed can be sanded and treated properly so that it can be considered a finished surface.

Three variants of making the levelling screed using hemp shive as the basic material are presented. The results obtained were compared with two current variants of pouring the levelling screed, such as pearlite screeds or polystyrene ball screeds. The aim is to provide technical information verified by laboratory tests to change the perspective on construction materials obtained from vegetable waste. This opens the vision of entrepreneurs and designers to adopt these eco-sustainable solutions as possible options to take into account when designing the levelling screeds in new or existing buildings.

Keywords: bio-buildings materials, circular economy, construction industry, hemp shive, renewable resources

OPPORTUNITY TO APPLY GNSS TECHNOLOGY TO MEASURE PARAMETERS OF HYDROTECHNICAL CONSTRUCTIONS

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Abstract:

Monitoring of the structural parameters of the hydrotechnical objectives is necessary in the operation process to know the stability of the construction. Some of the frequently monitored parameters are the 3D movements of constructions such as dams, reservoirs, intake tower at dams, buildings and so on. An important requirements is the speed in performing and interpreting the data. Measurement methods have diversified in recent times through the contribution of topographic research. In recent years, new technologies have been applied to track the behavior of hydrotechnical constructions, providing favorable results for safety, management and structural analysis. GNSS technology is a modern method that allows the creation and measurement of geodetic networks to track the movements of landmarks fixed on and around hydrotechnical constructions. GNSS technology has the advantage of quickly determining the coordinates of the points being tracked, both static and in real time kinematic (RTK). The classical methods of tracking the movements of hydrotechnical constructions allow the determination of coordinates with high precision. The main disadvantage of classical methods is that they do not allow the simultaneous tracking of three-dimensional movements. The operating mode of the instruments is manual and the operating time is long. GNSS technology has the advantage of being able to provide continous and secure three-dimensional data with high accuracy. From a topographical point of view, positioning using GNSS technology follows the principle of classical trilateration: an indirect intersection of electronically measured distances. The GNSS receiver measures the transfer time of the satellite signal between the GNSS satellites and the receiver, which multiplied by the speed of light provides the distance between the satellite and the receiver. GNSS technology is used in various engineering monitoring applications, thanks to recent improvements in tools and methodologies that allow for high positioning accuracy, 24 hour availability, automatic data processing.

Keywords: accuracy, analysis, displacement, monitoring, positioning, receiver

STUDIES AND RESEARCH ON THE PHENOMENON OF HYDRODYNAMIC EROSION IN RIVERBEDS

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Abstract:

The paper presents a series of results obtained through documentary studies and field research on the behavior of riverbeds formed in weakly cohesive rocks. The phenomenon of hydrodynamic erosion influences the stability of the economic and social objectives located in the riverbeds and in the riparian area. The research areas were located in the Siret river basin and especially in the Moldova river basin. The middle and lower course of the Moldova River is formed by layers of easily erodible rocks. This situation determines important morphological changes of the riverbed after each flood with medium and high flows. In the study areas on the rivers considered in the researches were located hydrotechnical and hydro-urban constructions such as water catchments (shore and at shore distances), underpasses, shore protections, bottom sills, etc. The phenomenon of hydrodynamic erosion at the constructive elements of the bridges located on the researched watercourses was also studied. The natural factors considered in the research were represented by the morphometric characteristics of the riverbed, the hydrological regime, the geotechnical characteristics, the frequency of floods and the influence of climate change. The anthropic factors considered in the research were represented by the exploitation of the ballast in the riverbed, the type and method of application of the riverbed maintenance works and the absence of the riverbed regularization works. An anthropic factor analyzed was the application of the maintenance works of the constructions in the riverbed and on the shore in the research areas. Field research on the erosion of the riverbed in the area of the bridges revealed significant degradation of the abutment and piles of the bridges. The research highlighted an active phenomenon of riverbed erosion, which led to the lowering of the trough and the uncovering of the foundations with piles and abutments.

Keywords: anthropogenic factors, bridges, natural factors, pipe crossings, shore protection, water catchment

EXPERIMENTAL STUDY ON THE DETERMINATION OF HYDROGEN PERMEABILITY OF STEEL DISTRIBUTION PIPES

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Abstract:

Given that the political factor creates the legislative framework for the production, transport, storage, distribution and use of hydrogen, it can become an important vector for the energy development of local communities. At the same time, hydrogen can be an inexhaustible source of energy under the use of green energy that can be used to produce hydrogen.
Hydrogen is considered an important source of energy for the future. It is also an efficient means of storing energy. As an energy solution, hydrogen has a high potential and offers many benefits - from its low impact on the environment to its sustainable nature. Today, fossil fuels account for more than 80% of the world's total energy consumption, with transport being 92% dependent on oil. While reserves are declining, global demand is steadily rising due to emerging economies. The development of a reliable hydrogen supply system would eliminate one of the main economic barriers to the hydrogen economy. Pipeline distribution systems are cost-effective ways to transport the hydrogen from one location to another to the final beneficiaries. Hydrogen can play an important role in decarbonizing energy and can play an important role as an energy vector for the urban utility system.
Global warming is another challenge for hydrogen in the fight to reduce greenhouse gas emissions. But in order to achieve this goal, solutions must be found for the production, storage, transport and use of hydrogen in homes so that it is safe to operate. The use of hydrogen in this way leads to the elimination of significant amounts of greenhouse gas emissions, knowing that the heating of homes is responsible for about 40% of total greenhouse gas emissions. The benefit of mixing hydrogen with methane gas would be similar to introducing biogas into the gas pipeline, which is a renewable product. One of the methods would be the use of hydrogen for the production of heat and domestic hot water in the own units (constructions) of the housing units so that it is not distributed on the existing methane gas installations. These power plants can be supplied in the following ways. One way to power these plants would be to inject a percentage of hydrogen into existing gas distribution pipelines. The paper examines a practical methodology for observing how hydrogen can be transported through steel distribution networks.

Keywords: accuracy, analysis, displacement, monitoring, positioning, receiver

BEHAVIORAL ANALYSIS OF HIGH DENSITY POLYETHYLENE GAS DISTRIBUTION PIPES UNDER LOAD

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Abstract:

With a view to sustainable development, the safe supply of natural gas necessary for food preparation and home heating is a priority issue. The natural gas industry is a competitive market that requires high-performing assets that can be translated into high operational availability, production efficiency, reliability, and maintainability of all assets. The quality of natural gas supply systems is the basic indicator of the economical energy industry. Reliability being, along with other technical and economic indicators, is a component of quality, it must be in the attention of all the factors that determine the good running of the company.
Following the technological developments in the field of plastics, in the last decades, the pipes made of polyethylene are more and more frequently used in the realization of the natural gas distribution systems. The use of high-density polyethylene pipes is due to the fact that the service life, corrosion resistance, flexibility, and resistance to dynamic stress are superior to steel pipes. However, this material also has some disadvantages.
High-density polyethylene pipe is easily affected by ultraviolet light. In addition, the mechanical strength of high-density polyethylene pipe is lower than that of steel. Due to the increase in the number of vehicles in urban areas and the degradation of asphalt on roads, the rate of damage to polyethylene pipes has increased rapidly. In view of the problems encountered in the operation of high-density polyethylene pipes installed underground in the roadway, an analysis of these problems is necessary.
This type of analysis is based on the assumption that pavements are subjected to static loads and that paving materials, supports, and pipes are linearly elastic materials. In reality, the pavements are subjected to both static and dynamic loads, the asphalt mixtures are viscoelastic materials, and the clays have plasticity. So, for simplicity, static loads are applied on a road section with properties of linear elastic material. The paper deals, by numerical methods (finite element method), with the deformation modulus and the stress state of high-density polyethylene pipes subjected to the loads resulting from the movement of vehicles on an asphalt road. This paper examined the application of QuickField software on an asphalt pavement at different vehicle positions and the responses of high-density polyethylene pipes to these loads. These analyses help to position high-density polyethylene pipes in the roadway directly from the design.

Keywords: accident consequence high-density polyethylene, methane, pipeline, traffic load

METHODS OF ADJUSTMENTS COSTS IN CONSTRUCTIONS

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Abstract:

This paper addresses the categories of construction projects financed from European and state funds. The methodology and impact of costs in constructions is analyzed by applying the formula for calculating the cost of price adjustments based on inflation published by the National Institute of Statistics. The cost of a project is defined by the direct and indirect costs, but in the projects carried out with the state there is a adjustments cost. The direct costs are represented by the resources of materials, labor, equipment, transport involved in the execution of the project. The indirect cost is represented by all the auxiliary costs with direct or indirect involvement in the execution of the project, such as but not limited to: remunerations of the management, technical, economic, other specialized personnel, administrative, service, labor protection, arrangement and maintenance of the construction site, insurance of construction works.

The adjustments cost is intended to take over a price increase due to changes that are not related to the project and related to the market economy of the industry in constructions. The final cost paid at the completion of the project is defined by the direct, indirect and adjustments cost.

By applying the methods regulated by the Government Decision no.1/2018 and the Emergency Ordinance no. 15/2021, we find a difference in the method of application. Basically for the construction projects to which the update formula from the G.D. no.1/2018 is applied, we find that it applies to the entire value of the execution contract (material, workmanship, equipment, transport and indirect expenses), compared to the Emergency Ordinance no. 15/2021 which applies only to materials without taking into account the costs of workmanship, equipment, transport, profit of the project.

The results obtained from the use of methods of adjustments the cost in constructions based on cost indices clearly show an increase in the cost of a construction project. In order to establish a general parameter for various types of projects, in-depth studies and analyses are required.

Keywords: cost in construction, cost inflation model, forecasting, material cost

RESEARCH ON THE DEGRADATION OF THE EVACUATORS FROM EARTH DAMS UNDER THE EFFECT OF CLIMATE CHANGE

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Abstract:

The paper deals with a topical issue of the influence of climate change on the operation of hydrotechnical water-evacuation constructions at earth dams. With global warming, there has been an increase in the frequency and intensity of extreme weather events in recent years. Climate change has caused hydrological risks in the river network, represented by fast and frequent floods for short periods of time. Rainfall is no longer evenly distributed throughout the year, but is concentrated in short intervals and with a high intensity. The safe operation of the earth dams is a topical issue, given their impact on the riparian environment in the event of damage.

Many of the earth dams in operation in the area of Moldova are over 50 – 60 years old. These have been made with less advanced execution technologies than the current ones. Because of this, dams have imperfections in their structure due to their design, methods of execution and operating conditions. Imperfections in the structure of the earth dams influence the behavior of the water evacuators. Rapid floods coupled with negative anthropogenic factors have led to partial or total degradation of large water evacuators, but also bottom drains. The damage and structural failure of the evacuators from a series of earth dams in the area of Moldova in the last 25 years confirm this aspect (eg. Mileanca, George Enescu, Iezer, Crujana, Grăniceşti, Horodnic dams, etc.). The rapid degradation of the water evacuators has also resulted in the partial and total destruction of the dam. The main antropogenic factor of the water evacuators degradation is the absence of annual maintenance and repair works of the earth dams. In order to reduce the disasters caused by the malfunctioning of medium and large water evacuators, it is necessary to analyze, re-evaluate, simulate the phenomenon of the flow through the evacuators. It is also necessary to adopt programs for the rehabilitation and modernization of evacuators.

Keywords: damage, floods, infiltration, maneuvering tower, rainfall

TACKLING SUSTAINABILITY IN TODAY'S BUILDING CLIMATE

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Abstract:

Sustainability is one of the most talked-about subjects in regards to architecture and engineering due to the increasingly alarming rate of pollution affecting people all around the globe. Two years later, the sanitary crisis caused by COVID-19 still leaves a scar over the industries on which we rely for perpetuating our lives. The world economy has been in turmoil, moreover affecting the livelihood of less developed countries. The construction industry has been taking a hit for the worse, leaving a lot of projects incomplete or developers in a state of bankrupcy. As the regulations changed the way we work and interact as a society, some things are slower to adapt (infrastructure, industry production cycles, etc.) and this has had consequences that we're seeing all over the media (raw metals, construction materials, even food have all increased in price by a significant amount, in turn the quality of products and constructions have been decreasing).

This, combined with the effects that global warming has been having on our planet over the years, makes us really reconsider the importance of sustainability in today's building climate. Problem is, the majority of people do not possess the necessary knowledge to assess the cost-benefit proposal of true sustainable building, and developers are rarely pushing forward the initiative towards a greener future. As such, the path of sustainable building becomes one of self-sufficiency for the undocumented individual, leaving space for architects and engineers to fill the gaps and educate the larger audience. Now, more than ever, sustainability has to take the front seat, exploring and integrating newer or alternatives to protect ourselves, our investments and the environment. The responsibility of living a sustainable life does trickle down to the choices we make everyday, and long term investment in the way we think about the built surroundings is imperative.

The construction industry is responsible for around 70% of the greenhouse gasses emissions, and as such is raising a lot of red flags for the European Union, which in turn has taken legislative measures against improper handling of building sites and sustainability of architecture. In short, from 2021, all new buildings must be built to the nZEB standard, meaning they have to be designed with sustainability in mind. As new technology and engineering feats within this branch of the construction industry commence, how can we incorporate it into the buildings we sketch, and what are the alternatives on which people can rely to themselves to save money and build sustainably? And how does this fit within the current state of affairs in regards to climate change doubled by economic turmoil?

Keywords: conservation, crisis, economy, materials, strategy, sustainability

STUDIES ON MODERN METHODS OF CREATING 3D MODELS FOR BUILDINGS

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Abstract:

3D modelling has seen a sharp evolution over the past decade through its use in various economic and social fields. 3D models allow the creation of virtual spaces that reflect, with increasing accuracy, the three-dimensional world in which we live. To create 3D models of buildings, several appropriate methods and software are currently available. This research aims to highlight the potential of laser scanning technology (LiDAR) as a data source for 3D modelling of urban areas. This research presents the current state, both nationally and internationally, of the use of LiDAR technology in the field of civil engineering and architecture along with the established methods of geomatics, such as photogrammetry and remote sensing. Creating accurate 3D models of buildings is currently considered an expensive and time-consuming process. This paper presents an automatic method of generating 3D models from LiDAR data by integrating geographic information systems (GIS) and computer graphics. The models obtained can be used in various fields, such as urban planning and systematization, flood analysis and forecasting, seismic disaster analysis, etc. Simulation can be done on situations existing before and after a disaster occurs.The raw data recorded by the airborne laser scanning equipment is transformed into a set of data processed using specialized programs. The data processing consisted of: classification in points of land, buildings and noise, creation of the Digital Elevation Model (DEM), extraction of the footprint of buildings and creation of the 3D model of buildings. An important issue is the evaluation of the results accuracy and the reduction of processing errors. In the analysis of data, a number of methods are used to eliminate errors that have occurred. The main errors are represented by polygons with voids, irregular edges of buildings, erroneous classification in buildings of small objects, etc. The evaluation of the results accuracy was made by comparison with the basic topographic map, which includes the footprints of the buildings. The analysis carried out showed that the results obtained were similar, which represents a validation of the workflow adopted in the research.

Keywords: ArcGIS, buildings, DEM raster, LiDAR, LSA

COMPRESSION RESISTANCE OF CONCRETE

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Abstract:

The paper presents the main mathematical relationships for the evaluation of the compressive strength of Portland cement concretes made over time by researchers of worldwide recognized scientific value. The authors use in their relations the influence factors on the value of the compressive strength and the conditions that the components of the concrete must meet. Each mathematical relation was verified by the authors through complex laboratory research and by imposing restrictive conditions for achieving the mechanical performance and durability of the studied concrete. It presents the advantages, disadvantages and scope of use of relations, as well as the possibilities for their application for the present.

Keywords: absolute volumes, available space gel ratio, cement hydration coefficient, cement paste compactness components, granular coefficient

SELF COMPACTING CONCRETE WITH BRICK DUST AND FLY ASH

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Abstract:

Because of the high amount of concrete used everywhere in the world, and the big necessity of aggregates and cement the science community has to come with a solution for this problem. The article presents a study of self-compacting concrete using recyclated aggregates, in this case crushed brick, for determining the mechanical properties. Self-compacting concrete seems to be a solution to stop polution when we talk about concrete because it doesn't need compacting technologies and offers the opportunity to add to it in limited dosage recycled aggregates to replace existing aggregates or fly ash as substitution of a small portion of cement. The study presents a number of 18 mixes who are using crushed brick divided in three categories according to the dimensions of particles such as: 0-4mm; 4-8mm; 8-16mm. The crushed brick is replacing the same category of aggregate in three separate percentages: 10%, 20% and 30%. The replacement of cement with fly ash has also been done for the 18 mixes in two percentages: 5% and 10% and the results for fresh state, mechanical properties and density is discussed. For the recycled concrete to be self-compacting it needs to satisfy a series of requirements in fresh state such as: filling ability, passing ability and segregation resistance. For each requirement a test method has been done in order to classify the mixes in different classes. The addition of water or additive has been made in order to satisfy the self-compacting properties of each mix. As for the mechanical properties 3 cubes with size of 150 mm were poured for each mix and the value of compression strength has been determined. The results have been discussed for every category of aggregates and cement replaced and for each percentage. The highest value of compressive strength has been determined for the mix who replaces 30% of the 8-16 mm aggregate with crushed brick and 10% of the cement with fly ash.

Keywords: crushed brick, fly ash, green concrete, self-compacting concrete, recycled aggregates

DANGERS OF HEIGHTS

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Abstract:

The paper „Dangers of heights" is an analysis of the risks of working at height and looking for solutions to eliminate or reduce the risks of injury during work at height. An in-depth analysis of the literature has shown that although the reduction of accidents at work has been the subject of several strategies, however, in terms of accidents due to falls from a height the figures remain high, placing this risk at the top of fatal accidents. Moreover, by analyzing the various studies, we found that in many cases, although the workers were properly equipped, they suffered various accidents due to the breakage of the connecting means (component of fall protection systems that connects the body support device and a point anchoring).

As accidents at work due to falls from a height have continued to occur over time, it is clear that the risk factors present in the work environment affect not only workers but also the PPE, negatively affecting its protective characteristics. The lack of specific standards in the performance of products, considering the actual conditions of use, has led to the establishment of erroneous protection features and false lifespans in use, which has been shown to have an impact on the direct user.

Statistics show that the construction sector is still at the top of the ranking for accidents due to falling from a height, so I set out to identify the factors that influence falls from a height, in order to obtain relevant information on the existence of causal relationships between system components. (performer, workload, means of production and working environment) and the risk of falling from a height.

The methodology applied to meet the objective included: online research and documentation, rigorous evaluation and critical analysis of the selected articles in order to identify and centralize the factors that influence the risk of falling from a height. The results of the analysis showed that the main factors in causing accidents are workers through "behaviors and attitudes", the configuration of the workplace and last but not least personal protective equipment, due to non-use, improper use, or deteriorated use.

Keywords: Work at height, organisational health and safety, construction field, work safety, safe work environment

STUDY ON THE MOISTURE CONDITIONS ASSESSMENT IN THEREHABILITATED ENVELOPE OF BUILDINGS PREFABRICATED CONCRETE PANELS

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Abstract:

Increasing the energy performance of the building stock is not intended solely to reduce consumption for environmental reasons. Rising comfort in buildings, access to healthy indoor conditions, or even energy independence are also important reasons which make the reduction of the consumption generated by the use of buildings a priority in the development of the European Union. This has led to the development of strategies andfurther to the creation of funding programs that make it possible to renovate existing buildings.
Romania's building stock is one with low energy efficiency, with the percentage of buildings modernized from an energy point of view, being less than 10%. In particular, in Romania, a large part of the buildings, built between 1970 and 1990, with exterior walls made of concrete prefabricated panels, has a low level of thermal protection which is generated by the execution technology and the panel composition. Such buildings should be given priority for their energy modernization.
The paper presents possible solutions to increase the energy performance of external building prefabricated walls,and it highlights the evaluation of moisture conditions in the building envelope and the influences of moisture content variation. Moisture analyses are performed with Wufi® Pro software, taking into consideration factors, such as built-in moisture, solar radiation, driving rain, or capillary transport, which makes it possible to analyse the variation in moisture within the element for several years. Finally, conclusions and recommendations are pointed out referred to increase the thermal performance of buildings wall elements, made of prefabricated concrete panels.

Keywords: building energy performance, moisture conditions simulation, prefabricated concrete panels, retrofitting

REASERCH AND CASE STUDIES ON WATER LOSSES IN DISTRIBUTION NETWORKS AND THEIR EFFECT ON THE GROUNDWATER

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Abstract:

The current paper approaches the possibility of using the devices owned by the Company I work for, namely the G.P.R. (Ground penetrating Radar), U.A.V., thermal imaging camera, for the purpose of pre or identification of losses on pipelines and transportation of drinking water, identifying fraudulent consumers by determining possible unauthorized digging and monitoring the sewage and treatment plants. both on drinking water distribution and transportation pipes.

The paper comprises a series of cases we actually encountered on site and successfully identified using the Geo radar and pre-encountered with the thermal cameras and drones. The cases are explained, illustrated with on-site images and have been confirmed by visual inspection in the respective areas and by other devices on Mobile Laboratory for Loss Detection and by conducting surveys (mechanized excavation) at those specific points.

The use of drones equipped with thermal imaging camera can help not only in external maintenance, but also in actions to limit fires (thus using efficiently water resource's by well organizing the teams in the field), in these periods of drought due to lack of rainfall. Using different types of GPR's such as low frequency, GPR with deep radar penetration up to 11 m depth, GPR with multiple antennas especially those with 40 or more, can help to create a better "image" of the underground utility's, as well as the presence of possible infiltrations, which can come either from damaged pipes or from the groundwater.

In conclusion, the "unconventional" methods (compared to traditional sound-based detection methods) used in the field to identify pipe losses, can have good results as a secondary procedure for leak detection. This equipment like G.P.R., drones and thermal imaging camera, should not be perceived as universal replacement of all the so far existing devices , either in terms of loss identification or in terms of utilities identification, as they are complementary devices on certain loss detection segments.

Keywords: best practices, drones, G.P.R, water losses

MONITORING OF WASTEWATER PARAMETERS IN TREATMENT PLANTS: CASE STUDY – WWTP OF IASI CITY

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Abstract:

This article briefly presents how to monitor a technological process in a municipal WWTP, in order to better understand the treatment processes. Monitoring the parameters of wastewater in a treatment plant, involves monitoring the quality of wastewater through measuring and control equipment, sampling wastewater as accurately and as many points as possible, the ideal case being after each technological object or treatment step and analysis of wastewater samples as accurately as possible, also the ideal case being compliance with well-defined methodologies. Following the monitoring of wastewater parameters, data and study results are obtained that can be used to evaluate the technological process, make graphs and tables or to optimize technological processes. The research methodology consists in the presentation of the way of monitoring the wastewater parameters with the measuring and control equipment, the presentation of the sampling method and the analysis method, after which the obtained data will be presented graphically and tabularly. The wastewater parameters that Iași WWTP must comply with from a legislative point of view are included in NTPA 001, NTPA 002 and NTPA 011, the most important parameters being temperature, pH, BOD, COD, TSS, N and P. These parameters, together with the wastewater flows from the treatment plant, indicate the quantities of pollutants that have entered the treatment plant, the quantities of pollutants that are removed from the treatment plant, can indicate the F/M ratio, the organic load of the basin, treatment efficiency, sludge production etc. Analyzing the parameters of wastewater from the inffluent and effluent of WWTP we will observe a low organic charge of wastewater, which makes bioreactors in the biological stage of Iași WWTP to operate on the extended aeration area, with high energy consumption in order to achieve high treatment efficiencies. In conclusion, the data and the results obtained from the monitoring of the wastewater parameters allow the control of the treatment processes and lead to the management of the technological processes as efficiently as possible.

Keywords: WWTP, parameters, wastewater, technological process, pollutants, monitoring

STUDIES ON THE HYDROMORPHOLOGICAL EVOLUTION OF WATERCOURSES

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Abstract:

Reinforced Concrete (RC) Frame structures are one of the main Seismic-Resistant structural systems used by structural engineers. In these conditions, the current research study highlights the importance architectural-structural conformation of Moment-Resisting (MR) RC Frame structures in preliminary seismic design stage, so that in the current practice often results MR RC Frame buildings with increased sensitivity to earthquake. Thus, the seismic response of this structural system type required to 1971 San Fernando Earthquake, 1978 Miyagi-ken- oki Earthquake, 1994 Northridge Earthquake and 1995 Hyogoken-Nanbu (Kobe) Earthquake was studied in parallel with seismic design specifications for RC structures, developed in P100-1 and EC 8 seismic norms. The observations regarding the effects of the inadequate architectural-structural conformation of the MR RC Frame structures overlapped with examples of real structures executed in the Iasi area (Romania). These structures with seismic sensitivity do not correspond to the architectural-structural conformation specifications of P100-1 and EC 8 seismic norms and may develop fragile rupture mechanisms in a major earthquake. The causes of the general torsion of the structure or the collapse of the weak floor/ ground floor or other local/ global mechanisms of seismic response are non-consideration in the architectural-structural conformation stage of the RC slab holes for staircase/ elevator shaft; rigid attachment of the elevator shaft walls/ staircase walls to the rest of the structure; gravitational loading conferred by the presence of balconies positioned only in certain areas of the structure; rigid attachment of the infill walls in RC frames to the RC frames etc. Practically, the importance of the preliminary verification of the structure skeleton in the modal analysis stage was highlighted through establishing the vibration modes and the behavior factor „q" – which can be considered with minimum values in some situations of general torsion of the building. Thus, it was concluded that non-compliance with the conditions of architectural-structural conformation of MR RC Frame systems leads to seismic design of the building for lower values of seismic action and non-existent high ductility of the structure. In these conditions, the lateral structure develops a non-ductile seismic response with local and global collapse mechanisms (general torsion; weak floor/ ground floor) as in the MR RC frame structures required to 1971 San Fernando Earthquake, 1978 Miyagi-ken-oki Earthquake, 1994 Northridge Earthquake and 1995 Hyogoken-Nanbu (Kobe) Earthquake.

Keywords: Earthquake, seismic norms, seismic response, general torsion, modal analysis.

THE IMPORTANCE OF ARCHITECTURAL-STRUCTURAL CONFORMATION OF REINFORCED CONCRETE FRAME BUILDINGS IN THE PRELIMINARY SEISMIC DESIGN STAGE

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Abstract:

Reinforced Concrete (RC) Frame structures are one of the main Seismic-Resistant structural systems used by structural engineers. In these conditions, the current research study highlights the importance architectural-structural conformation of Moment-Resisting (MR) RC Frame structures in preliminary seismic design stage, so that in the current practice often results MR RC Frame buildings with increased sensitivity to earthquake. Thus, the seismic response of this structural system type required to 1971 San Fernando Earthquake, 1978 Miyagi-ken- oki Earthquake, 1994 Northridge Earthquake and 1995 Hyogoken-Nanbu (Kobe) Earthquake was studied in parallel with seismic design specifications for RC structures, developed in P100-1 and EC 8 seismic norms. The observations regarding the effects of the inadequate architectural-structural conformation of the MR RC Frame structures overlapped with examples of real structures executed in the Iasi area (Romania). These structures with seismic sensitivity do not correspond to the architectural-structural conformation specifications of P100-1 and EC 8 seismic norms and may develop fragile rupture mechanisms in a major earthquake. The causes of the general torsion of the structure or the collapse of the weak floor/ ground floor or other local/ global mechanisms of seismic response are non-consideration in the architectural-structural conformation stage of the RC slab holes for staircase/ elevator shaft; rigid attachment of the elevator shaft walls/ staircase walls to the rest of the structure; gravitational loading conferred by the presence of balconies positioned only in certain areas of the structure; rigid attachment of the infill walls in RC frames to the RC frames etc. Practically, the importance of the preliminary verification of the structure skeleton in the modal analysis stage was highlighted through establishing the vibration modes and the behavior factor „q" – which can be considered with minimum values in some situations of general torsion of the building. Thus, it was concluded that non-compliance with the conditions of architectural-structural conformation of MR RC Frame systems leads to seismic design of the building for lower values of seismic action and non-existent high ductility of the structure. In these conditions, the lateral structure develops a non-ductile seismic response with local and global collapse mechanisms (general torsion; weak floor/ ground floor) as in the MR RC frame structures required to 1971 San Fernando Earthquake, 1978 Miyagi-ken-oki Earthquake, 1994 Northridge Earthquake and 1995 Hyogoken-Nanbu (Kobe) Earthquake.

Keywords: earthquake, general torsion, modal analysis, seismic norms, seismic response

GEOTECHNICAL BEHAVIOR OF AN EXPANSIVE SOIL IMPROVED WITH WASTE TYRE CRUMB RUBBER DETERMINED BY LABORATORY TESTS

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Abstract:

The present study focuses on the sustainable solution for the improvement of expansive soils behavior using scrap tyre rubber. With the alarming increase of tyre wastes, the researchers world-wide are looking for sustainable methods to include all types of scrap tire materials in civil engineering structures. This type of waste is very hard to dispose and its clearly unwanted in any kind of urban-industry. Expansive soils are well known for their problematic behavior and have always caused geotechnical problems including high liquid limit, high plasticity index, high linear contraction and caused different types of structural damage at buildings, roads, bridges etc.

Light infrastructures that are placed directly on natural expansive soils can degrade in time because of the moisture content variation. The expansive soil used in this experimental study is the Bahlui Clay which is analyzed in various conditions and in different mixtures with the waste tyre crumbs. In the laboratory tests different percentages of scrap tyre crumbs along with rubber powder have been used aiming to see some improvements of physical parameters. Results have shown some changes in the structure of the expansive soil and indicated that the waste tyre crumbs can be used as a method of soil stabilization, but only in certain conditions. The 30% scrap tyre addition proved to have a positive influence on the geotechnical properties of the active clay, improving the soil parameters such as Atterberg limits, linear contraction, and plasticity index.

Keywords: Expansive soil, waste tyre crumbs, Bahlui Clay, sustainable solution

DRAINAGE DENSITY MAPPING USING ARCGIS IN THE LIWIEC WATERSHED

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Abstract:

In recent years, GIS methods have been successfully applied to determine the characteristics of the watershed and its shape. Even though field mapping is the most precise method of determining channel or drainage networks, sometimes it is impossible to use it in vast and inaccessible mountainous areas. The drainage study relies heavily on topographic maps, which serve as a helpful proxy for drainage networks. Drainage analyses using topographic maps and hand delineation takes time, knowledge, and subjectivity assessments. The density of the drainage system reflects the climatic imprint on the terrain and influences the boundary conditions for surface hydrology. It can also be described as the total length of streams per unit area, and it defines the drainage spacing and distribution in a basin. Drainage density is closely related to many hydrologic processes, such as infiltration, soil saturation, overland flow, overland erosion, and the interactions between them that control runoff and sediment production. The purpose of this paper is to study the possibility of improving processing time, accuracy and to better delimit the density of the drainage systems. GIS technologies were used to determine the drainage density. Using multiple GIS functions, including flow direction and flow accumulation, a grid network is determined from the original digital elevation model. The grid network is converted to a vector file with the help of GIS using raster to vector transformation tool. The results of this paper show the drainage density of the Liwiec watershed and provide high superiorly data. The higher the drainage density value, the lower the infiltration rate and the higher surface flow velocity. High drainage density is often associated with large amounts of sediment carried through river systems, high flood peaks, steep slopes, and low agricultural aptitude. The results of this study can be used for future management planning in this area.

Keywords: digital elevation model, drainage density, hydrology, GIS, watershed

NUMERICAL ANALYSIS ON THERMAL COMFORT IN ROOMS USING CONVECTIVE HEATING AND RADIANT HEATING TERMINALS

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Abstract:

The concept of energy is closely related to the building sector and the systems used for heating, implicitly energy saving which is a current problem of new buildings, but especially of old ones. An effective way to reduce the energy consumption used for heating and its costs at the same time, is by choosing a system which is as efficient and sustainable as possible. As highly efficient heat emitters, both radiators and underfloor heating produce high level of thermal comfort in any building, being found in most European homes. The temperature and its distribution in the room is a factor of great importance when it comes to comfort.

In this paper a series of numerical simulations were made in Autodesk CFD Simulation in order to study the influence of terminal heating systems over the thermal comfort in rooms. Three case solutions were analyzed, as follows: heating a room using a steel radiator, heating a room using an aluminum radiator and heating a room using underfloor heating.

For the steel and aluminum radiators, a thermal power of 1000W was assigned in order to reach a temperature of about 70°C. For the heating coil, a thermal power of 300W was set in order to reach a temperature of about 37.76°C. Following the simulations, transverse and longitudinal planes were made inside the room in order to observe the stratification of the temperature in the volume of indoor air. The values resulted through numerical simulations for the average room temperature in each case were compared with the values for ideal heating.

It was observed that underfloor heating is the most efficient source of heating among those analysed. Compared to heating using radiators, the temperatures along the length and height of the room using underfloor heating are constant and close to the ideal heating. The human body feels the most comfortable due to the uniform distribution of temperature from ground level on height.

Keywords: comparative analysis, heating system, temperature distribution, thermal comfort, underfloor heating

STRESS ANALYSIS OF MASONRY WALLS IN CASE OF UNDERPINNING CONSOLIDATION WORKS

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Abstract:

In the case of continuous foundations, the underpinning works produce changes of stress related behavior at the level of the masonry walls. Currently, the underpinning is done on sections and it is used to strengthen and develop higher bearing capacity of the soil beneath the extended foundations. In this paper, a series of parametric cases were evaluated by numerical finite element modelling analysis of a masonry wall using the calculation program Plaxis. The static analysis was performed using a spatial calculation model with shell surface finite elements and linear frame elements. Using this method, it was followed the stresses variation in a masonry wall with a thickness of 0.45 cm and a height of 2.80 m statically loaded, in conditions of changing the mechanical characteristics of the structural elements, as a consequence of weather and climatic factors, and the variation of the pillars interax distances. These numerical tests enable the possibility to optimize the arrangement of the pillars under the continuous foundation, so that the stresses and settlements are maintained at acceptable values and the execution is carried out safely. The excavation for the underpinning is assumed to start from oposite corners of the wall, with variable sections of pilasters, from 1.00 m increasing with a rate of 0.10 m, up to 2.00 m and variable distances between them. After performing finite element numerical simulations it can be concluded that the stresses in the masonry wall are directly proportional to the interax distances. The introduction of pillars leads to a decrease in tension in both studied points, and the optimal distance for this ideal case is between 3.00 ÷ 4.00 m interax distance.

Keywords: excavation, finite element modelling, Plaxis software, stress analysis, underpinning

QUANTIFICATION AND REDUCTION OF SHEAR MODULUS UNCERTAINTIES USING MODERN BENDER ELEMENTS

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Abstract:

Maximum shear modulus (Gmax) is an important parameter in soil dynamics critical to the study of ground motion, ground response to cyclic loading and soil-structure interaction. It contributes to the evaluation of soil behavior during earthquake, traffic loading and vibrations of machines. Different methods for determining the Gmax have been used both in the laboratory and in the field. The recent and popular method for the determining the shear modulus of soils is by the use of Bender Elements. Bender elements can be applied to various laboratory apparata to measure the Gmax of soils. However, in determining the travel time, the bender element method has some uncertainties. The difficulties with electrical crosstalk, mixed radiation of both P – and S – waves, near field effects and uncertain detection of first arrivals bring some uncertainties in the measurement of the travel time. Further innovative means of measuring the Gmax is the use of the Wykeham Bender Element machine which measures the shear wave velocity, shear modulus and the wave travel time at different levels of testing. In this research paper, the Gmax would be determined using the Wykeham Bender Element on remolded cohesive soil samples that will be collected from the Bahlui River. The sample will also be taken through tests to provide the factors what influence their dynamic properties and using the equations by Hardin and Drnevich, empirical correlations of shear modulus with index properties of soils would be determined. An analysis of the results obtained from these methods would be compared and correlated with the values of the typical initial shear modulus of typical soil types from site investigations. The obtained results will help ascertain the expected uncertainties in the use of this Bender elements for the determination of shear modulus and also identify the need for specific correction factors that can be applied in the use of this equipment for future application.

Keywords: bender elements, cohesive soils, shear soil modulus, shear wave velocity, S-waves

SECTION 4.
Electrical engineering; Energy engineering; Electronic engineering, telecommunications and information technology

TOWARDS RELIABILITY AND SAFETY IMPROVEMENT OF MEASUREMENT AND CONTROL PROCESSES ON SHIPS: IMPLEMENTATION OF WIRELESS HART PROTOCOL

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Abstract:

Measurement and control systems in maritime engineering applications are quite similar to those in shore based engineering applications except for some unique features which differentiate between each of them. These features are either related to the specific nature and purpose of the maritime application (Various types of commercial ships, Oil/Gas rigs and others) or linked to the harsh environmental conditions such as salinity, corrosion and vibration which usually exist in higher levels than shore based applications. Accordingly and due to such a specific nature of maritime engineering applications, more requirements should be considered to ensure reliability and stability for measurement and control process avoiding any negative effects that might be associated with such a unique engineering environment. As was discussed in previously, smart transmitters based on hybrid analogue-digital (HART) and digital (Foundation Fieldbus and Profibus PA) communication protocols with additional diagnostic information, they might be an option to consider as wired alternative protocols for analogue transmitters (mostly based on 4-20 mA analogue standard). Similarly, wireless HART protocol can be an alternative for 4-20 mA analogue transmitters with others based on wireless WiFi technology. This article will discuss the possibility of replacing classical 4-20 mA analogue transmitters with Wireless HART smart transmitters on a commercial ship as an example for maritime engineering application. The first section of the discussion will include a theoretical background for the basic principles of wireless HART protocol supported by an experiment – based example for implementation a small Wireless HART network indicating the main factors according to which stable and successful communication process can be achieved. Based on the understanding provided through the first section, the second section will discuss the possibility of utilising wireless HART protocol in the most common measurement and control systems on any commercial ship in order to discover to which extent wireless HART can either coexist with 4-20 mA analogue standard or replace it. Ultimately and based on the conducted discussion, general perspective will describe the best possible techniques to implement Wireless HART protocol on a commercial ship providing measurement and control process with an improved performance.

Keywords: access points, gateway, wireless field devices, wireless hart, WiFi

THE IMPACT OF DISTRIBUTED GENERATION ON THE VOLTAGE PROFILE

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Abstract:

The increased attention, in last years, to sustainable developments and environmental pollution has led to the accelerated development of distributed generation (DG) technologies, based in particular on renewable energy sources (RES). The integration of the distributed generation units on the electrical network leads to a series of benefits and challenges, both in terms of exploitation and control. The traditional power energy system, where the power is produced centrally, in large power plants and delivered to large consumption areas by means of transmission power lines and, finally, distributed to consumers through the distribution infrastructure is currently in changing to a power system characterised by the integration of numerous sources of distributed generation. Thus these changes led to the modifying of power flows in the system from unidirectional to two-way. Of course, the introduction of distributed generation units at various points in the distribution network lead to various key problems and challenges, including optimal voltage level management in the network busses. This problem can be solved by controlling the active and reactive power of the DG units, correlated with the adjustment of the plot of the transformers in the transformer stations.

The purpose of this paper is to present the main factors that influence the assigned generation and to analyze one of its effects. An important control component for a safe and efficient operation of the distribution network is the influence on the voltage level in the network busses. With the introduction of DG, there can be variations in the voltage determined by active and reactive power injection in the nodes of a network.

This paper presents the case of a distribution network on an industrial platform, with six concentrated loads and three turbogenerators. The electrical one-line diagram has been simulated in the DigSilent Power Factory software and the results obtained after performing the permanent regime calculations have been presented in graphical form and analyzed. Thus, is presented the contribution of distributed generation sources on the voltage profile of the network busses due of the active and reactive powers flow.

Keywords: DigSilent Power Factory, distributed power generation, distribution system, mathematical model, renewable energy, voltage control

ASPECTS REGARDING WIRELESS COMMUNICATION WITHIN ELECTRICAL EQUIPMENT

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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 there 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, SAW sensor, power system, Wi-Fi communication

ASPECTS REGARDING THE USE OF TCSC DEVICES IN POWER GRIDS

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Abstract:

Abstract: The TCSC is part of the FACTS device category that uses series compensation to regulate active and reactive power flows. The principle of series compensation is to change the impedance of the transmission line by inserting reactive elements in series with the line. Distance protection is used, in most cases as the main protection for the protection of high voltage lines. Distance protection commands the tripping of the line circuit breaker, on which it is installed, with a delay that depends on the distance to the fault location. The operation of the distance protection is based on the measurement of current and voltage, through current transformers and voltage transformers, from the same end of the line. Depending on these measurements, the impedance and electrical distance to the fault location are determined. Depending on the distance to the fault location, the protection will send the trip pulse to the CB1 circuit breaker with one of the timings provided. The values of the impedances set in the distance relay are obtained following calculations that take into account the length and constructive parameters protected lines, the transformation ratio of the current transformers and voltage transformers, as well as the framing of the line in the energy system. The distance protection has the role of locating the defects present on the line, by measuring the impedance at one of the ends of the line and of tripping the circuit breaker depending on the distance to the fault. Due to the mode of operation of the TCSC device, the line impedance changes dynamically, which can cause problems for the correct protection of the remote protection. Depending on the firing angle of the thyristors, the short-circuit impedance in the event of a fault is different, as there are problems locating the fault. This leads to problems coordinating the protections in the system

Keywords: distance protection, high voltage lines, poligonal triping zones, protection coordination, TCSC devices, relay test

MODELING AND CONTROL OF HORIZONTAL AXIS WIND TURBINES

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Abstract:

In the current context, characterized by the alarming increases in pollution caused by fossil fuels energy production and decreasing fossil fuel reserves, alternative solutions are needed. As wind is a clean and inexhaustible source of energy, wind power is attractive both environmentally (no emissions of pollutants and greenhouse gases, no waste produced) and economically.
This paper deals with the modeling of a wind energy conversion system with a doubly-fed induction generator (DFIG) due to its robustness, low cost and high efficiency. It is proposed to design a fractional order controller (FOPI) and a classic PI controller to control the generator current loops. By introducing the fractional order controller, higher performance is obtained, thus ensuring efficient operation of the wind turbine.
The subject is in line with the concerns of many specialists in the field of power generation systems, through the development and implementation of modern regulation and control methods.
The paper presents appropriate mathematical models describing the wind speed variation, aerodynamic behaviour of the horizontal axis wind turbine and the doubly fed induction generator. Using these, the wind turbine control structures and generator current loops are built in the Matlab-Simulink program.
The design specifications for the fractional order controller that must be satisfied in order to achieve stability and robustness of the system are described. The PIDtune function in Matlab is used to design the classic PI controller and determine its parameters. For the DFIG generator the rotor flux vector control strategy is used, which provides decoupling between torque and flux.
Simulations compare the performance of generator current loops using FOPI controllers and classic PI controllers. The step responses of the generator current loops to the variation of its parameters are illustrated. By applying a FOPI controller, good dynamic performance in terms of disturbance rejection and noise minimization is obtained, compared to a classic PI controller. The fractional order controller provides increased robustness and improves system performance.

Keywords: DFIG, FOPI controller, PI controller, vector control, wind turbine

2D AND 3D FEM-BASED ANALYSIS ON MACHINE STRUCTURES WITH UNCONVENTIONAL TOPOLOGY PERMANENT MAGNET

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Abstract:

A double rotor and median stator, fractional slot concentrated winding permanent magnet synchronous machines with 18 stator teeth and 20 rotor poles topology has been studied for two different rotor poles alignemts: the first having the same magnetic polarities for the two opposing poles of the rotors facing the airgaps of the machine (N - N), for which the magnetic flux lines being forced to pass through the median stator yoke; and the second one (N - S) having different polarities for the two oposing poles of the two rotors for which the magnetic field will close from the exterior rotor to the inner rotor passing through the stator teeth only. For these two layouts, the closing of the field lines, the magnetic induction maps at idle operation, the phase and line voltages, and the magnetic flux density distribution at the air gaps levels for the two rotors were analyzed comparatively. These studies were performed using bought 2D and 3D FEM analysis at idle operation and in nominal load working conditions. Thus, in addition to the values obtained previously, the line currents during load operation were also studied, as well as the harmonic decomposition of the line and phase voltages during load. Following the 3D study of the 18/20 structures in both variants, it was concluded that there are insignificant differences between the results given by the studies on the 2D and 3D models, which justifies the further limitation to the 2D analysis of the machine operating and other working conditions or different operating parameters. Using this study an experimental model has been built to validate the simulation results. The experimental model has been designed in such way to ensure a simple change between the two proposed configurations in order to test both layouts using the same machine.

Keywords: 2D/3D FEM simulations, double-rotor, experimental model, PMSG

EXPERIMENTAL VALIDATION OF AN ELECTRICAL MACHINE WITH DOUBLE ROTOR AND INTERMEDIATE STATOR PERFORMANCE

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Abstract:

A permanent magnet concentrated winding synchronous machine with double rotor and a commun intermediate stator has been studied for two different rotors poles arangements. For the proposed structure with 18 stator teeth and 20 rotor poles was first studied usinf 2D/3D FEM simulations and for results validations a prototype fas been build and tested. The experimental model was build to easely allow the change between the two variantes:Variant 1 (N - N) of the machine, where the pairs of permanent magnets on the inner and outer rotor produce opposite magnetic fields at the airgaps level, the lines being forced to pass through the middle yoke of the stator, and Variant 2 (N - S) the polarity of the permanent magnets on the inner rotor is reversed, so that the pair of permanent magnets located in the same radial direction produces magnetic fields with the same polarities. To test the desired operating characteristics, a test stand of the synchronous generator with double rotor was made, monitoring the electrical quantities both analog/digital and virtual, by using a data aquisition board. Phase and line voltages, line currents, their harmonic decomposition, as well as some operating characteristics were analyzed, both no-load and rated working conditions. The tests performed on the experimental model, both in generator and motor duty; confirm the results obtained on the theoretical model by MEF analysis. Although there are some particular differences in the external characteristics of the generator duty, these are justified by the presence of technological imperfections in mounting, or deviations from the dimensions obtained by calculations, relating to permanent magnets or details of the stator ferromagnetic circuit, to isthmuses, etc.

Keywords: confirmations, double-rotor, experimental model, performances, PMSG

VISUALIZATION AND INTERPRETATION OF ELECTROMAGNETIC INTERFERENCES ON ULTRASOUND DIAGNOSTIC SYSTEMS

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Abstract:

These days, there is an increasing demand and dependence on the use of electromagnetic transmission systems. As the number of these devices increases, there is also an increase in the electromagnetic radiation these systems produce. The electromagnetic energy that disrupts the proper functioning of electronic devices is known as environmental interference, and its sources can be categorized as environmental, incidental, or intentional. An area of real interest in which the effects of electromagnetic interference can be observed is the medical field. This paper aims to identify and categorize electromagnetic interferences in the case of ultrasonographic diagnostic systems. Ultrasound imaging is a method with high diagnostic value based on the sonograms that provide information about the condition and behavior of different regions of the body, and every detail can be visualised, designated, and interpreted for a diagnosis of the patient. In addition to the desired images, errors can occur because the signal needed for image reconstruction does not correspond fully to the reality. An imaging artifact is a term used to describe any area of the image that does not represent the proper anatomy of the subject being scanned. The ability to recognize and correct ultrasound artifacts is important for image-quality and diagnostic improvement. We will categorise them into two groups of possible artifacts: those related to violation of built-in assumptions, and those related to interference from external equipment and devices. To identify and differentiate the source of the artifacts, we use the visualization method, through which, depending on the shape, intensity, color, and frequency with which the artifact appears on the image, we can identify their cause. If the shape of the artifact looks like a band of noise from top to bottom, this is mainly due to electronic interference. Understanding the physics principles behind imaging artifacts, and the corelation with the electromagnetic interferences, we can identify, and furthermore eliminate the sources that cause them for an increase of the image-quality.

Keywords: artifacts, electromagnetic interference, image-quality improvement, ultrasound imaging, visualization

MODERN APPROACHES FOR THE OPTIMAL POWER FLOW PROBLEM IN DISTRIBUTION NETWORKS

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Abstract:

The sharp increase in the number of prosumers connected to the electricity distribution system and the injection of energy from renewable sources has created new challenges for distribution companies such as managing the increase in distributed energy and power flows. By using a proper management of Distributed Generation units the following benefits can be achieved: an improved voltage profile, a reduction of power losses in the distribution network, a reduction of dependence on conventional sources, the financial impact being a positive one. In this context, the use of Optimal Power Flow (OPF) has gained interest for applications in distribution systems. The methods used to solve the OPF problem are classified into two classes: (a) Traditional methods, such as Gradient Method, Newton Method, Linear Programming Method, Quadratic Programming Method and Interior Point Method and (b) Artificial Intelligence (AI) methods, such as Genetic Method, Particle Swarm Optimization, Artificial Bee Colony, Genetic technique for OPF problem decomposition. Because distribution systems are large and interconnected, controlling such kind of systems is a real challenge. To facilitate optimal control, the problem can be broken down into several subproblems that are solved in a coordinated manner, in this sense various algorithms being proposed, one of the most used being ADMM (Alternating Direction Method of Multipliers). The system topology will be divided into several subregions, where the distribution operator will solve OPF problems locally through optimal programs. It should be noted that a local solution affects a neighboring solution, so if a global optimization is desired, the subregions must exchange information with each other, the OPF problem being solved on the information received, leading to a solution accepted at the global level. A developing technology for descentralization and data storage is Blockchain, being secured by a combination of cryptographic signatures. Agents on the blockchain network are able to come to a universal agreement on the system state at each time step, even in the presence of cyberattacks and participants joining/departing the network. Recent research shows the possibility of applying the Blockchain technology for different OPF problem formulations. This paper aims to present the state of the art for the OPF problem for distribution system, emphasizing the most recent and modern approaches and technologies

Keywords: alternating direction, blockchain, distributed generation, method of multipliers, optimal power flow

THE INFLUENCE OF ELECTROMAGNETIC INTERFERENCE ON THE RADIOLOGICAL INVESTIGATION EQUIPMENT

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Abstract:

The proper functioning of medical equipment can be easily disrupted by the electromagnetic fields, such as those generated by the electrical network, the internet network and by other equipment in the medical unit. The electromagnetic fields can be classified in two groups: low frequency fields (up to 100 kHz) and high frequency fields (from 100 kHz to 300 GHz). The purpose for this paper is to highlight the importance of the isolation the electromagnetic field generated by a magnetic resonance imaging equipment and the artifact that can affect the radiological investigation process because of the external magnetic field. Therefore, it is an important impact of electromagnetic interference in the proper functioning of the medical equipment that may affect image quality and must be prevented, in order to not misinterpret the investigation. This is very important fact for analyze the field sources, the electromagnetic coupling paths and how it can cause artifacts that can damage the proper functioning of other radiological investigation equipment such as computer tomography, mammography and X-ray. In the case of the magnetic resonance investigation, it is used a statically magnetic field of 1.5 T, a radiofrequency magnetic field of 63 MHz and there are used non-ionizing radiations. In these conditions a special room is required in which the equipment should be placed in order to not interact with other medical equipment. Magnetic resonance imaging equipment is commonly used due to the high-quality images obtained and their demand is increasing. Also, the quality of the obtained images can be indirectly affected by the electromagnetic fields in the environment and in the process of installation a magnetic resonance imaging equipment it is a protocol that must be followed about the organization of the building. Medical units were not built taking this into account, so it is necessary to analyze and measure where is the lowest electromagnetic background that can interfere with the magnetic field of the equipment that will be installed

Keywords: artifacts, electromagnetic field, electromagnetic interference, magnetic resonance imaging, radiology, medical unit

A ENERGY STORAGE MANAGEMENT APPROACH CONSIDERING THE PROSUMER INTEGRATION IN MICROGRIDS

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Abstract:

The current evolutions in low voltage electricity distribution grids see the proliferation of microgrids that supply consumers able to generate electricity with local installations of PV panels. These entities, called prosumers, use the local generation for their own consumption needs and export the surplus in the LV grid, modifying the classic steady state operation conditions. For mitigating this inconvenience, local storage equipment can be used. Low-voltage residential electricity distribution networks are operated with four-wire circuits that supply unbalanced demand in their nodes. The demand is unbalanced in space, as the one-phase consumers are unevenly distributed at connection points, and in time because of the actual consumer needs. Lately, local consumption is supplemented by generation from PV panels, for consumers that want to achieve independence from the grid or lower their electricity bills. In a given network, a number of prosumers can be active at certain times and can generate a surplus of electricity that normally would be injected back in the grid. These supplementary power flows can generate additional energy losses that can be avoided if storage is used. The literature shows that by optimally using storage in microgrids, the quality and security of supply deterioration can be minimized in the presence of prosumers. This paper presents a novel approach for local storage management in prosumer enabled microgrids that seeks to find the optimal configuration of community storage systems that charge batteries overnight, taking advantage of low consumption hours and providing load levelling opportunities, energy loss minimization and bus voltage profile improvement. A study case performed on a real electricity distribution network shows the performance of the proposed optimization. The main contributions of the paper are the following: the conceptualization of the mathematical model for energy storage management; the adaptation of the Genetic Algorithm for the new constraints of the optimization problem; a comparison between the influence of day and night battery charging on daily energy

Keywords: community storage systems, genetic algorithms, low voltage electricity distribution networks, multipurpose algorithm

USING IoT IN SMART AGRICULTURE: STUDY ABOUT PRACTICAL REALIZATION AND TESTING IN REAL ENVIRONMENTS

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Abstract:

The paper presents the construction, operation and performances of an Internet of Things (IoT) system for data collection in agriculture. Smart agriculture involves the precise measurement of specific parameters without the intervention of the human factor. Devices that make up an IoT system for agriculture must be able to operate as long as possible in harsh conditions, have easy maintenance and must not require specialized knowledge or tools for exploitation. These devices should have a robust construction because they are usually subject to external factors such as temperature, humidity, various chemicals, dust, insects, animals, shocks and vibrations. The proposed system performs automatic measurements of environmental factors in the air and soil and makes image recordings via measurement nodes. The construction of a measurement node has as its central element an ESP32 microcontroller that offers multiple facilities such as: serial communication, WiFi, Bluetooth, sufficient memory, good computing resources, analogue and digital data acquisition interfaces and also offers simple programming. The peripherals of the node are represented by sensors designed to acquire environmental parameters such as temperature, humidity, solar intensity, amount of precipitation, etc., and video cameras to record the evolution of plants in accordance with the measured parameters. The sensors are mounted near the monitored plants, in the air, on the ground and underground. The measurement nodes are powered by independent energy sources based on solar panels. In order to reduce power consumption, consumption optimization algorithms based on adaptive data acquisition, transmission and storage protocols are proposed. An important element is the remote data transmission from the measuring node to the gateway. This is achieved through LoRaWan technology, which offers advantages such as long communication distance (20 km in open field) and very low power consumption during transmission. The data is temporarily stored at the node level and in database files in the cloud, where it is also analyzed. As experimental results, the paper presents data collected during the winter-spring periods using the proposed system and an analysis of the main influencing factors that can affect the accuracy and proper functioning of the system.

Keywords: ESP32, environmental sensors, Internet of Things, LoRa, LoRaWan, smart agriculture

SCENARIOS-BASED ANALYSIS TO EVALUATE IMPACT OF PROSUMERS ON THE OPERATION OF THE LOW VOLTAGE ELECTRIC DISTRIBUTION NETWORKS

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Abstract:

The prosumers are consumers who can partially produce the electricity they need for consumption. Specifically, the term refers to energy consumers who ensure the energy for their consumption (e.g., diesel generators, combined heat and electricity systems, wind turbines, photovoltaic panels, or batteries for energy storage) and sell the surplus to the suppliers or aggregators. The law 184/2018 for the approval of the emergency ordinance given by the Romanian Government established the possibility of the prosumers who have generation units with an installed capacity of less than 27 kW per consumption place to sell the electricity surplus injected into the distribution network to suppliers with whom they have concluded the supply electricity contracts. Afterward, the installed capacity of generating units of the prosumers increased to 100 kW in 2020. The penetration degree of prosumers in the initial stage did not lead to technical issues in the distribution networks. They had a positive impact on improving the voltage level and power loss reduction. But, the massive increase of injected power from multiple sources, which is also volatile, represents today a challenge for the Distribution Network Operators (DNOs) to ensure the optimal operation of the network, besides the reliability and quality of the power supply. In this context, the DNOs would like to know the installed capacity of the prosumers, the location in the network, the type (single-phase or three-phase), and, if possible, the typical injected power profile. Using this information, they can calculate the state-state of the network and take the best measures to minimize the negative impact to ensure an optimal operation. Using the typically injected power profiles determined for the Romanian prosumers’ classes by the authors in a previous paper, several scenarios considering various penetration degrees (between 10 and 50%), the connection phases, and locations (close, middle, or end area) to the supply electric distribution substation have been analyzed for an electric distribution network with 88 pillars and 114 end-users (consumers and prosumers). The obtained results can lead to developing strategies regarding the optimal operation of the distribution networks integrating prosumers.

Keywords: electric distribution networks, low voltage, penetration degree, scenarios-based analysis, prosumers

THE CURRENT STAGE OF PORTABLE MEDICAL DEVICES FOR ECG SIGNAL MONITORING

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Abstract:

Development starts with solving a (functional) problem, the need for safety and comfort with an ergonomic approach, to a technology that replaces many mechanically driven functional aspects. Progressive development in the field of medical technology has led to the testing and evaluation of wearable and wireless applications. Wearable medical devices that can be worn on the body are becoming increasingly popular because they can be used in everyday activities. Their integration and their inclusion in different garments lead to the demand for quality signals with a minimum of inconvenience for the users. The electrocardiogram (ECG) records the electrical activity of the heart muscle fibers, by analyzing the basic parameters of the ECG signal (morphology, amplitude, duration, frequency, rhythm), various abnormalities of the origin and conduction of the cardiac electrical impulse can be identified and evaluated. Continuous ECG monitoring plays an important role in detecting of cardiac arrhythmias such as atrial fibrillation, extrasystoles, or atrioventricular blocks that correlate with the patient's symptoms. Sudden death from a heart attack in supposedly healthy people is a very shocking experience. This was a challenge for the medical profession in the 20th century, they saw the need to intensify the search for early warnings of a possible heart attack. This article describes the evolution of automatic detection of ECGs, to the latest signal processing techniques, ECG development stages, ECG leads, portable ECG monitors, signal processing schemes, and complex transformations. Currently, most studies are focused on making small systems to minimize the inconvenience they cause to users. In addition, this paper provides recommendations for future research and directions. In addition, this paper provides an overview of earlier to the latest ECG signal processing techniques. Signal processing can be mainly divided into four phases: ECG signal acquisition, ECG signal pre-processing, feature extraction in different areas, and classification of the procedures. The research challenges of the current ECG processing trends are discussed.

Keywords: ECG signal, signal acquisition, signal pre-processing, wearable device

THE INTELIGENT MEASUREMENT SYSTEM FOR PHOTOVOLTAIC PROSUMERS

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Abstract:

The liberalization of electricity markets, as well as the European directives on energy and environmental issues, have required the promotion of the production of electricity from renewable energy sources which has had the effect of increasing the number of prosumers, owners of power plants. In last years the smart measurements systems are becoming more important for Distribution System Operators (DSO) because these systems provide valuable information related to power flows from the distribution network. This paper presents an intelligent measurement system for photovoltaic prosumers (called IMS) used in the low voltage grid, designed and developed to provide data of consumed and generated energies by consumers and prosumers into low-voltage electrical grid for the purpose of efficient management. The IMS is designed as an integrated solution as point to point communication, based on General Packet Radio Service (GPRS) and Power-Line-Communication (PLC) communication, being suitable for photovoltaic prosumers. The IMS acquires, validates, aggregates and storage into a database the information related to billing values and also the load profiles of costumers and prosumers. Furthermore, the IMS monitors the alarm events from the meters equipment in order to validate the acquired data. Based on these issues, a description of IMS infrastructure is presented in the paper. The paper presents main components of which the IMS system is composed. First part of the section presents the HES (Head End System) components, whereas the second part presents the meter equipment which allows the measurements, acquisition and transmission of data to central unit. The main conclusions are given at the end of the paper.

Keywords: acquisition data, communication, customers, measurement system, prosumers

IN-DEPTH CRITICAL REVIEW ON IMPORTANCE OF OPTIMAL DESIGN PARAMETRIZATION OF CE VS. WE DIMENSIONAL RATIO

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Abstract:

Biosensors are defined as those devices which are used in various applications for transforming or converting a biological or chemical signal into an electrical or electrochemical signal. The qualitative or quantitative interpretation of the output signal is providing information on a certain phenomenon occurring in nature. The "backbone" or the key component of the electrochemical biosensors are the electrodes which are facilitating signal conversion. The majority of electrochemical platforms are consisting of three electrodes (reference, working and counter) fabricated of conductive materials which can be transferred at the level of a substrate via different patterning methods. The working electrode is responsible for the efficiency of electrochemical conversion, while the reference electrode has the role of ensuring stable potential and the counter electrode is used for applying the input potential [1]. In spite of the fact that the constitutive materials of the three electrodes are very important in facilitating the biological-electrical conversion, another crucial influence in respect to overall electrochemical system is played by the geometrical and active surface architecture of these electrodes. As highlighted by Hernandez-Vargas, the surface of the working electrode is directly proportional with the amplitude of the output potential and implicitly with the bio-recognition efficiency of the biosensors [2]. However, the information in literature regarding the importance of counter electrode surface or the importance of ratio counter to working electrode is antagonistic. For instance, Garcia in [3] is stipulating that the surface of the counter electrode in designing the electrochemical platform is irrelevant, while [4] is drawing attention on importance of carefully considering the surface ratio counter vs. working electrode. The herein study is aiming to present an in-depth analysis of the importance of tailoring optimally parametrization the geometrical and electroactive surface ratio between the constitutive electrodes of a printed electrochemical platform for ensuring most-efficient conversion of the biological signal into electrochemical signal by considering the state-of-the-art information currently available within the scientific literature.

Keywords: biosensors, counter electrode, electrochemical platforms, working electrode

COMPUTATION OF MAGNETIC FLUX DENSITY PRODUCED BY UNDERGROUND MEDIUM VOLTAGE POWER LINES

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Abstract:

This paper presents our results on signal processing of non-electrical biological signals. The best known example is the respiratory signal, which is not associated with variations in electrical voltage. Therefore, the subsequent electrical signal associated with the respiratory signal is low and affected by noise. The presence of these noises requires the use of high-performance filters, as only digital filters are. After filtering the noise as completely as possible, the biosignal can be exported, allowing a doctor to analyze this information and establish a diagnosis or a certain medical behavior. A graphical interface has been developed in Matlab 2021 for the digital filtering of these signals. All the necessary filtering functions have been inserted. For an easy-to-use design, the App Designer Toolbox was used, an interactive development environment for designing programming applications that have a number of well-established functions. The programming was done with the help of MATLAB editor. By means of predefined buttons someone can load the raw biological signals or can choose the desired filter. The digital filters made are of Butterworth type. They can be selected via the interface and can be High pass, Low pass or Notch. There are presented recommendations for selecting the most appropriate topology for the applied filter, be it Finite Impulse Response or Infinite Impulse Response. To validate the filtering results, the publicly available "ICBHI 2017 Challenge" database has been accessed. This comparison validation contributes to the professional training of the bioengineer. This is because an incorrectly designed or improperly chosen filter may affect the processed signal, introducing considerable errors. This reference database comes in support of those who want to evolve on the side of analyses and research of respiratory parameters. The paper presents comparatively (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 JPEG or PNG format. The interface allows 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 biological signal, raw biological signal, topology

SOLUTION FOR PUMPS CONTROL IN IRRIGATIONS SYSTEM USING S7-1200 PLC

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Abstract:

The control and monitoring of irrigation systems has become an important subject in the context in which the demand for food has increased in the world due to the growth of the planet's population. The pumping station can vary depend the flow that has to deliver to the beneficiary and contain a number of pumps driven by electrical motors which are controlled by frequency converter or soft starter. The automation system gathers the process value from the electrical equipment's and can sends signals via GSM network to a central facility for analysis the data from the pumping station.

This paper analyses and implements the control of a pumping station for irrigation system where the water pressure has to be at 6 bars for the end user. In this ease the solution proposed is to have one frequency converter which will keep the pressure at the demand value and if there is a request för more water flow in the network then additional pumps, driven by soft starter, will keep the flow at the specified value. A pump can be controlled by either the frequency' converter or the soft start at a certain moment. Once the pumping station is on auto mode, it will not be allowed to switch the pump from frequency inverter to starter or vice versa. So, the configuration at a certain moment will be one pump connected to a frequency converter and the rest of two will be connected to the soft starters.

The algorithm control of the pumps includes the working hours and the availability of the pump and the pressure demand. The pressure has the reference at 6 bars and will be manage by the PID controller used in the PLC program. The results of the performance of the PID controller can be displayed on the runtime screen for different values of the controller parameters.

Keywords: control, frequency converter, HMI, industrial communication, PLC, pump station

DISCOVERING THE PATTERNS OF OPERATING REGIMES BY K-MEANS CLUSTERING-BASED DATA MINING FOR HYDROPOWER PLANTS

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Abstract:

Hydropower plants represent one of the main components in the deregulated power systems that help today the EU fulfills its energy and environmental targets. Water resources can define the strategies in the decarbonization policies, seen as renewable sources and energy storage possibilities. Due to these advantages, hydropower plants can have a significant role in achieving the 2030 targets and the future ones of the EU. But, without an optimal operation of the hydroelectric power plants to satisfy the system requirements, the maximization of the generated power can not be possible. In this context, the operation strategies that lead to the maximization of the efficiency need data acquisition and processing to establish the optimal regimes based on using the water reserves in the accumulation lakes. Thus, the water levels in canals and lakes, the operating regimes of the generation units, the state of the hydromechanical installations, and the discharges of the dams should be supervised continuously through a SCADA system which can reduce the operation and maintenance costs. The paper aims to present a clustering-based Data Mining tool to extract hidden knowledge from the historical data obtained from the SCADA and recorded in the database of a hydroelectric plant in Romania. The database included the hourly records associated with the following variables: upstream and downstream water levels, the generated powers (active and reactive) and operation parameters of each hydro unit, and the water flows. Based on this information, the Decision Maker can find how the hydropower plant was operated during an analysis period (month, season, or year) and establish the relationships patterns among variables. A data pre-processing based on the statistical methods has been used initially in the analysis to remove the missing data, irregular or atypical values due to the failure of the communication system, and manual registration, through the reading measurement devices, in the database by the Control Room Operators. After that, the K-Means clustering algorithm led to the optimal number of patterns associated with the operating regimes of the power plant. Finally, the relationships have been established between the powers of each generating unit, the water flows, and the upstream and downstream water levels. The proposed approach conducts to higher efficiency in the hidden data discovery process, reducing the time in the decision-making process.

Keywords: data mining, hydropower plant, knowledge discovery, K-Means clustering algorithm, operating regimes

DATA PROCESSING IN THE DETECTION OF ABNORMAL CELLS IN TISSUE

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Abstract:

Cancer has been and will continue to be a major public health problem, both nationally and globally, with the first or second leading cause of premature death. In females, the most common cancers were recorded, in close connection with the following locations: breast, colorectal, cervix, lung, uterine body. The purpose of the theme is to process the data from the sensors so that it accurately show the state of a cell. Filtering data by respecting the values of medical parameters is one of our objectives. The experimental methodology includes the following steps:

1. Detailed documentation on which technology to choose
2. Identify the process to be studied and the purpose of its performance
3. Building a prototype
4. Identifying the results
5. Local processing (smartphone) vs. centralized processing (server)
6. Determining the accuracy and precision of measurements
7. Identify variables that can be controlled
8. Analysis of the data obtained and the resulting conclusions
9. Generation of statistics and reports, evolution
10. Improvements following the analysis

Following the research so far, we have come to the conclusion that the aim is to use artificial intelligence in data processing. Artificial intelligence offers us growth opportunities for exceptional results, undeniable advantages, but the use of these tools presents many challenges. The algorithm behind it depends on a lot of medical parameters. Lots of tests needed until a somewhat compliant answer. Also, the realization of the experimental module requires many adjustments

3. Conclusions Following the experiment, we realised among the data received from the sensors there are many anomalies. Their analysis gives us significant results, but not complete because not all cancer cells are highly vascularized. Current research is based on choosing a technology that complements previous results. Artificial intelligence will help us a lot because we have large amounts of data to manage. We will pay special attention to the quality of the data for accurate pre-diagnosis.

Keywords: calibration, conductivity, diagnosis, galvanic, vascularised system

RELIABILITY ASSESSMENT USING MONTE CARLO METHOD

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Abstract:

The purpose of this paper is to use the Monte Carlo (MC) method to determine the reliability of the auxiliary power system within a power plant. The results obtained in this work will be validated by comparing with the results obtained using Fault Tree Analysis (FTA) method. A Monte Carlo method is a method that uses sets of random numbers to solve a problem, so it can be applied in any situations where equivalence can be established between the desired outcome and the expected behaviour of the stochastic system. MC was first used as a primary method in the 1950s in simulations needed to model neutron scattering in the Manhattan Project (hydrogen bomb development). The name of this method (Monte Carlo) was given by scientists after the name of the city of Monaco, famous for its many casinos. With the support of organisations (including the US Air Force), which disseminated information on Monte Carlo simulations, the method was taken up in other fields such as engineering, research, finance and physics. Within the MC method there are two techniques, known as the sequential and non-sequential techniques. In the non-sequential technique, the individual states of the components of a system are sampled in proportion to their probability. When the components are independent to each other, the state of the system is determined by repeating these samplings until a suitable number of repetitions is reached. Thus, using this technique, the state of the system can be determined based on the evaluation of the probabilities of all states for each component. The sequential technique is based on sampling the evolution of the probabilities of the states of one or more components. In this technique, the simulation is carried out chronologically, recording each change in the state of one or more components of the system. In this way, the state of the whole system and the corresponding time periods can be determined according to the reliability indicators of their components. In this paper, the non-sequential technique was used and the results will be compared with those obtained using the FTA method.

Keywords: Monte Carlo, non-sequential technique, reliability, sequential technique

A STUDY REGARDING COMPATIBILITY BETWEEN MFCN OPERATING IN C-BAND AND RADIO ALTIMETERS

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Abstract:

During the last year, 5G networks, also referred as MFCN-Mobile/Fixed Communications Networks, were rapidly proliferating around the globe, bringing access to 5G services to hundreds of millions of people around the world. For the past 15 years, the 3 GHz band globally has been the subject of harmonization activity for mobile broadband, both at the International Telecommunication Union and within regional groups. Many countries around the world are already deploying wireless networks in the bands from 3300 to 4200 MHz. On the other hand, radar altimeters (RA), also known as radio altimeters, are critical sensors used to enable and enhance several different safety and navigation functions throughout all phases of flight on all commercial aircraft and a wide range of other civil aircraft. Radar altimeters operate in an Aeronautical Radionavigation Service (ARNS) spectrum allocation in the 4.2—4.4 GHz band, which is internationally recognized and protected by the International Telecommunications Union (ITU).

Since the radiated power levels from RA are low, typically on the order of one watt, and thus highly sensitive receivers are required for radar altimeters to function properly. As such, radar altimeters are highly susceptible to RF interference entering the receiver, which can negatively impact their performance. The issue of coexistence of MFCN in C-band with Radio Altimeters has been under discussion globally in various countries lately, including the USA.

The scope of this paper is to estimate the possibility of coexistence of MFCN (deployed in the proximity of airports) with RA, by evaluating the interference level produced to RA by MFCN operating in adjacent band, in different scenarios.

In order to do that, using SEAMCAT, different simulation scenarios were built, where MFCN are operating in various bands adjacent to RA with RA positioned at various distances and altitudes. So, in one scenario, MFCN was considered to use the band 3400-3800MHz (CEPT allocation scheme), with RA positioned at different flight levels and distances from 5G network. In the other scenario, MFCN was considered to use the band 37003980 MHz, as allocated in the USA.

The results show that the European allocation of C-band spectrum for MFCN networks deployment does not impose supplementary measures for the protection of RA's, existing BS's filters ensuring the fulfilment of protection criteria requested by RA's receivers. Even though simulation results from the scenario in which USA's spectrum allocation scheme is used do not evidentiate an infringement of the protection criteria further investigations are needed in order to evaluate the impact of MFCN on RA in some specific worst-case scenarios.

Keywords: 5G, C-band, EAMCAT, Radio Altimeters, SMFCN

IMPROVING GAS SENSOR PERFORMANCES USING NANOTECHNOLOGIES

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Abstract:

Nanostructured materials are of increasing interest for research in the field of naotechnology, due to their excellent benefits for creation of new materials. The evolution of research is also influenced by the new morphologies of materials, which bring new possibilities for applications in bioengineering. Among the composite materials in particular, metal oxide nanofibers have attracted attention, with great potential in the research and development of gas sensors. Metal oxide nanofibers can improve the characteristics of gas sensors, especially the selectivity and sensitivity of the sensor. This paper presents the development of sensors with nanomaterials with new composite structure, nanotubes or nanofibers with oval structure of metal oxides. With this aim, a polymer is electrospinned on the surface of a ceramic support with an interdigital electrode structure. A layer of metal oxide with a thickness of hundreds of nanometers is deposited on the surface of the polymeric nanofibers. The deposition of the metal oxide is done by sputtering with magnetron in RF. The ceramic substrate with polymeric nanofibers on which a metal oxide has been deposited is passed through a calcination process in a high temperature furnace to remove the polymeric substrate. Following this process, nanotubes or nanomaterials with an oval structure will remain on the ceramic surface of the sensor. The process of electrospinning, metal oxide deposition and calcination are performed several times, generally between 5 and 10 cycles to make a layer of composite nanomaterial with an appropriate thickness. The deposited metal oxide may be the same for all layers or a layer of another metal oxide may be intercalated. Deposits are made in thinner layers and in several cycles to achieve during the calcination an adhesion of the composite nanomaterial to the digital electrodes on the ceramic support. With the obtained sensors, tests are performed in special enclosures with different gases. The ceramic support has a filament for heating, to bring the sensor to temperatures between 350^{o}C and 400^{o}C, to which the sensor is sensitive to the presence of gas. After tracing the characteristics according to the obtained results, the selectivity and sensitivity of the realized sensors may be assessed.

Keywords: gas sensor, electrospinning, nanofibres, sputtering

EQUIVALENCE OF THE ROMANIAN TERMINOLOGY WITH THE EUROPEAN TERMINOLOGY REGARDING THE POWER RESERVES NECESSARY TO ENSURE THE FREQUENCY-POWER REGULATION IN THE ELECTRICITY TRANSMISSION SYSTEMS

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Abstract:

Frequency-power control in electricity transmission systems has become a relevant research topic due to the increasing penetration of renewable energy sources, changing system structure, and the integration of new storage systems, controllable loads and power electronics technologies. The advances in control, communication, and computation technologies also contribute to the development of new techniques and solutions. Frequency stability is the ability of an electric system to regulate its frequency within the permitted/nominal operating range. Frequency instability is often a result of a serious imbalance between the grid total generation and load. A power system is always exposed to sudden variation, unwanted changes in system demand or losing generating units that cause a frequency deviation in system frequency. In particularly, a change in system load or loss a generating unit will results in a steady-state frequency deviation, depending on the governor droop characteristic. So the frequency regulating will be arisen. Frequency regulating is one of most important challenges for Transmission System Operators (TSO, hereinafter) or market operator in deregulated electricity industry. In restructured power systems, frequency regulating can be considered as an ancillary service (AS, hereinafter) that will be supplied employing the eligible resources provided by market participants. Usually, preparation reserve capability is called as "frequency control reserve", which is classified in four distinct types of reserve. This categorization depends on the response time of frequency control reserves and how they are deployed. In Romania, the power reserves intended for the supply of AS are classified according to the "Procedure for dimensioning the active power reserves in SEN", code TEL-07.IV OP-DN/106, issued in September 2006 by the local TSO, TRANSELECTRICA. According to this procedure, active power reserves are classified as: Primary regulation; Secondary regulation; Fast tertiary regulation; Slow tertiary regulation. At European level, frequency control system services are governed by European Regulation 2017/1485 of 2 August 2017, which sets out guidelines for the operation of power transmission systems. The following frequency control reserve categories are defined in European Union: Frequency Containment Reserve (FCR) Automatic Frequency Restoration Reserve (aFRR); Manual Frequency Restoration Reserve (mFRR); Replacement Reserve (RR); In this document I will explain the equivalence of the four Romanian categories of reserves with the four European categories. Additionally, the paper presents the basic results of an assessment of power reserve requirements in a small reliability test system.

Keywords: frequency-power control, operational contingency, power grids, power reserves, reserve provider, stability limits

CONTRIBUTIONS TO A HYBRID FES&MECHATRONIC SYSTEM FOR HAND REHABILITATION IN STROKE PEOPLE

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Abstract:

This paper aims to describe novel contributions on rehabilitation systems for stroke people. The major outcome is related to the improvement of the voluntary movements of their paralised upper limbs, in this particular case at the hand level. There are diverse mechatronic systems (e.g. ARMin) providing treatment for this kind of disability, but for this specific research, the system is composed from two key physical components, functional electrical stimulation (FES) and a mechatronic exoskeleton. The functional electrical stimulation (FES) subsystem may be seen as a textile glove with embedded electrodes connected to a programmable neurostimulator. The mechatronic component is in fact a glove, each finger being driven by a linear motor, all five motors being controlled by a board with a programable microcontroller. The mirror therapy requires a sensorial glove attached on the healthy hand, acting as movement reference for the hybrid system placed on the impaired hand. The whole system is controlled by a computer application which reads the data from the healthy hand, and controls the system to support the impaired hand by FES and mechatronic glove simultaneously, in a balanced way. The software, developed in C++, is meant to also calibrate and configure the FES and mechatronic components, individually for each patient. The program is able to convert the sensorial data, during the therapy, and to send controls as constant doublet timeframes of 350us with currents between 0 and 127 mA for electrical stimulation and as PWM signals to the linear motors. Of course, there is also the possibility to detect the malfunctions and signal errors, and most important to safely stop the system to limit any harm to the patient. In terms of future implementations, the software application is ready to read and interpret the feedback of the patient during therapy, in order to provide the medical personnel with information regarding the efficiency of the therapy for each individual patient. Also, the implementation allows adjustments in order to enhance the algorithms for better therapy experiences based on the continuous validation results from the hospital. Getting back to the whole system it is important to mention that the development is aimed on ISO 13485 (Quality Management on Medical Devices Development Standard) and IEC62304 (Medical Devices Software Development Standard) regulations, as an approach for a future CE certification

Keywords: exoskeleton, FES, neuromuscular diseases, rehabilitation glove, upper limb rehabilitation

ATA COLLECTION SYSTEM USING UAV

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Abstract:

Nowadays there is a growing interest in using unmanned aerial vehicles (UAVs) to collect data in many areas. This paper presents a system for collecting data from wireless sensor networks (WSN) using UAVs. The system will be named DataBox and its purpose is to collect, to store and transmit the data collected from WSN networks. There are situations in which the wireless sensor network cannot be connected to a fixed gateway with internet access or other communication medium that allows the transfer of data from the sensors to a remote station. In special situations such as monitoring remote and inaccessible areas: mountains, deltas, natural reservations, forests or agricultural areas where there is no internet coverage, we need a system that is able to collect the data recorded by sensors in these locations. During the research, a network of wireless sensors was developed, which is able to store the data locally, on an SD memory card, the data will be transferred to a gateway, Databox, mounted on a drone / UAV. The particularity of the proposed system is that the gateway mounted on the UAV is completely independent of the UAV and for this reason any kind of carrier UAV can be used. LoRa communication modules, SX1278, were used to transfer data between the drone and the sensors. Each node in the wireless sensor network consists of an ESP32 development board, powered by a Li-ION 18650 battery, charged by a solar panel. The ESP32 module will read the data from a DHT22 temperature and humidity sensor and from an MQ-135 air quality sensor, it will store the data, which will be transferred to the DataBox on request. In addition to the DataBox concept, the paper will explore ways to save energy while transmitting data from sensors to UAVs using data compression. Results showed that data from wireless sensor networks can be collected using drones and that data transfer time can be reduced if data compression is used.

Keywords: data collection, ESP32, LORA, UAV, wireless sensor networks

ADVANCED TELCO ARCHITECTURES FOR NetApps ONBOARDING

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Abstract:

There are many researches and also implementation activities in the 5G Stand Alone area, covering network segments as 5G RAN, Core Network or Virtualization and Automation, that provides the capabilities of the 5G (e.g. Enhanced Mobile Broadband or Ultra Reliable and Low Latency Communication), to be adopted by various vertical's industries in the near future. It has been identified that there is a difficulty for the developers and the Network Application (NetApps) developers to perceive the advantages of the new 5G services. The complexity is retrieving from the advanced technological networking deployment and capabilities that are not yet clear presented to the community. As there is not a clear understanding of the technology potential that could be addressed, the NetApps developers cannot fully benefit by the 5G performant services. The key motivation of this research is to define and expose the full architectural framework, from the APIs, virtualized 5G-enabled testing and validation experimentation facility, to the resources and orchestration availability. The scope is also to demonstrate the benefits and the added value of 5G connectivity for advanced services, as support from existing testbeds for developing the cutting-edge technology and applications. The proposed paper provides the required architectural design of the existing telco infrastructures, 3GPP compliant for RAN/Core and Edge Computing, the centralized control and management of the systems, defined as 5G-Platform orchestration, the new Restful Interfaces between Platform and 5G facilities, the readiness for services and network automation activities. There is also a concern regarding the new services and network monitoring solution, real time NetApps and data acquisition from different network segments, that can be analyzed and evaluated by proper ML/AI engines. 5G security aspects are also treated, as a proper secured design for the future platform/testbeds and NetApps developers. As conclusion, the proposed research work is aggregating all the novelties and capabilities of the 5G technology that can be further exploit by the developers, as a key solution for the future implementation. This work was funded by the European Commission under the European Union's Horizon 2020 programmed – grant agreement No. 101016567 (VITAL-5G project).

Keywords: 5G, APIs, experimentation platform, NetApps, orchestration

AN OPTIMIZATION-BASED ANALYSIS TO EVALUATE THE IMPACT OF THE WIND FARMS ON THE OPERATION OF THE ELECTRIC NETWORKS

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Abstract:

Concerns about climate change have been more and more visible in recent years, and the European Union emphasized the importance of increasing sustainability and protecting the environment. The need for decarburization has led to changes in the energy strategies of European countries in terms of increasing energy efficiency and the widespread use of renewable energy sources. In these conditions, the Distribution Network Operators (DNOs) and Transmission System Operators (TSOs) should perform analyses to evaluate how the integration of renewable sources influences the operation and planning of the networks. The paper addresses the Optimal Power Flow Problem in the electric networks integrating the wind farms. An analysis has been performed to evaluate the impact of the voltage control based on an optimization process where the tap changers of the transformers from the electric stations represented the decision variables. The analysis has been based on the preliminary hypothesis regarding the competence of the DNOs and TSOs to have the control capability of the transformers with on-load tap changer (OLTC) due to the advanced technologies based on the automatic voltage control. Successive Quadratic Programming has been used to determine the optimal solution associated with the tap positions of all transformers to obtain a constant level of voltage at each bus from the electric network with a positive impact on decreasing the energy losses. A test 10-bus network (with two voltage levels, 220 kV and 110 kV) integrating two wind farms has been used in the study. Three typical generation profiles have been considered for three analyzed scenarios to remove uncertainty regarding the possible generation profiles of the two wind farms. The results have been compared with the base scenario when the wind farms are off to quantify the benefits of the operation of the network with the wind power sources integrated, overlapping the coordinated control of the OLTCs. A constant voltage level has been obtained for each bus in all scenarios, with an average voltage drop between initial and final buses between 0.002 and 0.004 p.u. Also, the energy losses decreased by over 30%. The results emphasized the feasibility of an optimization-based analysis to evaluate the impact of renewable sources (in this case, wind farms) on the operation of the electric networks.

Keywords: energy losses, on-load tap changer, optimal power flow, optimization-based analysis, voltage level, wind farms

ABS DETECTION USING NEURAL NETWORK ALGORITHM APPLIED ON NATURALISTIC VEHICLE PARAMETERS DATASET

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Abstract:

These days, artificial intelligence (AI) may be found in almost any domain, particularly in the automotive sector. From car manufacturing to self-driving cars, there is no doubt that AI plays a major role in automobile industry. Looking at the architecture of a car, we can see a wide range of electronic control units (ECUs) used for all kinds of tasks, from wiper actuation to brake actuation. A lot of data flows through these ECUs, data that could be used as input for an artificial intelligence algorithm. In this paper I will use the data that flows through the braking system ECU and predict the behaviour of the Anti-lock Braking System (ABS) in various scenarios, using a neural network approach. The data acquisition for this research is performed on a Hardware in the Loop (HIL) environment, which is considered state of the art in simulation equipment. Having the real ECU, hydraulic circuit and the valve block available for research, the data taken from this equipment is as naturalistic as possible and only one step behind real vehicle data driving on the road. ABS is a function of the braking system and has two main purposes: to reduce the braking distance and to maintain steering capabilities while braking. The parameters used for ABS detection are: driver torque request – describes the force with which the driver presses the pedal, drive pressure – the pressure created by pedal press, main pressure – the actual pressure that goes to the wheel created by a linear actuator, wheel speed – the speed of the wheels and accelerations – the longitudinal, lateral acceleration and the steering wheel angle. For this research, a supervised learning approach using the actual ABS entry as a reference for the learning algorithm will be used. The accuracy of the ABS detection needs to be as high as possible, because we are talking about the automotive industry which is higly regulated, and the purpose of it is that will serve as an input for a standalone module that will detect anomalies during the development process

Keywords: anti-lock braking system, artificial intelligence, electronic control unit, hardware in the loop, neural networks, supervised learning

POSITIONING KEY ELEMENTS FOR INCREASING LOCALIZATION PRECISION OF THE VRUS IN 5G NR ENVIRONMENTS

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Abstract:

The growing number of road accidents and fatalities created a necessity for applications exploiting communication between traffic actors like vehicles, vulnerable road users (VRUs), and infrastructure. Vehicle-to-everything (V2X) communications enable real-time responses and awareness messages that provide accurate location information regarding each traffic participant, information about the state of a road user (position, speed, direction, etc.) towards the users from their proximity to grasp what action they should take: reduce the speed, be more attentive to special cases, e.g., a pedestrian with disabilities crossing the street, and so on. Vehicles are equipped with various sensors (radar, lidar, camera, GPS, etc.) to understand the surrounding environment and determine their position within the environment, but this does not improve the traffic safety unless these location features are precisely known by the other vehicles or pedestrians, or even by the infrastructure. To determine the vehicle position and to communicate this data to the traffic users, the vehicles and user's smart devices are equipped with communication modules and positioning modules. The information related to the position determined by the sensors should be strengthened and combined with the position determined by the network for more accurate results. The fifth generation (5G) cellular network promises to respond to the requirements of a city traffic management by: ultra-low latency, reliability, and position determined with high precision. The 3GPP Release 16 mobile communications standard details the use-cases of the industrial verticals and their requirements, the most important key performance indicators (KPIs), and technologies that the new radio (NR) architectural component uses to obtain the position information. 3GPP Release 16 targets a positioning accuracy between 1 and 3 meters for traffic monitoring and control, as well as for wearable devices. Moreover, the standard specifies the most common solutions that the 5G technology can support: Downlink Time Difference of Arrival (DLTDOA), Uplink Time Difference of Arrival (UL-TDOA) and so on. This paper aims at presenting the context of the positioning essentials that the 5G NR can support, which are necessary to achieve road users' protection and congestion avoidance within an urban area.

Keywords: localization techniques, positioning, traffic use-cases, vehicle-to-everything, vulnerable road users

CONTRIBUTIONS IN THE FIELD OF METHODS OF ASSESSMENT OF THE MUSCLES WITH REDUCED DYNAMICS- PELVIC FLOOR MUSCLE

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Abstract:

The assessment of the pelvic floor muscle (PFM), regarding its function and strength, is an important task for medical evaluation of patients' healthiness. This evaluation can give information about the ability of the patient to contract this area, to support the pelvic floor organs (bladder, bowel and uterus) and abdominal ones, ensuring the sphincter function, the balance in walking, blood circulation, and to see the changes in PFM function and strength during rehabilitation. The aim of this paper is to give an overview of the methods already used in the assessment of these muscles and to present a new system to evaluate this area. In the first part, anatomical and biomechanical data, relevant for this study, are described. The assessment methods, like palpation, visual observation, electromyography, ultrasound or magnetic resonance imaging (MRI) can provide a quantification of the PFM activity. All these methods need a special private space and equipment, a well-trained staff and may lead to reduced comfort for patient. The review includes some sensorial systems currently in use to evaluate the PFM. Finally, a new device to evaluate the PFM is proposed. Another purpose of this paper is to find a model of the pelvic area, for simulation, as an input for the requirements of a new proposed sensorial system to evaluate the PFM function. The new sensory device for evaluation of the PFM will be composed from a Foley urinary catheter, a wireless transmitting part, and a sensor that will be activated by an incompressible fluid. The catheter is usualy used for patients with urinary disorders. The sensorial system will be included in a free separated lumen form Foley catheter. The expected benefits of this new sensorial device are: it looks alike the Foley catheter to be used for both genders, is cheap and accepted as a usual procedure, it can be used as a benchmark in identifying and recruiting the PFM, easy handled by medical staff, the patient can wear it for long time and can use it at home also, reduces the need of supplementary equipment and evaluation space, can guide the patient in performing exercises and records a possible progress of the treatment.

Keywords: model, pelvic floor muscles, sensor, strength assessment

CONTRIBUTIONS TO BRAIN-COMPUTER INTERFACE BASED CONTROL OF HUMANOID ROBOTS

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Abstract:

This paper aims to present a Brain-Computer Interface (BCI) based control of a humanoid robot to initiate activities like walking, speech recognition and answer etc. This could allow paralyzed pacients to use a humanoid robot to perform mundane tasks such as: getting food from the fridge, grabbing a glass of water etc. Or, the BCI could allow locked-in pacients to communicate with their loved ones. The present application uses the Unicorn Hybrid Black, a high-quality wearable EEG-headset for BCI applications to accurately record brain waves. It delivers data from 8 graphene Unicorn Hybrid dry electrodes, sampled with 24 Bit and 250 Hz per channel, sending it to the computer via Bluetooth. The robot is the NAO Humanoid Robot, our 11-year-old “colleague” from Aldebaran Robotics. It is a 25 degrees of freedom robot that mimics human behaviour from simple tasks like walking or speaking to dancing or taking a stroll while humming to a song. NAO uses the Choregraphe desktop application which allows the user to create animations or behaviours, test applications on virtual robots and to monitor and control NAO. The communication with NAO is possible either wireless, through a network wire plugged in the network port at the back of the head, or through speech recognition using pre-programmed keywords. The application uses the P300 method to recognize the user’s intention. The graphical interface presents two flashing icons that represent the pre-programmed actions that the robot can do. The user focuses on the chosen icon and the BCI recognises and translates it into the apropriate NAO command. Preliminary results of this application show promise towards multi-command BCI based remote-controlled humanoid robot. While this application only has two commands, the number of possible commands is almost limitless. Future improvements in both BCI and humanoid robot fields are sure to follow, thus making the present application a steppingstone for the not-so-distant future.

Keywords: brain-computer interface, EEG, humanoid robots

DISCRIMINATION OF FOCAL AND NON-FOCAL EPILEPTIC EEG SIGNALS USING DIFFERENT TYPES OF CLASSIFIERS

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Abstract:

Epilepsy is characterized by the spontaneous appearance of seizures, during which the perception or behavior of patients is disturbed. The electroencephalogram (EEG) signals of epileptic patients are used to detect epileptic types and epileptic seizures. It is difficult to detect vital differences in EEG signals of epileptic patients by simple visual inspection. For a successful epilepsy surgery, it is very important to localize the epileptogenic area. The use of nonlinear features by the higher-order spectra (HOS) has been reported to be a promising approach to differentiating between focal and non-focal EEG signals. In this paper, a new method based on HOS parameters is proposed to classify EEG focal and non-focal signals. The proposed approach consists of pre-processing, feature extraction by higher-order spectra, feature normalization, and classification of EEG epileptic signals by four classifiers: LDA (linear discriminant analysis), QDA (quadratic discriminant analysis), MD (Mahalanobis distance-based), and k-NN (k-Nearest neighbours). The feature vectors for focal and non-focal signals were formed from the quantities calculated for the bispectrum and bicoherence. Various combinations were tried to form the feature vectors and the best performances were obtained in a ratio of 10% bispectrum and 90% bicoherence. The method is validated on a public dataset that consists of 3750 EEG focal signals and 3750 EEG non-focal signals, collected from epileptic patients of the Department of Neurology, University of Bern. This paper aims to identify which is the best classifier used to differentiate between EEG focal signals and EEG non-focal signals when the feature vectors consist of 10% bispectrum and 90% bicoherence. For this, several classifiers were tried: LDA, QDA, MD, and k-NN. For each, their performance was calculated and it was shown that k-NN is the best classifier, with an accuracy of 99.4%, sensitivity of 100%, and specificity of 99.09%. Overall, the proposed classification method reports a significant improvement in terms of sensitivity, specificity, and accuracy in comparison to the existing techniques. Besides, the proposed method has the potential to identify the epileptogenic zones, which is an important step in resective surgery

Keywords: bispectrum, epilepsy, electroencephalogram, focal EEG, non-focal EEG, seizure

ENERGY EFFICIENCY FOR BUILDINGS AND ITS ROLE IN REDUCING CLIMATE CHANGE

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Abstract:

Accelerated climate change associated with fast technologization and industrialization, as well as population growth, have led to chaotic decisions with a devastating impact on the environment in recent decades. On a worldwide scale, energy efficiency is a serious problem with different approaches in each region such as every country has a plan of how to reduce the energy consumption. The main goal for European Union is to reduce greenhouse gas emissions with 80-95% until 2050 compared to 1990, and for that European Council adopts periodically objectives and strategies with deadlines on short and long term regarding climate and energy policy framework. The energy sector has the largest contribution to the phenomenon of global warming through the enormous dioxide emitted, so it is necessary to implement public rehabilitation programs and policies to promote buildings energy efficiency. The current work describes the main features and the central points of implementation of energy efficiency within a building, starting from the global energy framework with the most popular polices and reaching the way in which the occupants influence the building. To the same extent the impact of thermal control of the indoor environment, the thermal comfort equipment and devices most often used likewise different types of buildings and of course the main problem of the consumption in a building, the HVAC system, that arouse the interest of researchers were highlighted. Promising solutions to energy reduction issues were detailed such as integration of BEMS, IoT, IoE, of the prosumer concept and storage system were provided. A practical analysis of a case study building situated in eastern Romania, with grid difficulties was presented. It can be remarked, that implementing a photovoltaic system with storage units in order for the energy to be available a longer period of time for devices or equipments, and thus the building having the role of prosumer, has covered the energy need and the remaining has been injected in the grid. The proposed study has the role of emphasizing the particular and unique character of the building, the grid and the adaptability of occupants comfort by having a continuous source of energy.

Keywords: building energy efficiency, building energy management system, energy policy, prosumer, storage system, thermal comfort

APPLICATIONS OF ROBOTIC AND MECHATRONIC SYSTEMS TO NEUROREHABILITATION

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Abstract:

Due to the worldwide growing number of people with disabilities, who need assistance, rehabilitation robotics has a special relevance. It should be noted that research laboratories in universities and research institutes, due to their developments in biomechanical research and the results obtained, served as impetus and motivation to achieve mechatronic systems, which give patients a real chance of integration into society. Mechatronics for medical recovery provides the beneficiaries with complex tools with therapeutic and assistive function. This paper discusses the systems containing electroactive polymers and artificial muscles, intelligent artificial limbs, exoskeletons to support and supplement sensory and neuromotor functions, cognitive assistive devices, up to brain-computer interfaces, robots with nerve function stimulation and locomotives and for biofeedback. Currently, robotic devices complement the work of physiotherapists, improving the effectiveness and efficiency of the rehabilitation process. Repetitive hand movement is often used as a rehabilitation technique to regain hand movement and strength. To facilitate this rehabilitation, several robotic gloves have been designed to help move and coordinate grip exercises. The mechatronic gloves can be operated mechanically, electrically and pneumatically, and in terms of the evolution of the development of these devices, they will be made with servo-electric and servo-pneumatic actuators. Starting with rigid exoskeletons, there are now light, comfortable mechatronic gloves with the ability to move the fingers simultaneously, or each finger independently. Conventional therapy combined with the use of a glove-type mechatronic system and the application of functional textile-based electrical stimulation will provide patients with the most effective form of hand recovery to regain self-service autonomy. Robotic and mechatronic systems are increasingly used in hospitals and rehabilitation centers as technological tools for clinical practice. These systems are used for the administration of intensive and prolonged treatment aimed at achieving the functional recovery of people with neurological deficiencies, in the subacute and chronic stage. Their functionalities, cosmetics, easy in donning and doffing, production costs, etc. are further challenges which need to be addressed in proposed research

Keywords: disability, FES, neurorehabilitation, recovery, rehabilitation glove

THE CONCEPT OF SMART CITY - IMAGE DETECTION USING EMBEDDED COMPUTER BOARDS

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Abstract:

In recent years, interest in and investment in cognitive systems and artificial intelligence has grown exponentially, and continues and will continue, both in academia, scientific research and technological development, and in the commercial and business world, from the most small to large corporations. The most famous names in technology (such as: Google, Facebook, Microsoft, Yahoo, Baidu, IBM, DropBox, etc.) invest heavily in artificial intelligence, which they incorporate into their own business models and use it more and more. much in their offer: virtual assistants (e.g. Siri), artificial vision, speech recognition, machine translation and lots of other applications. In addition, initiatives have emerged such as the Partnership on Artificial Intelligence consortium, which brings together Amazon, Apple, Deepmind, Facebook, Google, IBM, Microsoft, and about 80 other partners from 13 countries. All of this is based today on technology provided by "deep" artificial neural networks and deep learning. One of the first areas in which they were developed and in which they became widespread is that of artificial vision, respectively of the detection and recognition of images. The present paper aims to use an embedded computing boards from Nvidia, the Jetson Nano developer kit. It is a small, powerful computer designed to power entry-level edge AI applications and devices. Jetson Nano opens the door to robotics and deploying deep learning to the edge for real-time image classification, object detection, segmentation, speech processing, and more. The purpose of this approach is to use the Jetson Nano board through which recording image is taken in real time by a video camera and to generate frames, in order to identify certain things that may occur in a city (broken traffic signs, asphalt potholes, fallen trees on the road, etc.). The results of the study can provide to recognize various obstacles that can cause traffic accidents or to transmit certain road malfunctions to a centralized information center.

Keywords: artificial intelligence, deep learning, embedded computing boards, image detection, smart city

EXPERIMENTATION FACILITY TO EVALUATE 5G-NATIVE NETAPPS

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Abstract:

The paper will introduce the architecture and role of each entity of the 5GASP (5G Application & Services experimentation and certification Platform) H2020 research project. From the eleven 5G Network Applications (NetApps) to be developed in the scope of 5GASP, we will focus on the Vehicle Route Optimizer NetApp for which we will describe the automotive vertical specific requirements as well as the high-level architecture of the NetApp. The paper will also introduce the infrastructure and the capabilities of Bucharest experimentation facility used to onboard and test the presented NetApp. Taking the input from the 5G NetApps's requirements, architectures and capabilities of the experimentation facilities, the paper defines the detailed architecture, the internal and external components and their interfaces, the APIs to the NetApp, as well as the user management interface and its requirements. The architecture's components include the user interaction portal, the 5GASP experimentation API service, the experiment service orchestrator, along with all the components that will support this architecture (monitoring, logging, issue management) and the multi domain capabilities and tools. It also defines the NetApp workflows, specifically, the NetApp deployment workflows and the NetApp testing workflows. Furthermore, the paper will specify the 5GASP entities' roles e.g. Service Experimenter, Platform Administrator, NetApp developer, Network Function Developer, etc., and how they should be implemented in the architecture. The targeted experimental model will be defined so that experiments are able to onboard and test their NetApps on any 5GASP facility. NetApps' deployment and orchestation are detailed based on the input of the 5GASP Bucharest facility provider, referring to the interaction with the facility, considering the middleware, domain orchestrators and experimentation environment. Finally, the paper indicates the high-level requirements and interactions for the CI/CD service to support the DevOps experimentation and the community engagement aspects of the 5GASP project. As conclusion, the proposed research paper presents a novel 5G architecture, onboarding technologies and capabilities that will be exploited by the 5G-native NetApps developers.

Keywords: 5G, CI/CD, NetApps, experimentation facility, service orchestrator

DATA ACQUISITION SYSTEM FOR ADVANCED MEDICAL DEVICES

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Abstract:

Introduction We know that early detection of cancer saves 80% of cases. We know that we can take data from human tissue to monitor our health. We need to know how we can detect cancer early by analyzing data taken by sensors. Also, we need to know how to gather relevant information that will give us a clearer view of what is going on in abnormal tissues because it can always save lives. This research focuses on the problem of constantly monitoring human tissue, monitoring parameters such as electrical conductivity of tissue and local temperature using temperature and ultrasonic sensors. Data transmission and processing are not the object of this paper. Can data collection and analysis be sufficient in this case? Statistical evidence shows that more and more people are facing this type of disease. Therefore, a sustained effort is needed in this direction and medical research together with engineering and technology can have a positive impact. Approach The system is based on measuring the galvanic response of the tissue. This response is measured using electrodes arranged in a matrix-like structure. The system takes into account global variations in electrical conductivity and calibrates the system in such a way that only zonal variations are detected as problematic. In the false alarm filtering algorithm, asymmetric variations will be analysed. Electronic components involved are electrodes, BLE data acquisition, processing and communications unit, a smartphone that processes and transmits data and has a graphical user interface. Also, software is needed for the data acquisition unit, a mobile application and a central platform that takes data and sends messages and alerts to the patient or doctor. In conclusion, it is desired to introduce in the economic circuit the technology resulting from this research work, in order to obtain a new, innovative product on the medical market. A system that takes on an innovative character, an affordable product that is not available in the world at the moment

Keywords: data acquisition, healthcare, medical monitoring, sensors, ultrasound detection

THE IMPACT OF ELECTROMAGNETIC FIELD SOURCES ON MEDICAL EQUIPMENT IN THE ANESTHESIA AND INTENSIVE CARE UNIT AND ELECTROTHERAPY ROOM

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Abstract:

In the Anesthesia and Intensive Care Unit and in the operating theatres, the electromagnetic environment is generated by both internal and external electromagnetic field sources. One of the main sources of electric and magnetic field in the Intenssive Care Unit is the power supply network. In this respect, an example of electromagnetic phenomen that can influence a sensitive main device can be voltage fluctuations, gaps and short interruptions of the AC and DC supply voltage. In hospitals, electrotherapy rooms are facilitated with different types of electronic systems, which produce electromagnetic waves. High magnetic wave intensities can have harmful effects on the biological environment. In this study, we want to measure and evaluate the electromagnetic field in different parts of electrotherapy rooms and intensive care units during operative procedures, while electrical instruments are used together or individually. Other sources include electronic medical equipment, mobile phones and external sources such as radio and television emissions. The aim of this study is to identify the sources and paths of transmission of electromagnetic interferences in Anesthesia and Intensive Care Unit. and Electrotherapy room. Knowing the number, complexity and positioning of medical equipments in the facility in relation to each other or to human plays an important role in avoiding exposure to electromagnetic fields. Characterisation of the electromagnetic environment in Anaesthesia and Intensive Care Unit and Electrotherapy rooms helps to identify sensitive medical equipment that may suffer from operational incompatibilities. Electromagnetic disturbances can influence and reduce proper functionality, leading to erroneous parameter results and even to shut down or total failure. These issues may draw attention to problems related to electromagnetic compatibility but also to electromagnetic biocompatibility whose effects are distributed to human health.

Keywords: electromagnetic compatibility, EMF measurements, electromagnetic interference, Intensive Care Unit, medical devices

DBD SYSTEM OPERATING IN AMBIENT AIR FOR SURFACE TREATMENT F POLYETHYLENE TEREPHTHALATE FILMS

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Abstract:

Polymers are materials widely used in many important technologies and applications because of their optical, physical, mechanical, thermal, and chemical properties. Polyethylene terephthalate (PET) foil is often used as an insulating material in printed electronics, flexible circuitry, displays, industrial application graphic films, or for clinical and healthcare applications. A big inconvenience of PET film is the low surface tension which also implies a low wettability, resulting in poor coating adhesion and poor printing properties. In order to eliminate this disadvantage, a surface treatment was used by means of a dielectric barrier discharge (DBD) operating in ambient air at atmospheric pressure which consisted of a high voltage AC source and two circular metal electrodes 60 mm in diameter. The paper aims are to treat two different PET film substrates designed in this work as PET 1, without thermal treatment, and PET 2 which is heat stabilized. The effect of plasma exposure was assessed by determining the water contact angle by means of an Ossila goniometer and by measuring the surface tension with a special ink. The considered foils were exposed to different DBD treatment times (0.2, 0.5, 1, 5, 10, 30 s) and the evolution of the water contact angle overtime after treatment up to 96 hours was monitored. It was found that the water contact angle of the untreated PET 1 and PET 2 was 74° and 73.5°, respectively, and after 30 s DBD treatment time it decreased to 30.9° and 30°, respectively. Following the analysis of the experimental data, it turned out that the best wettability corresponds to the first hours of DBD treatment where the angle recorded the lowest values. Subsequently, the hydrophilic properties decrease together with the increase of the water contact angle.

Keywords: DBD plasma, PET surface, surface tension, water contact angle, wettability

NON-INTRUSIVE MONITORING SYSTEM OF LOW VOLTAGE COMPONENTS FROM POWER CIRCUIT BREAKERS

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Abstract:

The safety operational of a power system is ensured by its protection elements, and for this reason, power circuit breakers are of particular interest, especially for their functional role, for opening and closing the power circuit in all the functioning regimes, without which a system cannot function. Moreover, circuit breaker maintenance is a very important activity for long-term operation without failures both of high voltage and low voltage components. Furthermore, a fault that may occur in the low voltage components, may result in the malfunctioning of the equipment or even its destruction if the fault is not remedied in time. To avoid such situations a non-intrusive monitoring and diagnostic approach to the secondary circuits of circuit breaker is presented. The proposed method involves determining an electromagnetic pattern of the loads that are part of the operating mechanism control system. The pattern can provide a classification of the loads and determine their mode of operation by using as few measuring points as possible. The process will involve the measurement of electrical parameters using a measuring circuit comprised of three transducers: current, voltage, and electromagnetic field that will collect data with a data acquisition board. The determination of the load pattern will be performed using a virtual instrument (VI) developed in LabVIEW. The VI instrument will convert the signals collected from the acquisition board and will be used to analyze and process the data to determine the load pattern and the operating mode of the monitored loads: reinforcement electromotor, closing electromagnet, and opening electromagnet. When the load pattern has been identified, any variation from the parameters that have been established as the normal operation will be considered a fault operation, and according to these new fault conditions, fault patterns will be determined, which will help to diagnose them more effectively

Keywords: circuit breaker, electrical measurement, load pattern, monitoring, operating mechanism

PARKINSON'S MONITORING SYSTEM

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Abstract:

Parkinson's disease is a know and unfortunately common problem that is characterized (as seen from the outside, when looking at an individual that suffers from this disease) by abnormal movements of the body, abnormal movement patterns or lack thereof. It can generally be observed as an involuntary sharking of limbs or the whole body, stiffness, slower muscle movements, lack of balance and/or coordination, autonomous movements that are different or non-existent (i.e. moving the arms when walking, which is generally a motion human do to balance when walking and also reduce energy usage when doing so). This disease is untreatable, unpreventable and progressive. Since it is a serious problem, it requires studying as accurately as possible. Part of this effort is determining via non-invasive and inexpensive methods if a patient is suffering from this disease and how it progresses and in which ways (since not all symptoms are present at the same time and not all of them do progress simultaneously). One solution is analyzing the movements of the patient and determining if any abnormal patters are present. This requires analysis of a wide range on movements in diverse classes of muscles during normal life full range of motion for an extended period. One approach is using a inertial measurement unit (IMU) since it can analyses linear and angular acceleration in the same time, presenting the analysis algorithm with a wider set of data, generating higher precision. Since the general symptoms are known, determining a patient's state is just a matter of effectively determining if their movement do include patterns specific to the disease. This allows for an early diagnosis and a close correlation between symptoms and progress.

Keywords: abnormal movements, analysis algorithm, IMU, Parkinson

LOAD MODELS FOR POWER AND ENERGY LOSS ASSESSMENT IN ELECTRIC DISTRIBUTION NETWORKS WITH PROBABILISTIC METHODS

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Abstract:

Today, smart metering is one of the most significant initiatives to bring to life the goals of implementing the Smart Grid concept. The increasing number of smart meters installed at individual customers allows electricity distribution operators to collect information remotely and automatically on electricity consumption and / or generation data. Based on the new technology, distribution operators can ensure the correct and real-time registration of electricity, which allows them to take initiatives and develop programs for cost-effective electricity distribution, particularly the assessment and reduction of power and energy losses. . On the other hand, the assessment of power and energy losses requires a good knowledge of the architecture and characteristics of the network, but also of the characteristics of the consumers supplied from the network. The description of the loads in the nodes of the distribution networks represents an old but at the same time current concern of the specialists; thus, the literature mentions a significant number of papers dedicated to load modeling. On the other hand, the uncertainties governing the consumption patterns and the level of network loads mean that, in addition to traditional approaches to power flows assessment, alternative approaches, such as those based on probabilistic / stocastic models are required. This paper presents the possibilities of using probabilistic methods, such as models based on Monte Carlo simulations or point estimate methods, to estimate power and energy losses in distribution networks, and in this context describes the possibilities of modeling loads at the network buses for the application of probabilistic methods such as those mentioned above. Thus, the modeling of loads based on measurements performed at characteristic consumers or at the level of the low voltage busbars of the substation transformers is taken into account. The statistical processing of these data allows the deduction either at the level of each characteristic consumer or at the level of a transformer substation, of specific consumption profiles with different types of sampling (per hour or quarter of an hour) in the form of average values and standard deviations for average consumption. These profiles can then be used in Monte-Carlo or point estimate methods for the probabilistic estimation of power and energy losses by repeated power flow calculations.

Keywords: load modeling, Monte Carlo simulations, point estimate method, power and energy losses, smart metering

WEARABLE DEVICE FOR MEASUREMENT OF EXPOSURE TO ARTIFICIAL LIGHT

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Abstract:

The impact of artificial light at night (ALAN) exposure on health has become increasingly prominent. Natural light contributes to the synchronization of the „biological clock" of the human body. It cannot be used during the whole daytime for most people, so it is replaced by artificial illumination which drastically influences sleep, concentration, mood and circadian rhythms. Interruptions in normal circadian light cycles and the resulting disruption of normal melatonin rhythms cause widespread disruptive effects involving multiple body systems, the results of which can have serious medical consequences for individuals, as well as large-scale ecological implications for populations. With the invention of electrical lights about a century ago, the temporal organization of the environment has been drastically altered for many species, including humans. In addition to the incidental exposure to light at night through light pollution, humans also engage in increasing amounts of shift-work, resulting in repeated and often long-term circadian disruption. In order to feel comfortable in any room, we must take into account several factors, including: intensity, color and temperature of light. All the mentioned criteria can create both damages and benefits, so we must take into account all the requirements. In this study, we are trying to make a wearable device that measures exposure to artificial light. The system includes a Cerebot MX3cK microcontroller development board based on the Microchip PIC32MX320F128H, a RN-42 Bluetooth module and a TCS34725 RGB sensor. The system can be controlled remotely via Bluetooth using a smartphone running a simple Android app. The system was used to measure illumination, color temperature and RGB components of artificial light from different angles (with the sensor pointing up, towards the light source, and with the sensor pointing forward, in the walking direction), every few steps, depending on the space between the illumination sources, in hallways and patient rooms of the Intensive Care Units (ICU) of different hospitals. The system was able to perform the wanted measurements, however the hardware components of used the measurement system will have to be replaced with more efficient ones which can reduce the energy consumption and have a smaller size in order to provide better wearability features

Keywords: articificial light exposure, color temperature measurement, circadian rhithms, illumination

LOCAL SURVEY OVER THE NON-IONISING RADIATION ASSOCIATED WITH 5G PHONE BASE STATIONS

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Abstract:

The paper presents a preliminary survey over the power density of the electromagnetic fields generated in the vicinity of the up-to-the-minute 5G mobile phone base stations recently installed in Iasi. We here present the exposure levels for different mobile communications technologies that have been measured with a calibrated NARDA SRM 3006 field strength analyzer system, provided with an isotropic electric field probe. The selected domain was from 420 MHz to 6 GHz, aiming to cover all the frequency spectrum used for mobile phone base stations transmissions. For the final displayed results, the measurement configuration has been set to convert the E-field strength in power density of the plane wave equivalent at the measurement point, expressed in W/m2. It has also been considered the antenna factor and the power loses in the connecting transmitting line between electric probe and spectrum analyzer. The methodology described by ECC RECOMMENDATION (02)04 has been rigorously respected. For the assessment of human exposure to RF EMF generated by mobile phone base stations were taken into consideration three locations in the city centre, with high density of mobile phone base stations, covering the whole range of mobile phone communications technologies: 2G, 3G, 4G and 5G NR. Specifically for the 5G mobile service two situations have been considered – with or without data traffic. Finally, a comparison between measured fields values data and limits imposed by international organizations and national regulatory bodies has been performed. Also, a compliance check (certification of conformity with respect to simultaneous exposure to different frequency fields) was performed and a set of preliminary conclusions have been drawn. Our acquired values averaged over a measurement interval of 6 minutes have been compared with the power density limit imposed by ICNIRP recommendations. Fortunately, for all the investigated locations, the averaged power density values recorded when data traffic has been generated for 5G services are around 3-4 orders of magnitude lower than 10 W/m^2 , the limit accepted by ICNIRP regulations.

Keywords: 5G, base station, electric probe, human exposure

COMPUTATION OF MAGNETIC FLUX DENSITY PRODUCED BY UNDERGROUND MEDIUM VOLTAGE POWER LINES

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Abstract:

The paper proposes a numerical modeling of the magnetic field generated by the 12/20 kV three-phase underground power line. We considered the most common case of two-point bonded shield. The topic could be interesting because in urban agglomerations the solution of underground medium voltage power cables is more and more often used. The electric current through these 3 phase power lines is frequently 100 A or even more, and the distance between the power line and the human can be less than 1m (we considered cables buried at 800 mm depth. In these conditions the magnetic field can have appreciable values. This might be a concern regarding the human exposure. We have been focused on the validation of modeling either by direct measurements or by analytical calculations based on the application of the Biot-Savart law in 2D. A validated model means more flexibility, being applicable in many other cases, theoretically possible. We have developed such a model based on ANSYS Maxwell software. The induced currents in the copper screen of the cable were considered for the analytical calculation of the generated magnetic field. Copper shields of all the three cables was chosen as being bonded in 2 points The three cables are in a horizontal line, the side cables being equidistant, 100 mm from the center cable. The analytical computational mathematical equations have been implemented in a LabVIEW program that allows the generation of lateral profiles of total magnetic flux densities (rms values) at any height selected by the user. For the numerical simulation performed in 2D ANSYS Maxwell model, the variant with aluminum central conductor and copper protection screen was chosen. The frequency being 50 Hz, the eddy current solver could be used. The values resulting from modeling or analytical calculations were compared, respectively. The results are quite close. If at ground level values of 5-6 μT were obtained for magnetic flux density, at the height of 1 m the decrease was considerable, values only slightly higher than 1μT. This value is about 100 times lower than 100 μT, the superior limit for residential exposure accepted by International Commission for Non-Ionizing Protection.

Keywords: computation, magnetic flux density, medium voltage, underground power line

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

MATERIALS FOR ELECTRIC CONTACTS

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Abstract:

An electric vehicle (EV) is an equipment that works with an electric motor, instead of an internal-combustion engine that generates power by burning a mix of fuel and gases. Therefore, such as vehicle is seen as a possible replacement for current-generation automobile, in order to address the issue of rising pollution, global warming, depleting natural resources, etc. Though the concept of electric vehicles has been around for a long time, it has drawn a considerable amount of interest in the past decade amid a rising carbon footprint and other environmental impacts of fuel-based vehicles. The charging speed depends on three components - the charging station, which is the source of power, the charging cable and the on-board charger. In this article, we will look at an important part of every charging cable - its connector. European cars used the Type 1 connector until major European automakers began looking for a new solution that could take advantage of all three phases. In 2003 new specifications IEC 62196 were established based on which the Type 2 "mennekes" plug was produced and it quickly became the new European standard. Thanks to the fact that both types of plugs (type 1 and 2) use the same J1772 signaling protocol for communication, car manufacturers can make vehicles in the same way and only at the very end they install the type of plug that corresponds to the market where the car will be sold. Passive adapters also exist among these types. Another important advantage of the Type 2 plug is that it supports a built-in automatic locking system.
The most commonly used contact materials include Au, Ag, Cu, Al, Ag Oxide, C, AgW, AgC, AgNi, AgPd, AgWC, and CuCr. The basic elements in an electric contact system are contacts. The contact with positive polarity is called anode, and the contact with negative polarity is called cathode. Current flows from the anode to the cathode. An electric contact system includes a pair of electric contacts, anode and cathode, and a mechanical structure that provides contact force so the electric contacts can join the electrical circuit together with minimum electric contact resistance. The resistivities of various metals as a function of temperature above 0 °C was analized and value given from technical literature. Contact materials for different switching device applications are proposed based to their electric and mechanical properties.

Keywords: contact materials, electric vehicles, silver coatings

LIFE CYCLE ASSESSMENT OF TEXTILE WASTE-REINFORCED COMPOSITE MATERIALS FOR CONSTRUCTION APPLICATIONS

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Abstract:

Establishing a balance between environmental protection, economic growth and finding alternative resources are crucial to ensuring the sustainable development of human society. Globally, the textile industry is considered one of the most polluting industry, requiring the adoption of specific policies to reduce the impact on the environment. The European Union generates approximately 5.8 million tonnes of post-consumer textile waste annually, with only 25 % of the total volume recycled in low-value products or incinerated, and the remaining 75 % sent to landfills. The storage and incineration of textile waste has detrimental consequences for the environment and human health due to decomposition phenomena and greenhouse gases emitted into the environment. The high volume of textile waste, the costs generated by the collection, transport, sorting, complexity of textile articles, underdeveloped industrial recycling infrastructure and obtaining qualitatively and economically unattractive products, are the main obstacles that contribute to disinterest in capitalising on these resources. A viable solution for reducing the amount of unused textile waste is the production of thermosetting composite panels that have as reinforcement waste from cotton-type fabrics with multiple fibrous composition, waste matrices of 100% polypropylene nonwoven material and 100% bio-oriented polypropylene film. The aim of this study is to quantify the environmental performance of these composite panels by assessing their life cycle to ensure that this innovative solution is environmentally sustainable. GaBi Software and its database were used to conduct this study. As the composite boards are intended as an alternative to the OSB type panels used in the field of construction, the standard size of such panel has been adopted as a functional unit: thickness 8 mm, length 2500 mm and width 1250 mm. The results of the main impact indicators obtained from the LCA cradle to cradle of the composite material and their comparison with the data adopted for OSB type boards suggests that the proposed solution can be considered as a step forward towards minimising the ecological impact of textile waste on the environment.

Keywords: construction applications, life cycle assessment, textile recycling method, textile waste, waste composite.

RESEARCH ON INFORMATION SECURITY MANAGEMENT IN ORGANIZATIONS

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Abstract:

The proposed research topic falls, as a general field, in that of scientific research in Engineering and Management, and as a specific field in that of Information Security Management (ISM). In this regard, research in the field claims that information security is a concern of both engineers and managers, with the aim of protecting information, customer satisfaction and conducting business operations.
This paper's purpose is the bibliographic research of ISM in organizations, to create a clearer and more up-to-date picture of this field, but also to create a framework for Information Security (IS) that is not only limited to the technological infrastructure, but also include human resource. At the same time, it aims to increase the performance of organizations through secure information and intelligence activities.
From the point of view of the research methodology, the approach is a gradual one, from the theme generality to particular by approaching each element of the research directions. Methodological model structure comprises the research purpose, goals for research directions, research methods applied to achieve the objectives, research results expected for each goal.
The research directions of the study are: identifying the need for IS within organizations, designing a model of evaluation in terms of IS, creating an Information Security Management System (ISMS) that should consider all the criteria, internal and external factors, to improve ISM, and, as the last direction, enhancing the efficiency of the organization through IS and intelligence activities.
As a result, the aim is to obtain a clearer picture of current researches, legislation and standards, thus adapting the model of evaluation of organizations in terms of IS, thereby succeeding in improving or implementing ISM. Beyond the protection of information assets, the aim is to understand the importance of meeting legal requirements (national, international) or partner requirements, but also image benefits, given the current context in which many organizations record damage caused by security breaches.

Keywords: damages, information security system, information security management, intelligence

APPLICABLE STANDARDS AND MATERIALS USED IN THE MANUFACTURE OF GLOVES USED BY FIREFIGHTERS FOR HAND PROTECTION

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Abstract:

Ensuring the safety of the operational personnel involved in the intervention actions is a priority for the institutions responsible for the prevention and management of the emergency situations, which is why special attention is paid to the protective performances of the individual protective equipment used. The safety and health of rescuers depend on how the materials used in the manufacture of protective equipment for the action of risk factors behave. In order to ensure adequate protection against injury to personnel in professional emergency services, the protective equipment is designed to isolate the wearer from the hazards of the environment in which the intervention is carried out. In the case of firefighters, the protective equipment is intended to provide protection against the effects of water, heat radiation, smoke, toxic gases, mechanical shock, falls or other environmental conditions which present a danger to humans.

There are different types of raw materials used at firefighter's protective gloves manufacture. The multilayer materials must be fire resistant, in order to provide protection against convective heat, radiant heat, contact heat, fire, mechanical risks (abrasion, cutting, tearing, punching) and water or chemicals penetration.

The aramid fibers chemical structure is the main reason of its superior performance, characterized by high mechanical and thermal properties, which justify their use as an ideal base material for composite materials reinforcement used in individual fire protection equipment manufacture. Aramids are high temperatures resistant and flame-retardant due to their structure, being capable to maintain their tensile strength and physical properties even after long time exposure under severe conditions (eg. decrease to approximately 60% of the initial value after exposure to 250 °C for 1000 hours)

This paper outlines the minimum requirements that firefighting gloves and the materials used to make them must meet.

Keywords: Firefighter gloves, material, aramid fibers, protection capability, protective equipment, safety

THE KNOWLEDGE OF MORTARS WITH MICRO AND NANOMETRIC INSERTS IN THE FIELD OF HISTORICAL BUILDINGS RESTAURATION

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Abstract:

With an average of about a ton of cement produced each year for every person in the world, the cement industry is the second largest producer of greenhouse gases on our planet. Carbon is not just a simple singular element in the periodic table of elements, is the sixth most abundant element in the universe: about 0.5 ppm and with about 0.20% by weight only in the terrestrial environment, and it is a fundamental element for all of the living world. Our interest goes to properties and characteristics of carbon as a solid and as a material. If we consider the potential of carbon nanotubes (CNT) as superior additives for hardening concrete and improve the appropriate impermeability against different water-cement (W/C) ratios, we can consider a transition zone between aggregates and cement paste, which is the most vulnerable concrete component and always limits the properties and applicability of concrete. Construction as a work sector requires about 85% of the planet's natural resources and has a huge impact on the environment using about 60% of raw materials extracted from the lithosphere, most reaching waste, which produced the need to develop other types of concrete and mortars that may reduce greenhouse gas emissions. Carbon nanotubes (CNTs) are allotropic forms of carbon with a nanostructure that can have a length-to-diameter ratio greater than 10,000. Our study advances the fundamental understanding of the nanoscale reinforcing mechanisms, correlating the microscopic phenomena with the macro-performance of the cementitious composite. Hybrid graphene-fiber reinforced cementitious composites will be able to accelerate the advancement of a new generation of construction materials, serving their fabulous multifunctionality for more economical, durable, safer, and smarter infrastructure systems. This enables us with an opportunity to design the high-performance cementitious composites through the rationalized optimization of the lateral size, thickness, functionalized degree, and filler content of graphene, as well as interface interactions between both graphene/fiber and graphene/cement.

Keywords: sustenability, SWCNT, carbon nanotubes, hydration, mechanical property, nanotechnology, nanotubes, Portland cement, porosity

DEVELOPMENT OF NEW ADVANCED TITANIUM ALLOY FOR MEDICAL APPLICATIONS

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Abstract:

Globally, there is a continuing concern for research and development of alloys for medical and biomedical applications. Thus, it is desired to improve both the classic technologies for the execution of implants and the technologies for the synthesis of biomaterials from which they are made, with the ultimate goal of promoting a new generation of multifunctional implants with long-term performance. The evolution of the use of biomaterials has seen a rapid development, doctors require biocompatible materials with increased resistance to corrosion and mechanical stress. A biomaterial is a synthetic material used for the permanent or partial replacement of a living organ or system or for functioning in close contact with active tissues. The main purpose is the use of biomaterials to repair human tissues. Titanium has attracted the attention of the medical world with its particularly advantageous properties: biocompatibility, low thermal conductivity, low density, corrosion resistance, odorless and tasteless, the cost price of the material being four times lower than gold. All materials used in the execution of medical implants must be biocompatible and meet stringent standards. This paper presents the latest trends in titanium-based alloys, properties as well as the medical applications in which they are used. The aim of this paper is to a study of the influence of alloying elements on titanium alloys for orthopedic applications. It is very important to study the alloying influence of the elements because depending on the amount of alloying elements (α or β), the mechanical properties and microstructure of titanium alloys differ. In connection with the specialty literature, we obtain a new titanium alloy from non-toxic elements with Mo, Zr, Ta and Nb, produced by argon arc-melting method. The alloy has been examined by optical microstructure, electronic microstructure, X-ray diffraction (XRD) and indentation tests. With the results obtained, the new alloy is a promising biomaterial, a potention candidates for medical field.

Keywords: microstructure, new biomaterials, non-toxic elements, titanium alloys, vacuum arc melting

QUALITY AND RISK MANAGEMENT IN IDUSTRIAL PRODUCTION SYSTEMS: A LITERATURE REVIEW

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Abstract:

Nowadays, quality assurance represents mandatory behaviour in industrial productions systems. Moreover, due to the high complexity and variability of the products and production processes, quality management can represent a challenge in SMEs (small and medium enterprises) and in shopfloors, where the manufacturing processes are designed to fulfil customer expectations. To assure the quality of the production, statistical process control is used combined with industry 4.0 specifics, especially data gathering is made instantaneous by inline sensors and triggers. Therefore, risk analyses are used as enablers for quality assurance. Identifying and mitigating the risks related to nonconforming parts together with collected data represents a comprehensive system that leads to achieving quality performance to satisfy the customer needs and to assure competitiveness in the market. In addition, the output of maintenance activities can be reflected in production conformity and the overall process performance can be highly influenced by maintenance policy and activities including the quality issues reduction. This paper provides a comprehensive literature review of the papers which imply mainly quality management behaviour and articles where risk management and maintenance management are related to quality improvements and their outcome can be used to improve the quality management system. Reviewed papers are divided for each main contribution (quality, risk, and maintenance) and tabulated by distinctive topic. Also, the main contribution or a short overview of each paper is listed in tables. The tables simplify the reader's access to the work done in the area and smooth the possibility of comparing the work done. Nevertheless, the present paper offers o complete overview for practitioners who are interested in quality and risk management specifics. In the end, the trend in this field was identified and the gaps are presented for future research.

Keywords: quality management, maintenance management, nonconformities, production, risk management

USE OF THE 3 LEVEL MIND MAP METHOD TO IDENTIFY CONSTRUCTIVE SOLUTIONS FOR THE DEVELOPMENT OF A THERMOFORMING MOULD

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Abstract:

Thermoforming is one of the oldest technologies for the manufacture of plastic products. This has its origins in prehistory, but today, new additive manufacturing technologies can contribute to the production of moulds, tools, or accessories, which can be used in other traditional manufacturing processes and not only in small production series or prototyping. Manufacturing such moulds for thermoforming is a challenging technical problem due to the multitude of equipment and materials that can be used. Another limitation is the combination of geometric or design and process constraints specific to the two technologies involved. Due to the wide fields of thermoforming and additive manufacturing, it was imperative to implement a mind map method, on three levels. Following the application of the mind map method, the material resources used for the study on the manufacture of a mould for thermoforming using additive manufacturing is established and includes equipment, software, materials, tools, and accessories susceptible to experimental testing. By studying the specialized literature in this way, it is possible to obtain an overview of the process parameters that will be monitored in future experimental research. Due to its complexity, the mind map method is only one of the first stages of theoretical research and the identification of new or improved solutions to solve a certain technical problem. After evaluation, based on 6 comparison criteria, of the identified ideas and constructive solutions, an office business cards holder is obtained by thermoforming with a vacuum, using a mould manufactured by Fused Filament Fabrication. The practical implementation of this theoretical approach made it possible to produce a custom mould ready to use in a few hours. Among the advantages are the high degree of flexibility in design and the low cost of materials and equipment compared to the classic milling, turning, and drilling technologies.

Keywords: additive manufacturing, Fused Filament Fabrication, mould, plastic, thermoforming

RESEARCHES ON THE AESTHETIC PERCEPTION OF WOMEN'S CLOTHING

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Abstract:

Nowadays, visual perception is a topic of interest in the clothing industry, due to the impact it has on the consumer's first impression. The dominant factor is the aesthetic one, due to the essence of the word itself, the nature of beauty and the preferences expressed by people. Aesthetics is characterized by the design elements and studied through specific aesthetic stimuli. In this context, an actual topic is the formal clothing for women, due to the large number of office jobs, where a certain dress code is required. The jacket is the most common product of this type, indispensable for the personal wardrobe of this category of wearers.
The present research focuses mainly on the visual perception of the business jacket for women and on the integration of the ergonomic design of the clothing product. The research aims to improve the conceptual development and design of the jacket models, suitable for the professional activity, the business field. The study aims to identify some comfort and perceived problems by evaluating the beliefs and preferences indicated by the participants involved in the study. Among consumers, many people are not satisfied with the variety of models offered on the market, both in terms of wearing comfort and model details. Each person wants to be able to purchase models that represent them, which will induce a special mental state, at an affordable price.
The research and development methodology focused on developing a self-administered questionnaire that includes visual stimuli, and using the 5-step Likert rating scale. The questionnaire was sent by e-mail and was addressed to women, who in their current activity, the professional one, have an outfit that includes a jacket.
The sample consisted of 100 women wearing business jackets, at least once a week. One of the design elements analyzed was the color. The evaluation of the results aimed the visual perception of the design elements on the respondents and the relationship between the elements and the personal characteristics of the respondents.

Keywords: aesthetics, colour, design elements, formal clothing, jacket, visual perception

NONWOVEN INSULATION IZOMIN – SUSTAINABLE DEVELOPMENT BY DISRUPTIVE INNOVATION

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Abstract:

In today's society we are confronted with the reduction of natural resources and the negative impact of human activities on the environment, which forces us to change both our thinking and the way we deal with the environment and economic and social activities.
Experimental research in the laboratory and in industry has confirmed the possibility of manufacturing non-woven textile products based on sheep wool, which ensure the achievement of both the objectives of strength and durability and thermal efficiency of structures, while contributing to the improvement of indoor air quality. Experimental tests have shown that this type of product contributes to the reduction of volatile organic compounds, including formaldehyde, from the indoor environment, through a process of physisorption (adsorption in micropores in the fiber structure) and through a chemisorption achieving a reduction in formaldehyde concentration of more than 85% after only 3 days of exposure.The new product is a registered trademark under the name IZOMIN LD, MD and HD and complies with EU standards, meets the requirements in terms of: Thermal conductivity (W/mk), thermal resistance (m^2k/w), bulk density (kg/m^3), water absorption (kg/m^2), resistance to fungal attack, flammability class E, classification of acoustic ceiling elements class B, C, with absorbent properties, including volatile organic compounds (VOCs) that pose a risk to human health.
Therefore, it is considered that innovative products, such as nonwovens made of wool contribute not only to the energy efficiency of buildings but also to the improvement of hygiene and comfort of inhabited interiors by improving air quality. In this way, indirectly but effectively, an improvement in the health of the population is achieved, especially in conditions where, according to WHO, over 99% of the population breathes polluted, unhealthy air and, as a result, 13,000,000 deaths occur annually.
The product approval process ensures the sustainable development of SC MINET SA, which has a positive impact on the protection of the environment and the quality of life.

Keywords: air quality, building efficiency, natural insulation, nonwoven

COMPUTER AIDED ANALYSIS OF FREE RESPONSE OF AN AC ASYNCHRONOUS DRIVING MOTOR DUE TO AN IMPULSE EXCITATION

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Abstract:

This paper intends to prove in experimental terms that the using of a three phase asynchronous AC motor as loading sensor for a driven rotary machine (or a rotary mechanical system), sensing the mechanical loading via the evolution of the absorbed electrical power is affected by the mechanical dynamics of the rotor motor. In the mechanical dynamics behaviour are involved the rotating magnetic field stifness acting against the rotor as a spring, the rotor moment of inertia and the damping phenomena (mainly due to the air friction). A first approach on mechanical dynamics was done using the computer assisted study of free response due to impulse excitation (during rotation motion). Some phenomena during transient regimes of the motor (e. g. starting in star-delta configuration or any suddenly change of the voltage in the supplying circuit) work as impulse excitation. One of the easisest ways to describe this free response is to use the evolution of the active electrical power in time domain. A simple experimental setup for signal acquisition and computer aided processing was developed. It consists of a voltage transformer and a current transformer placed on a phase of the electrical supplying system. The signals delivered by transformers (instantaneous current and instantaneous voltage evolutions) are converted in numerical format using a high sampling rate digital oscilloscope and transferred to a computer. Some signal processing techniques were developed in order to describe and to analize the evolution of the active power, to detect and analize the free response of the motor (e. g. curve fitting). The analisis of the free response provides the value of resonance frequency (for absolute torsional vibration of the rotor) and the value damping ratio. These two values help to a better understanding of the motor behaviour, especially as sensor for variable loading.

Keywords: active electrical power, AC motor, free response, mechanical dynamics, signal processing

MODELING AND ANALYSIS OF THERMAL BEHAVIOUR FOR BRAKE DISCS

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Abstract:

Reffering strictly to the braking system, it is one of the most important components for any type of vehicle, whether we are talking about cars, motorcycles or bicycles. Its main role is to convert the kinetic energy and potential of the vehicle into heat, which allows the vehicle to stop. During braking, the brake discs must withstand sudden changes in temperature, so heat absorption and dissipation must be eliminated. As efficiently as possible, in order to maintain a high performance of the entire braking system. Also, the cooling of the brake discs is an important research topic for the top car manufacturers, who need a high performance for cars, and therefore the brake discs are a main component and their geometry must be paid great attention. The purpose of this paper is to analyze five possible variants of the geometry of the brake disc, each geometry being different from the other. Because for a more efficient release of heat, the five chosen geometries of the discs have on their surface vanes, holes, in order to remove heat from their surface. For the actual making of the discs, the chosen models were made and designed in the CATIA V5 design program. The brake discs chosen for thermal analysis in this paper are simple discs from a geometric point of view, usually found in motorcycles, bicycles, karts, where the braking forces and tensions in the braking assembly are much lower compared to brake discs mounted on cars. The next step in this work was to perform analyzes and simulations for the selected disks. At the same time, the material chosen for them was considered. At the beginning, all the brake discs had the same type of material, namely semi-metals, later for the best variant from a thermal point of view, the materials were changed to gray cast iron and ceramic, for a better comparison. The 3D models were imported into the ANSYS analysis program, where individual analyzes were performed for each brake disc, and a comparison was made between the values of each one.

Keywords: brake, disc, modelling, simulation, thermal, analysis

METHODOLOGY FOR DESIGN, CHARACTERIZATION, AND CONVECTIVE ANALYSIS THROUGH A DOUBLE-TUBE HEAT EXCHANGER FOR NANOFLUIDS

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Abstract:

Achieving high-efficiency heat transfer systems has been one of the main objectives of the past decades. Nanofluids have been proposed as a potential contribution to improve the heat transfer performance of the mentioned systems. A reliable characterization of the nanopowder, as well as the thermophysical profile and an analysis of the heat transfer performance of the nanofluid are fundamental for an appropriated design and to reach this goal. In this study, a methodology for the design, characterization, and convective analysis trough a double-tube heat exchanger is presented. Regarding the design and characterization of nanofluids, there are some techniques that give useful information about the nature of the employed nanopowder such as Transmission Electron Microscopy (TEM), X-Ray diffraction (XRD), UV-Vis spectroscopy, and Fourier-Transform Infrared (FTIR) spectroscopy. The analysis through these techniques will provide information about the shape and crystallinity of the selected nanopowder or the vibration of the chemical structures of the nanofluid, among others. The determination of the thermophysical profile of the nanofluid is also fundamental for further analysis of their feasibility as heat transfer fluids. Thermal conductivity, dynamic viscosity, density, and specific heat capacity of the nanofluid are needed to perform the calculation and determine the convective heat transfer coefficients through the double-tube heat exchanger. Several experimental parameters measured in the heat exchanger such as the temperature of the hot water and the nanofluid at inlet and outlet of the heat exchanger, and the flow of both fluids, are also needed. Gnielinski correlations for a fully developed turbulent flow through annular ducts were employed to determine the convective heat transfer coefficients of the hot water flowing through the annular section of the heat exchanger. Then, a set of assumptions such as consideration of steady state, the outer surface of the heat exchanger as adiabatic, unidirectional flow through the heat exchanger, speed of fluids perpendicular to the cross section, constant thermophysical properties, and no consideration of the thermal resistances associated to the dirt of the pipes allow to obtain the convective heat transfer coefficients of the nanofluid by means of the Wilson plot method.

Keywords: convective heat transfer coefficients, double-tube heat exchanger, nanofluids, nanopowder characterization, propylene glycol, water mixture, zirconia

DETERMINATION OF AIR FLOW-METHODS AND MEANS

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Abstract:

Industrial ventilation is a complex field that represents the primary protection against the formation of explosive, toxic, asphyxiating or radioactive atmospheres. Calculating the airflow required to ventilate a room can be a real challenge, and a wrong choice can lead to its inefficiency. A ventilation system is defined by the exchange of air between the indoor and outdoor environment in order to create environmental conditions as close as possible to the required thermal comfort conditions. Fans are such simple and common equipment that we tend to underestimate their importance, enjoying our attention only when their performance leaves something to be desired. A number of techniques and means are known for the control of aerodynamic parameters specific to installations or ventilation systems.
Before installing a fan, the space in which it is to be used must be analyzed and the method of compensating the exhaust air (mechanically with another fan or naturally with sized grids). The most important factors to consider when choosing a fan are: the volume of the space, the number of shifts per hour required depending on the destination of the space and the heat release, heat input from the outside and other moisture or odors.
The aeraulic balance of the system both in the design phase but especially at the time of commissioning has a very important role in achieving the comfort parameters. Everything starts from the initial conditions imposed in the design theme. In order to achieve the desired comfort parameters (indoor temperature, air quality, humidity, noise level, airflow speed, etc.), an air flow is determined by calculation to lead to the simultaneous fulfillment of these requirements. This air flow is determined for each room, and then, if necessary, divided into several inlets or outlets. That is why it is very important to introduce or evacuate exactly the calculated amount of air at the level of each speaker or grille, otherwise the comfort requirements are obviously not met. The paper presents the methods and means of determining the air flow.

Keywords: aerodynamic parameters, air flow, industrial ventilation, exhausted air, means of determination

NON-SPARK METALLIC MATERIALS FOR APPLICATIONS IN EXPLOSIVE ENVIRONMENTS

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Abstract:

Non-spark materials present a high interest in applications were explosions can take place after ignition from a metallic spark. Many times the Cu-Be alloy was used as metallic material in minning areas or for natural gaseous exploitation in order to obtain specific working tools. In order to design and apply active elements like gears made of non-spark alloys we propose a new material Cu-Al-Be that can be used instead of steel for in contact gears that can produse sparks. The alloys were proposed with weight percentages for aluminium between 8 and 12% and for Be from 1 to 5 wt% and copper the rest. We obtain using induction and electric furnace alloys in the chemical composition proposed domain. 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. Electro-corrosion resistance of the material was evaluated using a three electrodes cell and a potentiostat. Linear and cyclic potentiometrywas analyzed in salt electrolyte solution along with the open circuit potential variation. Effect of Be addition on the corrosion resistance was investigated. 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.

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

OVERVIEW OF DRAWBACKS AND BENEFITS OF IONIC LIQUID 1-BUTYL-3-METHYLIMIDAZOLIUM TETRAFLUOROBORATE BEHAVIOUR AT HEAT TRANSFER

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Abstract:

IoNanofluids, according to the basic concept of nanofluids, are fluids based on ionic liquids to which a very small amount of nanoparticles is added, in order to improve the thermophysical characteristics. Among the factors that influence the thermophysical properties of IoNanofluids are the structure and properties of ionic liquids, but the type and amount of nanoparticles used are also very important. Most research in the field of IoNanofluids is focused on trying to increase the thermal conductivity and decrease the viscosity of ionic liquids, by adding different types of nanoparticles, for example MWCNT (multi-walled carbon nanotubes), but also graphene or Al2O3. This review summarizes the experimental research conducted so far in the field of IoNanofluids that have as a base fluid the ionic liquid 1-Butyl-3-methylimidazolium tetrafluoroborate ([C4mim] [BF4]). The results published in the literature on the thermal conductivity of IoNanofluids have shown that these new fluids have a higher thermal conductivity compared to that of the base ionic liquid, which suggests that the addition of solid nanoparticles can overcome the disadvantage of low thermal conductivity of the ionic liquid. As for the specific heat, it increases almost linearly with temperature and the variations of specific heat remain between 0 – 3 % while the temperature and concentration increase. In terms of density, it has been shown that this property can be correctly estimated with classical relations. The rheological behavior of IoNanofluids, also studied in the literature, shows that IoNanofluids generally have a non-Newtonian behavior, with a decrease in viscosity with increasing shear rate. The viscosity of IoNanofluids has a much higher value compared to basic ionic liquids, even for a small amount of dispersed nanoparticles and also has a strong temperature dependence. On the other hand, the experimental results on electrical conductivity are extremely few, there is no unitary theory regarding its variation with both the temperature and the concentration of nanoparticles or their type. If reference is made strictly to IoNanofluids which have as their basic fluid the ionic liquid [C4mim][BF4], there are very few experimental data in the literature and no clear conclusion is possible as to their properties or their variation with temperature.

Keywords: Ionic liquids, , IoNanofluids, nanoparticles thermophysical properties

PEG BASED NANOFLUIDS AND THEIR THERMOPHYSICAL PROPERTIES

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Abstract:

This research focused on the experimental production of new fluids and tests to determine their electrical conductivity. The analysis of the experimental results and their comparison with the current state of the art in the field, will allow the identification of new fluids that have improved characteristics compared to the basic fluids (polyethylene glycol, for example). The importance of estimating electrical conductivity has been highlighted more intensely since about 3-4 years ago, so there are not many experimental studies in the literature. Electrical conductivity is a very important property of fluids, especially for electric field heat transfer applications. Since the discovery of nanofluids, there has been much discussion about the potential of these new fluids in practical applications involving heat transfer, especially due to their improved thermophysical properties compared to traditional liquids. On the other hand, the experimental results on electrical conductivity are extremely few, there is no unitary theory regarding its variation with the temperature and the concentration of nanoparticles or their type. The results will be discussed for nanofluids with a mass concentration of 0.25 - 5.0 % wt nanoparticles of alumina and zinc, having as base fluid polyethylene glycol PEG 400. Edge® Multiparameter HI 2030 (Hanna Instruments) was used to measure the electrical conductivity of all studied fluids. The experiment was performed in two stages (at ambient temperature and heating in the range 293.15 - 333.15 K) and was performed at ambient pressure, the overall accuracy being calculated at 3 %. Three determinations were made for each measurement to verify the accuracy of the measurements, and the recorded data represent the average value of the experimental data. The calibration of the equipment was performed with a standard solution (of known electrical conductivity) in the estimated value range. The temperature variation was provided with a temperature controlled water bath. In conclusion, the electrical conductivity of Al2O3 nanoparticle nanofluids decreases with increasing temperature, and the addition of ZnO nanoparticles to the base fluid does not modify its electrical conductivity.

Keywords: electrical conductivity, heat transfer fluids, nanofluids, nanoparticles

FRICTION BEHAVIOUR BETWEEN TEXTILES AND GLASS IN LOW LOADS AND SLIDING SPEED CONDITIONS

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Abstract:

In the sliding tribological systems operating at low speed and dry conditions, the nonlinear variation of the friction force can be observed with alternative stick and slip processes. Two parameters are important in this stick-slip process: differences between static and dynamic friction coefficient and rigidity of the system. Generally, the static friction coefficient has a higher value than kinematic friction coefficient [1]. Both static and dynamic friction coefficients are not constant values for a pair of materials, static friction for rigid materials having higher values than dynamic friction coefficient. Based on the previous experiments realised in [2], the authors extended the friction research on the contacts between the cloth for wiping glasses in contact with the glass, for a sliding speed range between 0.02 and 8 mm/s and a very low contact pressure (0.004MPa). The tests were realized with a unidirectional oscillator including a mass-spring system sliding on a glass surface. The glass surface was attached on the sliding table of the Tribometer CETR UMT-2. Between the oscillator mass and glass surface were included different materials as cloth for wiping glasses and thin soft paper. The experimental results indicate a special behaviour of the transition between adherence and sliding on the glass surface. So, for the speeds between 0.05 and 0.1 mm/s was observed presence of a typically stick-slip process with a static friction coefficient higher than dynamic friction coefficient. By increasing of the linear speed from 0.2 to 2 mm/s the variation of the friction force is characterised by a single peak followed by the important decreasing of the friction force that means an important difference between static and dynamic friction coefficient also. By increasing of the linear speed over 4 mm/s a continuous increase of the friction force is observed up to a certain limit and the transition between adherence and sliding process is characterised by a continuum increasing of the friction coefficient once the slip between the contact surfaces starts. The dynamic friction coefficient has important increasing of the values from 0.18 to 0.35 when the sliding speed varied between 0.2 to 8 mm/s.

Keywords: cloth, dynamic friction coefficient, glass, low speed, low loads, soft paper, static friction coefficient,

FINITE ELEMENT ANALYSIS OF THE SELF ALIGNING COLLET CHUCK MECHANISM

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Abstract:

In this paper, the authors present a finite element analysis study, namely a collet chuck. Finite element analysis (FEA) is a method of computerized analysis that highlights how a manufactured product will react in the physical world. Therefore, finite element analysis examines the product's behavior in contact with forces, heat, vibration, fluid flow, and other physical conditions. As a result, we can say that finite element analysis studies the probability that the product will break, will wear out, or how the product will behave in real conditions. In order to obtain the desired results, the object is modeled, subjected to stress and analyzed under different conditions similar to the real ones. The purpose of the research was to model and describe the mechanical behavior of the structures with complex geometry, namely how the collet chuck behaves in real conditions. To achieve this objective, a collet chuck was made in the Fusion 360 design program. The parameterization was used to make the study as easy as possible, thus allowing the effortless modification of the dimensions of the collet chuck. A finite element analysis study was performed in which constraints act on the collet chuck, so that the collet chuck does not move, but also loads so that the jaws of the collet chuck move, thus catching the part. The method is a discretization process: the geometric shape and the fields of displacements, specific deformations and stresses are described by discrete quantities (eg coordinates) distributed throughout the structure. This requires a matrix notation. Tools are digital computers, capable of storing long lists of numbers and processing them. As a result of the finite element analysis, we obtained the report that specifies the safety factor, the tensions of the collet chuck but also the displacement of the collet chuck. Due to the analysis we were able to compare the theoretical calculation with the practical one, analyzing the reports we obtained after the simulation in the design program. The precision of centering and tightening of the elastic bushing can be analyzed with finite element.

Keywords: collet chcuck, digital computer, finite element analysis, parametrization

FILM THICKNESS IN MICRO BALL BEARING GREASE LUBRICATED

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Abstract:

The micro ball bearings generally are lubricated with grease. Most of research indicates that the film thickness in ball-races contacts can be theoretically determined according to the IVR-EHD lubrication theory considering as lubricant the base oil of the grease at the working temperature. Recent researches [1,2] experimentally evidenced that at low speed in ball-disc contacts the film thichness generated by grease is higher than the film determined from the base oil. Because some micro ball bearings operate in low rotational speed and low loads the authors investigated experimentally and theoretically film thickness in an angular contact ball micro bearing grease lubricated. The experiments were realised with 7000 angular contact ball bearing lubricated both with grease and oil. The rotational speed of the inner race varied between 50 and 400 rpm and the axial load applied on the ball bearing was 5N. First tests were realised by using a mineral oil having the similar viscosity with base oil of the grease. Using the equipment from the Tribometer CETR UMT-2, electrical resistance of the ball bearing has been register for various rotational speeds. According to the EHD theory, the film thickness between the balls and the two races has been calculated. The correspondence between film thickness and electrical resistance has been obtained. In the second step, the electrical resistance of the same ball bearing lubricated with grease has been register. Important differences between the electrical resistance of the ball bearing lubricated with grease and oil have been observed especially at low rotational speed (50-100 rpm). By increasing of the rotational speed (over 250 rpm) the similar resistance of grease and oil has been obtained. As a first conclusion the experiments realised on the full angular contact ball bearing confirm the results obtained by a single ball-disc contact by [1,2]. More researches are in working with different greases recommended for micro ball-bearings.

Keywords: EHD film thickness, electrical resistance, grease, micro ball bearing, oil

PRELIMINARY RESEARCH ON THE USE OF SYNTHETIC MAGNETITE IN THE CONSERVATION AND RESTORATION OF ARCHAEOLOGICAL IRON. STUDY ON THE POSSIBILITY OF USING FERROFLUIDS BASED ON SYNTHETIC MAGNETITE AS POLISHING MEDIA

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Abstract:

In this paper, we study the state of art and some possibilities of using ferrofluids based on synthetic magnetite, as a polishing media for archaeological iron objects in particular. The purpose of this treatment is to prepare the surfaces to be varnished, but also to ensure their resistance to further corrosion. The principle of the method is to immerse the objects to be treated in this way in a ferrofluid which is agitated in a magnetic, ultrasonic or mechanical field. The ferrofluids used may contain, in addition to magnetic particles, other non-magnetic abrasive particles (synthetic quartzite in this case). The transport liquid may be non-ionic (aromatic solvents, oils) or ionic (distilled water or solutions of acids or bases), compatible with the chemical character of the particles used. Suspended particles show their abrasive character on the microsurfaces, resulting in their superfinishing. The synthetic magnetite used is obtained by coprecipitation, using methods that require two precursors and methods that require a single precursor and reducing or oxidizing agents for the second precursor. Co-precipitation reactions take place either at room temperature or at high temperatures (<90C). Magnetite synthesized in this way is used raw, or is chemically stabilized with citric acid, as a surfactant, to obtain the characteristics of a ferrofluid. Quartzites used as additional abrasive material are obtained by acid precipitation of sodium silicate and are kept in suspension by magnetic particles as a result of the properties of ferrofluids. The study in this paper analyzes the effectiveness of the method in terms of an optimal formulation of a ferrofluid with high durability and controlled chemical composition.This method allows the simultaneous polishing of all surfaces of the object, regardless of their complexity or location (exterior or interior). In the case of iron objects of archaeological origin, the effectiveness of this treatment can be studied by optical microscopy (especially in polarized light) or electron microscopy.

Keywords: archaeological iron, conservation, ferrofluids, magnetite, polishing media, restauration

USE OF BALANCED SCORECARD DESIGNER LIGHT - IN ORDER TO DEVELOP THE MAIN PROCESSES WITHIN THE SCHOOL "ALEXANDRU IOAN CUZA" ECONOMIC HIGH SCHOOL PIATRA NEAMŢ

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Abstract:

Balanced Scorecard is a strategic performance management framework that is designed to help an organization monitor its performance and manage the execution of its strategy. In a recent global study of the management tools used, Balanced Scorecard proved to be the sixth most widely used management tool in the world, which also had one of the highest ratings, satisfaction. The concept, with two components BS personal (BSP) and BS organizational (BSO), was introduced in 1992 by Robert Kaplan and David Norton. The BSO identifies several dimensions of the organization, representing areas where organizations need to achieve results, at the level of departments, teams or individuals. Depending on the type of company, the essential dimensions can be: financial aspect, customers, internal processes, knowledge and learning, quality of service, market share, etc. Kaplan and Norton stop at four fundamental dimensions, which give four perspectives from which to examine the organization's business. The four Balanced Scorecard perspectives are: Financial Perspective, Customer Perspective, Internal Process Perspective, Learning and Development Perspective. Research has shown that organizations that use a Balanced Scorecard approach tend to outperform organizations without a formal approach to performance management at the strategic level. BSC Designer is powerful software that allows organizations to design, implement, and use a customized Balanced Scorecard to track critical performance data and progress toward the organization's goals. For organizations with a strong desire to grow and succeed, BSC Designer can provide the tools you need to lead your organization effectively. Balanced Scorecard Designer is a software that facilitates the analytical approach of performance management, facilitating the interconnection of processes related to the creation and computerized management of balanced dashboards (Balanced Scorecards). The strategy, the annual planning and the management system of the quality and of the operations in the cart of the school "Alexandru Ioan Cuza" Economic High School Piatra Neamț were created based on this model. The use of BSC Designer Ligt is the framework for the entire organization-wide planning and quality assessment. Through this we were able to create a practice-oriented model, a model suitable for an educational institution.

Keywords: Balanced Scorecard Designer Light, BS organizaţional (BSO), BS personal (BSP), computerized management , management tool

PARTICULARITIES OF DESIGNING FUNCTIONAL CLOTHING THROUGH THE JULIVI AUTOMATED SYSTEM

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Abstract:

The design of functional clothing for children aims to meet the specific requirements of this category of wearers and of the team of specialists who are directly involved in the medical procedures to which these children are subjected. In order to obtain suitable products, anthropometric data, the degree of development of children and advanced methods of designing products with shoulder and waist support, based on the use of computer technology, are taken into account. In this regard, the creation of a database for the design of computer-aided clothing is an urgent task. The products thus developed ensures an increase satisfaction of the needs of children through a high level of comfort and quality. The aim of this study is to develop products through automated clothing design technologies. To achieve this goal, the main related issues are:

- Study of the requirements imposed on this type of product.
- Classification of functional clothing for boys and girls.
- Defining a rational system of values, which allows the unification of dimensional data.
- Creation of technical documentation for the manufacture of children's clothing.
- Development of the database in CAD system for the proposed models.

As a result of the analysis of the data for obtaining the series of sustainable functional products for premature babies, the following steps were performed:

- Analysis of the needs and functional, aesthetic and economic requirements of the carrier group.
- Development of a database with the right solutions.
- Selecting the model solution in accordance with the pre-established requirements.
- Elaboration through the CAD system of the proposed models.
- Elaboration of the prototype of the product which is subsequently subject to verification and compliance with the specified criteria.
- Elaboration of technical documentation for the proposed products.

The size of the wearer and the requirements that the product must meet in the process of dressing and undressing, and handling for various medical investigations were taken into account. Subsequently, the calculation of the materials required for the manufacture was made based on the frames generated by the CAD system. The Julivi porting method presents the possibility of optimizing the process of drafting and obtaining the package of documents. This method, applied for the development of products for premature children, was proved to be an effective and efficient one.

Keywords: CAD system, design solutions, functional products

COMPARATIVE STUDY OF CRISIS RESOLUTION METHODS

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Abstract:

The crisis is defined as a period in the dynamics of a system characterized by the sudden accumulation of difficulties, the conflicting outbursts of tensions, which hinder the normal functioning, triggering strong pressures for change. Because the success of today's society is linked to communication systems, which are closely linked to features such as responsiveness, clarity, real-time and adaptable involvement, crisis-time communication plays a crucial role in the availability and establishment of a safe climate. economic, political, social.), period of tension, of the trials that manifest in society. Acute lack (of goods, time, work), a strong threat to the structures, values or fundamental norms of a social system that must make essential decisions under time pressure and in circumstances characterized by a high degree of uncertainty, a crisis it poses a threat, but at the same time an opportunity. Methods of diagnosing and predicting a crisis can bring benefits during its development. Crises are complex phenomena that can affect either the whole social group or certain sectors of it: economic life, the political system, international relations, financial-banking systems, social structures, educational institutions. and culture etc. In the conceptual analysis of the crisis, two basic characteristics of the crisis can be taken into account: the severity of the crisis and the intensity of the crisis. Crisis resolution methods refer to the communication objectives of this stage and include: taking the necessary measures to keep the public informed about the evolution of events, knowledge of risks and solutions for their management; providing support information to those who need it. Collecting "listen, learn and evaluate" reactions. Throughout this period, there is a continuous analysis of the evolution of the event and the adaptation of the resource allocation model, if necessary. Thus, this research paper provides clear directions for the development of a model for identifying the first signs of a crisis, based on the concepts identified in the literature and complemented by changes already applied in higher education, generated by the current post-pandemic situation. they match and respond to the challenges of the current Romanian situation.

Keywords: crisis resolution methods, crisis resolution model, crisis strategic management, crise-solving

DESIGN AND TESTING OF MULTI-MATERIAL FLEXURE HINGES WITH MORPHING STRUCTURE FOR FUSED FILAMENT FABRICATION

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Abstract:

Flexure hinges or living hinges are non-assemble flexible joints that allow the relative rotation of two adjacent rigid parts through bending. Conventionally, living hinges are made using thermoplastic materials by injection molding and have a restrictive design, but Additive Manufacturing (AM) technologies gave new opportunities regarding hinges development allowing more design freedom. Multi-material technologies can further extend living hinges design thinking by using flexible materials only for the bending component. Currently, Fused Filament Fabrication (FFF) technology offers the widest variety of materials that can be explored. However, most studies refer to single materials hinges with a non-symmetrical design, referred to the folding direction. Thus, this paper focused on exploring and testing various multi-material hinges designs with bidirectional folding made of compatible and low-compatible thermoplastic materials. Design thinking methods such as axiomatic design and mind map were used to find new hinge solutions and macroscopic interlocking geometries between the flexure hinge and mating bodies to compensate for the material compatibility issue. The identified designs are profiles based on regular hinges and shape morphing structures, which can change their 2D shape into a 3D shape when bent. The resulting morphing designs are based on corrugated and auxetic structures with multiple solutions. Each solution was designed based on two variables, hinge thickness and length, with respect to design for manufacturing guidelines. For the experimental part, only the morphing structures were considered. All designed solutions were printed as samples made of acrylonitrile butadiene styrene (ABS) and polylactic acid (PLA) with thermoplastic co-polyesters (TPC) for the hinge. Firstly, the samples were tested using a universal tensile machine to evaluate hinge design performance when stretched. The results show that besides the design, the printing conditions influence hinges tensile strength. Secondly, they were evaluated through bending tests. The results show that both corrugated and auxetic structures can be used as a design solution for flexure hinges.

Keywords: flexure hinge, fused filament fabrication, morphing structure, multi-material hinge, two-way folding
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FROM CONVENTIONAL TO BIONIC LIMB PROSTHESES - AN OVERVIEW

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Abstract:

Replacing a missing part of the body is an issue that has been studied extensively since ancient times. Such a medical procedure, to make up for the missing limb, allows the amputee to regain his mobility, to reintegrate into society and to carry out the activities of daily living, without the help of a companion. Given the growing interest in prosthetic research, prostheses have evolved rapidly. They have evolved from classic medical devices, often made of materials such as wood, metal, and leather, to intelligent, bionic, microprocessor-controlled prosthetic medical devices. Today we are talking about sophisticated technical components, biocompatible materials and hybrid elements that facilitate the connection of a mechanical device with the human biological system, and of course, with the nervous system of the amputated patient. In the study presented in this paper, we analyzed the main technical generations of upper and lower limb prostheses developed over time, in order to gain an overview of the current state of the art in the field of limb prosthetics. For the analysis of the specialized literature, a logical method of classification is proposed, that of the diagram of ideas. By using this method, we obtained a graphical, branched representation, that contains the broad categories of prostheses developed over time and applicable to different levels of amputation. These categories of prostheses are classified according to the technology they are based on, in order to fulfill at least the locomotor function of the patient, to support his weight, but also aesthetic function. The diagram also shows the areas of activity in which these devices are used, depending on the technical configurations they adopt. The results obtained allow the organized highlighting of the state of the art in the field of prostheses of the upper and lower limbs, which comes to the aid of young researchers interested in developing a topic specific to limb prostheses. At the same time, the proposed method indicated the intensively studied research areas and the categories that still need a pragmatic approach in the development of the new prostheses ideas necessary to regain the lost functions.

Keywords: amputation, bionic, bioengineering, medical devices, prostheses

CIRCULAR ECONOMY. BUSINESS MODELS AND GOOD PRACTICE MODELS. WASTE USES OF WINE PRODUCTION

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Abstract:

Seen as part of the solution to the crisis of natural and ecological resources, the Circular Economy has become a development priority both in the European Union economy and in the world. It is an integral part of the European Community's industrial strategy. Particular attention at international level is given to sustainable development based on the transition from a linear to a circular economy. We can talk about business models in the circular economy and examples of good practices in this field. Both the socio-economic evolution and the decrease of natural resources and the appearance and aggravation of ecological problems have contributed to the development of the modern economy through the circular economy. In a circular economy natural raw materials are used to their full potential and waste is reintroduced into the circuit for sustainable reuse and thus it becomes a solution and an opportunity to transform the current economy into a sustainable one. There is a growing international focus on sustainable development, based on the transition from a linear to a circular economy, and efforts are being made to achieve this. The rational consumption of resources, the reintroduction into the economic circuit and the maximum capitalization of what we consider to be waste are concrete possibilities to contribute to the restoration of the environment but also to be more competitive. Like any other industry and the wine industry is a producer of waste but some of them can become by reuse raw materials needed and used in other industries (pharmaceutical, cosmetics, chemical) and producers can reintroduce them into the economic circuit thus helping to maintain a ecological environment. Any wine producer can become part of the circular economy, thus increasing their income and reducing pollution or consumption of natural resources.In some European countries, massive investment has been made in recycling and reducing waste from wine production and an increasing number of organic wine producers have emerged.

Keywords: circular economy, producers, resources, sustainable economy, transformation, waste

THE INFLUENCE OF THE RAW MATERIALS ON KNITTED FABRICS BEHAVIOUR IN DYNAMIC TESTING CONDITIONS

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Abstract:

Working in a vibrating environment can cause conditions ranging from mild discomfort such as kinetosis to serious illness such as gangrene on the fingers of the worker operating the vibrating instrument. Under these conditions, the use of protective equipment is mandatory. It must fulfill the function of both protection and comfort. Since the commonly used materials such as rubber or polyurethane foam provide low comfort, a number of experiments have been carried out in recent years in which the damping layer of personal protective equipment was made of knitted structures. In this context, the present study complements the existing research with results and conclusions regarding the potential of knitted materials for use as a protective layer in a vibration environment. Thus, a complex study of natural frequencies was carried out for three groups of knitted structures manufactured with different technologies and from different raw materials. The performance of the textile structures was evaluated by studying the dynamic behavior of a metallic mass directly attached to the surface of the knitted fabric, which in turn is fixed to a heavy plate to avoid relative movements between the knitted fabric and the surface. In this context, an attempt was made to establish a correlation between the raw materials used, the test direction or machine depth and the response of the knitted fabric to the vibrations. By analyzing the obtained data, some important conclusions could be drawn. It was confirmed that the type of raw material used is a characteristic that has a strong influence on the behavior of the knitted structure in a vibrating environment. Since we know that the raw material has a great influence on the comfort, it is necessary to study the nature and characteristics of the raw material in more detail. The direction of vibration application is also crucial, since the highest values of natural frequencies are registered in the perpendicular direction. The stitch depth affects the tightness of the fabric. It was found that the higher the stitch depth, the lower the natural frequencies of the fabric.

Keywords: comfort, dynamic performance, knitted structures, protection to vibration, raw material

METHODS FOR INVESTIGATING THE ADHESION TO THE SUBSTRATE OF THE COATINGS OBTAINED BY THERMAL SPRAYING

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Abstract:

One of the most important characteristics to be considered for the correct use of thermal spray coatings is its adhesion to the substrate. Studies are available in the literature that apply various methods for evaluating this characteristic, both standardized (ISO 14916 – „Thermal spraying - Determination of tensile adhesive strength", ASTM C633-13(2021) – „Standard Test Method for Adhesion or Cohesion Strength of Thermal Spray Coatings", EN 15340:2007 – „Thermal spraying - Determination of shear load resistance of thermally sprayed coatings", , ASTM D 6677:2018 – „Standard Test Method for Evaluating Adhesion by Knife", etc.) and non-standardized (indentation, scratch, shot-peening etc). Due to the specificity of the coatings deposited by thermal spraying (lamellar structure, variable porosity, adhesion to the majority substrate based on a mechanical mechanism) a complete and correct evaluation of this characteristic is very difficult to achieve. In this paper, a review was made of the methods used for various studies available in the literature, both standardized and those used in particular, in cases that exceed the limits of applicable standards. Thus, it could be concluded that a large part of the methods is not efficient in terms of time, costs involved and equipment required, not being feasible for industrial use. However, a direction of customized approach to coatings is outlined based on the simulation of the operating conditions in operation.

Keywords: lamellar structure, substrate adhesion evaluation, thermal coating

ANALYSIS OF THE PLASTIC MATERIAL HARDNESS IN THE CASE OF A PART MANUFACTURED BY 3D PRINTING

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Abstract:

Using 3D printing allows obtaining parts of various complexities and functionalities. Multiple types of research on the 3D printing process make it possible to use this manufacturing technology in wider fields and with important benefits. In order to be able to apply this manufacturing process to a particular part, it is necessary to assess the extent to which the part in question can meet the requirements for use so that it does not present any operational risk. In general, certain tests to verify their properties are required to validate the material of the part. One such property is hardness. Knowing the hardness parameters of the part material is important and can highlight, for example, the possibility of using 3D printed plastics instead of metal materials, when it is necessary to ensure a minimum hardness of the investigated part material. In the paper, the research objectives are specified, following not only the hardness of the plastic material of the part manufactured by 3D printing but also the degree of homogeneity of the material, which would mean a variation between the specified hardness limits for the entire printed part. The premise is that, during 3D printing, anisotropic behavior of the material may occur due to the values of the selected process input factors, as well as the processes that develop when the material cools and solidifies after printing. Different hardnesses could appear in distinct areas of the obtained part. Highlighting such a result through measurements could allow for further optimization of the 3D printing process, better control of the 3D printing process, and for optimizing the behavior of the part in the operation. At the same time, such measurements are relevant to the idea that by performing a large number of measurements, the experimental results can then be mathematically processed and statistical analysis of the hardness distribution for the obtained part can be performed. In the paper, the author's observations are presented by considering the performance of hardness tests as a possibility to obtain additional information on the physical and mechanical characteristics of plastics used for the manufacture of parts by 3D printing.

Keywords: 3D printing, hardness, measurements, parameters, plastic material

SELECTION AND EVALUATION OF TECHNOLOGIES IN MACHINE BUILDING

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Abstract:

The paper refers to the study of the issue of selection and evaluation of technologies for their transfer to the machine building industry. For low-income countries such as the Republic of Moldova, where the potential for technology generation is low, it is very important to create policies for selecting and evaluating technologies that would facilitate the transfer of technologies that can be assimilated in that country, taking into account human resources and existing technological and financial potential. The proposed purpose is to research the existing methods of selection and evaluation of technologies, the experience of other states in this field, the state of affairs in the Republic of Moldova. So far, the methods used for the selection and evaluation of technologies have been highlighted, the practices of other countries and the potential of the Republic of Moldova in the field of machine construction have been studied. The decision was made to study in-depth product technologies and product development technologies. Process technologies in Moldova are mainly obsolete, however it is planned to elaborate the list of existing technologies for the presentation of the image as a whole in the field of machine building. The description of the proposed methodology for selection and evaluation of transfer technologies in machine construction was made. As the various methodologies analyzed place greater emphasis on the protection of Intellectual Property Law and Foreign Direct Investment, less emphasis has been placed on interventionist approaches to International Technology Transfer, such as: licensing and technology transfer requirements, local content and technology requirements. Performance, facilitation of technology-focused investments, promotion and stimulation, technology absorption policies. In conclusion, the proposed methodology is to cover topics that have not been identified in other methodologies, to propose new techniques and criteria for evaluating technologies in the field of machine building. The methodology can be used by machine builders, policy makers and investors when planning technology transfer within the organization or industry.

Keywords: evaluation and selection, innovation, machine building, methodology, technology transfer

INJECTION HIGH-PRESSURE PUMPS EVOLUTION AND WEAR ANALYSIS METHODS

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Abstract:

The wear analysis is a basic step for assessment of the functioning of mechanical systems and helps to the products improvement. The service life of the assemblies is approximate depending on the level of wear of their components. Starting from the product prototype phase, all components are tested and very carrefully analysed. This is very important in order to establish a correlation between product operating mode and components wear. The automotive injection high-pressure pump represents a complex mechanism where can be encountered many wear types. Regardless of the high-pressure pumps evolution, the wear occurrence is inevitable and will continue to be a interest factor in automotive area. The cost control influences the production process in all area and important resources are allocated in this direction. For instance, many manufactures give up at threaded assemblies in order to introduce welded assemblies. The production cost is reduced, but the product cannot be analysed without destroying it so that the tear down precision is absolutely necessary. The most relevant results are obtained form the material analysis. This kind of analysis depends on the fault type and also the analysis devices are chosen in view of this. The Scanning Electron Microscope is one of the most used equipments which provides images with very good resolution at nanometers sizes. The classic microscopes are very often used for surface analysis or measurements. Durimeters and addeshion measurements devices help to evaluate the material hardness and coatings addesion. The improvement of the wear analysis methods is necessary due to continuing evolution of the materials and production processes. This paper presents the most common wear types from the injection high-pressure pumps and their analysis methods. Adhesion, corrosion, abrasion and fatigue are the wear types which can lead to total high-pressure pump malfunction. Therefore, they are the main reasons for continuous developement and future research on this area.

Keywords: devices, high pressure-pump, injection, material analysis, wear

STUDY ON THE CONCEPTS OF BEAUTY AND GREEN AESTHETICS IN CLOTHING

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Abstract:

Green aesthetics in clothing is an ambiguous concept and needs clarifications. The COVID-19 pandemic has severely destabilized our lifes: consumers ceased to need fashionable clothing, retailers rushed to cancel and return orders, designers could no longer cover basic expenses. Suddenly, an industry that was already on the verge of collapse completely froze, and was forced to reset and reconsider any decision. It is becoming increasingly clear that the fashion industry needs a massive systemic transformation. At the same time, a change is very likely to happen in our perception of aesthetics in clothing design.

The aim of the research is to define the dimensions of aesthetic perception with emphasis on green aesthetics in clothing. It is very important to build solid knowledge about green aesthetics in product design. We are all aware of the importance of the aesthetic criteria when choosing a clothing item, and, moreover, when we decide to purchase it. The study presents a literature review which brings to discussion the aesthetic dimensions and perception in the clothing context, and the integration of the concept of green aesthetic during the fashion design process. It points out what types of researches and analysis systems, critiques and open discussions should be used and the opinions of the specialists about the fact that this discussion needs to be extended from the art and abstract world to the one of everyday products. The reference element is represented by Kirsi Niinimäki's paper "Green aesthetics in clothing: Normative beauty in commodities", (2014), where she pointed out that little was known about the aesthetic dimensions in clothing. The bibliographic research carried out led to a series of conclusions: Aesthetics has not been carefully studied in the clothing context and therefore its definition is not fully outlined. The same situation is found with regard to the concept of green aesthetics in clothing.

Keywords: aesthetics, beauty, clothing, consumer behaviour, green, visual perception

DESIGN SOLUTIONS FOR RELIABLE AND SAFE LARGE SIZE BALL VALVES

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Abstract:

Development of sustainable cities requires safe and efficient pipeline networks for the transportation of fluids. Ball valves are usually used to start/stop the flow of liquids and gases in pipelines, because they generate low hydraulic losses when the valve is in fully open position and no leakage in fully closed position. They are highly recommended in pipe sections, when quick operation is needed, in the event of emergency. European Union (EU) has implemented stringent laws to regulate the standards of small and medium size pipeline components. Design parameters may require large size valves that are not in the focus of the present standards and in this case, individual solutions are needed. In this work, a method de design a Trunnion ball valve with a 900 mm bore diameter is presented. The standard SR EN 1983 recommends design methods for valves with face-to-face flanges, for diameters up to DN800, therefore the proposed solution is original. The proposed valve is a ground type, with flange according to SR EN 1092-1 compound from three body, with removable construction. To obtain high reliability for sealing the ball and the seats, the proposed ball valve uses the Primary Metal and secondary Soft Sealing (PMSS) with tungsten carbide technology. The sizing method is based on procedures to calculate the thickness of the body wall, the diameter of the acting stem and the identification of the adequate coupling method. This work argues that resistance calculations must also have in view the screws of the upper components (the connecting piece and the actuator flange), which are holding the acting stem of the valve, because the entire pressure is spread on every component. The results indicate a construction solution with blow out proof stem and bolts on the main body, which are bigger than the screws that are holding the acting stem. An explanation is the increase of pressure on the components comparing to classical ball valves, due to optimization procedure targeting the minimum value for the diameter of the bore. Concluding, solutions adequate to design highly reliable large size valves that require low maintenance costs and provide safe operating conditions are presented and substantiated in the present paper.

Keywords: ball valve, Primary Metal and secondary Soft Sealing (PMSS), safety, sealing

DESIGN AND EXECUTION OF DEMOLITION WORKS BY BLASTING OF INDUSTRIAL CONSTRUCTIONS - TECHNICAL AND SAFETY ASPECTS

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Abstract:

The buildings demolition process using blasting works have a challenging application from the technical point of view. The choice of a demolishing method by blasting variants is conditioned by the physical state of the construction, by the existence of objectives in the vicinity of the demolition construction, by the possible effects of the demolition on these objectives. The basic idea when performing a building demolition is that the destructive effect on the neighbouring objectives to be protected has to be negligible, the number of elements destroying by blast has to be as small as possible, as well as like the explosive quantities that are blast at once. Each construction creates a special case, the calculation of the blasting parameters is adapted according to each specific situation. The most commonly used method of demolition is the collapse of the construction itself or it overturning in a given direction. For this purpose, most of time numerous works of structural preparation, removal or reduction of the section of constructive elements are made beforehand.
The paper describes how to choose the technical solutions and plan safety measures for a successful overturn of a construction in the intended direction, in very sensitive location conditions regarding the buildings and installations in its immediate neighbouring. In order to verify the design and demolition parameters, a computerized simulation was performed on the behavior of the structure during the demolition process.
In order to establish the possible secondary effects generated by the blasting works, a risk assessment was made with reference to seismic wave, air shock wave, noise, dust and the level of shock generated by the impact of construction with the soil. A significant number of demolitions works performed by using explosives and characterized by a high degree of difficulty, have shown that the use of the blasting technique and the described approach in this paper from technical and safety point of view, is a proper alternative for demolition from the point of view of efficiency, quality and security.

Keywords: blasting parameters, demolition, explosives, , risk evaluation, safety

MORPHOLOGICAL CHARACTERISTICS OF DIFFERENT PHOSPHATE LAYERS DEPOSITED ON THE SURFACE OF CONCRETE REINFORCEMENT STEEL

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Abstract:

The importance of phosphate deposition on metallic aloys (steel, iron cast, magnesium alloy, aluminium) is well known. It is used in many fields (deformation process, automotive industry etc.) due to its improved adhesion and corrosion resistance properties. In the field of civil engineering, a major problem facing builders is the corrosion of steel bars used to reinforce concrete. This problem occurs more frequently in constructions in areas with a Mediterranean climate or in those made near beaches. Usually, the concrete protects the steel used as reinforcement, but there are specific situations in which its protective and anti-corrosive properties are very limited. Thus, the properties of reinforced concrete decrease, endangering the structure of the concrete buildings. Over time, attempts have been made to improve the corrosion resistance properties by galvanizing concrete steel, but this is not a very long-term solution. Therefore, in order to improve the corrosion resistance and adhesion properties of concrete steel, an attempt was made to find another variant, namely phosphating. Phosphating shows the process of depositing, by conversion, a layer of phosphate, different in terms of chemical composition and properties, depending on the type of metal used (zinc, magnesium, manganese, iron). The phosphating process is divided into three stages: degreasing (removal of fats), pickling (removal of oxides and activation of the surface) and phosphating (formation of the phosphate layer). This paper aims to study the possibility of improving corrosion resistance by depositing phosphate layers on the surface of steel used to reinforce the concrete, using three different phosphating solutions from the point of view of chemical composition. At the same time, the paper aims to analyze the morphology of phosphate layers obtained using the scanning electron microscope (SEM), noting that it differs depending on the type and amount of metal ions dissolved in nitric acid and orthophosphoric acid.

Keywords: corrosion resistance, morphologic characterization, phosphating process, reinforced concrete, steel

A REVIEW ON TREATING TRIBOLOGICAL PROBLEMS WITH FRACTALS

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Abstract:

As design science enters the 21st century, a clear understanding of friction has emerged and it is expected that friction is considered when improving and designing various machine units. Fractals are prevalent in a variety of materials, including crystal growth, fracture theory, thin coatings, and porous materials. Fractals and chaos theory provides a means of modeling dynamic changes in micro and nano topography on friction surfaces caused by various tribological mechanisms and processes. Friction and wear phenomena in tribological systems can be interpreted on a macroscopic scale. With the development of miniaturized scale and nanoscale systems, it has been launched the hypothesis that macro-level systems cannot reflect the microscale and nanoscale phenomena. A conclusive case is given by the calculation of frictional torque in microscale orientation, in which case it has been found that models created by bearing producers cannot validate experimental results. To address the tribological phenomena of micro-and nano-sized systems, fractal concepts are needed. Therefore, tribological phenomena occurring in a macrosystem are better seen if viewed at the micro and nanoscale. This can be achieved by examining hardness or atomic composition. This article reviews the most current ideas on treating tribological problems with fractals. Fractals are formed by partitioning geometric shapes into smaller pieces that are smaller copies of the whole or rough surfaces. As compared to standard geometry (lines, squares, circles, etc.), fractal geometry analyses geometric shapes that are chaotic or scattered. For this theory to work, it is necessary to study this process using the "box-counting method of fractal dimension estimation". By applying the "box-counting" method, it is possible to estimate the fractal dimension both directly and indirectly by comparing the area-perimeter-scale relations. Based on scaling equations, a system was created for this operation. For analyzing the complex patterns that allow us to derive our understanding of the fractal parameters, we have to collect data for solving the equations set. The conclusion is that all existing theories in tribology should be adapted to take into account fractal size and fractal roughness.

Keywords: chaos, fractal dimension, fractal roughness, microscale, nanoscale, tribology

EXPERIMENTAL RESULTS FROM THE OBTAINING OF CERAMIC LAYERS BY APS AND THEIR POST-DEPOSITION PROCESSING

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Abstract:

Ceramics materials, in recent times, are used in industry, namely, aerospace, construction, electronics and medical applications because they excellent properties of high temperature resistance, wear, corrosion resistance and high mechanical strength. Since it has a higher coverage area and a lower production costs, one method of deposition on metal substrate can be atmospheric plasma spraying (APS). In this case APS was used with a robotic arm able to cover big areas in a short time. Analysing a deposited ceramic layer (a mixture of ZrO2 and Al2O3 powders in 25/75, 50/50 and 75/25 reports) obtained after five passes through atmospheric plasma spraying (APS), after the substrate (low carbon steel) has been subjected to a blasting process, we observe that it becomes chemically homogeneous, without cracks, pores or fissures of the layers on the surface. The thin layer (30 µm) shows discontinuities with uncoated surfaces, as the substrate is almost in contact with the environment. The metalo-ceramic system was mechanically processed by laser cutting. The cutting process was carried out on a marking fiber laser equipment (Boron) with a maximum power of 30 watts and a wavelength of 1064 nm. Two different grooves were obtained on specimens with the following parameters: double laser pass at a speed of 500 mm/sec, pulsed laser with a frequency of 20KHz, and the beam power was set to 50% (about 15W) for the first groove) and 80% (about 24W for the second groove). As comparation water jet technique was used for cutting and the results were also analyzed. Structural, morphological and chemical evaluation of the cut was performed using optical microscopy (OM Zeiss + digital camera), scanning electron microscopy (SEM VegaTescan LMH II, SE detector) and energy dispersive spectroscopy (EDS Bruker X-flash). This analysis revealed the type of defects along the cut, i.e. and the behavior of the materials at the ceramic-metal interface.

Keywords: ceramic coating, EDS, laser cutting, plasma coating, SEM

SHORTEST PATH ROUTES FOR BATTERY ELECTRIC VEHICLE CHARGING IN LARGE CITIES AND THEIR METROPOLITAN AREA

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Abstract:

Despite the benefits accompanied by European regulations, the large-uptake of electric vehicles of any type is bottlenecked by several factors that range from the purchase price, availability accounting their readiness from manufactures production lines, not to mention the limited number of charging stations with small to large cities. In addition, an induced anxiety due to lower driving range of these vehicle type with respect of their counterparts, internal combustion engine-based vehicles, can be regarded as the main problem in their widespread. The herein contribution aims to present the results of simulations on the problem of minimizing the overall travel time for battery-powered electric vehicles in smart cities. The input data will be drawn from real situations, under different scenarios, applied to the Brasov city and its metropolitan area proven the limited capacity of plug-in electric vehicles that need to be charged. As already known, the charging process is time consuming, and depend on several factors including battery type, battery state of charge, battery capacity, temperature, etc. Thus, full charge or partial charged battery situations will be accounted in the simulation that will be implemented under the MATLAB R2021b using the inbuilt shortest path functions from Graph and Network Algorithms. The purpose of the study is to identify the shortest feasible solutions inside the city and around its surroundings as one decides to take the main routes, back and forth, as well as south to north and east to vest. The proposed solutions account for the locations of charging stations already available for recharging the plug-in electric vehicle batteries, the serving time and available charging stations. The contribution will be organized as following: a section will highlight and review the related research works, next will be developed the problem under different scenarios and results obtained after carrying the simulations will be analyzed to enable few insights followed by the section that summarized the contributed approach and prospects on further developments.

Keywords: battery electric, metropolitan area, vehicle charging

LIFE CYCLE ANALYSES FOR SOLAR THERMAL COLLECTORS

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Abstract:

The environmental impact of consumer products is the subject of long and intense debates for more than half a century, especially during the last two decades. This includes comparative analyses ranging from original sources, manufacturing steps, properties used and recycling options to end use or disposal. The current drive towards including renewable and sustainable energy sources into energy consumption mix implies thorough studies on savings in materials and energy, as well as waste management. Life cycle analyses are concerned with identification and quantification of each inputs and outputs of a product manufacturing process. Even if the results are not accurate and precise data, the analyses are suitable for estimating energy efficiency and environmental impact of a product or service. This may facilitate the managerial team with decision options to establish future strategies in developing new products or optimization of existing ones. This paper proposes complex life cycle analyses that include assessment on inventory, analyses of energy payback time, life cycle cost and end of life, applied to solar thermal collectors, as part of a solar conversion system. The life cycle stages are analysed in detail for all components, evaluating the environmental impact of each production stage, distribution, usage and recycle / disposal. Data available from literature or data banks were collected and analysed in the inventory and impact assessment steps. The Eco-Indicator 99 approach identified the harmful categories most environmentally damaging and results show that the categories with most impact, besides terrestrial toxicity, are human health, global warming and depletion of fossil fuels, that is, the main reasons to implement renewable energy sources. Terrestrial toxicity and human health exhibit values of at least one order of magnitude larger than the rest. The next group of impact categories consists of global warming, depletion of fossil fuels and depletion of mineral resources. These results are in very good agreement with data published in literature. The end of life assessment of recycled parts and recovered materials influenced the overall result for greenhouse effect, carcinogens, heavy metals and solid waste categories.

Keywords: energy payback time, environmental impact, life cycle analysis, thermal collectors

THEORETICAL MODEL FOR PHOTOVOLTAIC PANEL THERMAL ANALYSIS

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Abstract:

The global energy demand is continuously increasing, generating ever-growing levels of pollution and climate changes. In this context, political and economic decision factors adopted measures to reduce environmental impact of classic energy sources and increase the use of energy from renewable sources. Solar energy is the most abundant resource the mankind may use, even considering the disadvantages related to direct or indirect conversion in both electrical and thermal energy. The process of energy conversion of incidental solar radiation to useful electric energy in photovoltaic (PV) panels is affected by several external factors, of which panel operational temperature is of utmost importance. The present study attempts to clarify the theoretical components of thermal behaviour of PV panels, by taking into account the detailed structure of thermal resistances of panel layers. The theoretical model details all thermal resistances associated with each layer, as well as contact resistances between layers. Also, heat flux computation considers only the surface area covered by the PV cells and not the entire PV panel area. Heat losses towards the environment account for both convective and radiative effects. The numerical model, developed from the theoretical analysis and based on the single diode non-linear equivalent electrical circuit, delivers both I-V and P-V output characteristics, accounting for PV panel specifications (packing configuration, operational and maximum electrical values, temperature characteristics, module efficiency). Data shows that for each 20-degrees temperature increment there is a minute increase in current (about 1.3%), but the sharp decrease of 8% in voltage triggers a power decrease of roughly 7.6%. Numerical results obtained for wide ranges of input data for incidental solar radiation intensity and panel temperature, show a good agreement with experimental data provided by manufacturer for the photovoltaic panel Suntech STP280 - 24/Vd. Graphical representations of P-V electric characteristic offer visual estimate of total power output decrease with the increase in panel temperature.

Keywords: mathematic model, numeric analysis, photovoltaic

A REVIEW ON TRIBOLOGICAL BEHAVIOR OF MECHANICAL COMPONENTS OBTAINED BY ADDITIVE MANUFACTURING METHODS

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Abstract:

Technologies such additive manufacturing are slowly becoming more and more present on the market, covering different areas of the industry due to its great potential. Even so, there are still many aspects which are unexplored or which can be improved. One of them being the study of the tribological proprieties for all these parts which are produced hrough additive manufacturing methods, such as: powder bed fusion, binder jetting, direct energy deposition, fused filament fabrication, material jetting, vat photopolymerization, and sheet lamination. The scope of this paper is to bring together the tribological proprieties for the 3D printed parts, and to have a critical comparation between these proprieties, in order to easily decide which printing method is suitable, depending of the working conditions of the printed component. In addition, this paper will describe the working principle for each technology, and the type of materials which are commonly used in the printing process. Depending of the printing method, the tribological proprieties vary greatly. For example, for the parts which are manufactured through powder bed fusion, it was found that the wear resistance is higher, and with a lower friction coefficient than for a part manufactured through traditional methods. Also, for many printing method, the produced part require an additional step of treatment. Especially for binder jetting, on which infiltration and sintering are often used, because the 3D printed part is porous and weak. Some researchers found that the average friction coefficient measured for a steel based part, and treated with infiltration with bronze, is comparable with the friction coefficient measured on a part, from the same material, manufactured through the direct energy deposition method. Of course, due to the physical limitations of the 3D printing method, the system will allow only the usage of a specific type or class of materials. One of such method is fused filament fabrication, for which only thermoplastics are used. Along with vat photopolymerization and material jetting, these methods presents comparable tribological proprieties.

Keywords: 3D printing, additive manufacturing, machine parts, tribology

A MODIFIED WEIGH-IN-MOTION SENSOR FOR URBAN TRAFFIC MONITORING

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Abstract:

The weigh-in-motion (WIM) sensors are used for the dynamic determination of the weight distributed on the wheel, on the axle (with the help of which the total weight of the vehicle is then determined) as well as for the monitoring of the urban traffic. Existing WIM sensors are used for highway measurements and are buried to the level of the pavement. These sensors are expensive and for their installation you have to dig a ditch that crosses the road and this is a big disadvantage. These sensors are expensive and for their installation a ditch that crosses the road must be excavated and this is a big disadvantage. There are currently no commercial WIM sensors for monitoring urban traffic. Such an overground WIM sensor was proposed in the OSIM patent application A/00132/6.03.2020. This sensor has the shape and dimensions of road speed bumpers and is mounted just like them. The sensor has the disadvantage that the elastic element (which has the shape of a cylindrical shell) is welded at the ends, along its entire width, by two rigid caps. For this reason, the sensitivity of the sensor is reduced at its ends. When the wheel of a vehicle simultaneously steps on two adjacent sensors, the output signal will be smaller due to stiffening in the area of the covers and thus measurement errors occur. This paper presents a similar sensor, but with covers chamfered at the top. In the chamfered area the caps are not welded by the elastic element and thus it also deforms in the end areas. The free space between the elastic element and the caps is covered with a rubber gasket, which ensures the sealing of the sensor. Due to this change the sensor becomes more sensitive in the end regions and the measurement errors decrease. The sensor was tested both in the laboratory and in the field, with good results. The usefulness of the sensor modification, described in this paper, has thus been proven. The sensor has the following advantages: low price; quick assembly and disassembly on the road, with a minimum of traffic disruption; high sensitivity.

Keywords: increased sensitivity, speed bump, urban traffic monitoring, weigh-in-motion sensor

INVESTIGATION OF STAINLESS STEEL SURFACE MODIFICATIONS

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Abstract:

A comprehensive review of stainless steels surface hardening methods was made from technical literature (main source ScienceDirect). The results obtained for ambient dry sliding friction and wear behaviour of laser surface, friction surfacing of precipitation hardening stainless steel coatings for cavitation erosion resistance; hardness, microstructure and texture of friction surfaced 17-4PH precipitation hardening stainless steel coatings with and without subsequent aging; rapid surface hardening and enhanced tribological performance of 4140 steel by friction stir processing, microstructural changes caused by friction loading in high manganese TWIP steel and shotblasting process for surface hardening were analyzed. Mechanical and metallurgical investigation of Laser surface hardening of stainless steel (SS) were analyzed with accent on the effect of process parameters influence on the geometrical dimensions of the hardened zone, micro hardness distribution, and microstructure of AISI 431 stainless steel. The results reveal that increasing the laser frequency and the pulse width causes more heat input (geometrical dimensions of the hardened zone rise). On the other hand, more heat input causes to increase the prior austenite grain size which contains the martensitic phase. So, the hardness value of laser treated region decreases. When the scanning speed and the focal plane position increase, the heat input decreases. Hence, the geometrical dimensions of the hardened zone reduce. The average hardness value increases by reducing the scanning speed due to the increase of the martensitic phase and the decrease of retained austenitic phase in the microstructure. Also, decreasing the heat input induced by increasing the focal plane position causes the grain size reduces and the hardness value increases. The structure consists of three regions (hardened zone, heat affected zone, and base metal). The microstructure of the hardened region consists of delta ferritic phase, martensitic phase and a small amount of retained austenitic phase). Experimental study on cyclic hardening characteristics of structural stainless steels was analyzed (the test results indicate that the cyclic hardening/softening behavior of the three grades of structural stainless steel generally shows obvious strain amplitude dependence and unsaturation before fracture under large strain amplitudes, which are significantly different from carbon steel. Meanwhile, there is a huge difference between the cyclic skeleton curves and the monotonic constitutive curves for different stainless steel grades. The effects of strain amplitude, stainless steel grade and loading history on the cyclic hardening/softening characteristics have been presented. Notable is the fact that the seismic performance of stainless steel structures is greatly affected by the loading history).

Keywords: friction hardening, laser hardening, surface modification

TOWARDS RIVER LONGITUDINAL CONNECTIVITY PRACTICES WITHIN THE SMALL HYDROPOWER PLANTS SECTOR IN EUROPE

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Abstract:

Water Framework Directive defines the river longitudinal continuity as “undisturbed migration of aquatic organisms and sediment transport”. Electrical energy production from hydro sources is the main activity generating hydromorphological alteration of surface waters by disconnecting the rivers. The flow reduction on the river sector from the water intake to the restitution point of the small hidropower plant is also considered as a hydromorphological alteration by modifing the natural hydrological regime. Last years, environmental policies restricted the construction of new Small Hydropower Plants by new regulations, because hydro-technical works are seen as physical barriers that can lead to river habitat fragmentation and to fish population isolation. This paper presents good practices for ensuring the river longitudinal connectivity while Small Hydropower Plants are implemented. In order to restore the river longitudinal connectivity for fish migration, some types of fish passages used within the hydropower facilities from Europe are discussed. From the hydromorphological point of view this aproach can be considered a win -win procedure beacause taking measures to ensuring the river longitudinal connectivity, also involve measures maintain an ecological flow on the river sector from the water intake to the restitution point of the small hidropower plant. The measures taken to mitigate the small hydropower plants’ negative effects on river ecosystems are in line with the environmental objectives of the Water Framework Directive. They also represent good practice to be followed to classify a Small Hydropower Plant as a renewable energy sources (RES) power unit, which is beneficiary of financial support programmes by green certificates (GC) issued for the energy generated.

Keywords: ecological flow, fish passages, green certificates, renewable energy sources, river longitudinal continuity, small hydropower plants

MULTI-DISCIPLINARY OPTIMIZATION OF A SPACECRAFT FOR A RE-ENTRY DESCENT FROM LEO ORBIT AT COSTANT HEAT FLUX DENSITY

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Abstract:

This paper deals with a pre-feasibility analysis of a new re-entry approach for manned missions based on a longer and a more gradual conversion of the internal energy (kinetic and potential) of the vehicle into thermal energy. This approach has been developed for a highly innovative re-usable wing-body concept with high surface-to-mass ratio. Having a longer and a more gradual conversion of the internal energy into thermal energy, i.e., the heat flux is kept constant at a predicted value, is equivalent to having lower thermal peaks. This implies the possibility of using less performing, and therefore less expensive, materials. One of the main reasons why the Space Shuttle has been retired is the high cost of the windside TPS (Thermal Protection System) replacement after each re-entry. Conversely, a reusable re-entry vehicle is currently required for the increasing demand of space tourism and to provide the International Space Station crew with a safe and fast way to return to Earth in case of emergency. For this purpose, a flight path angle lower than typical Shuttle-like values, namely -0.1 deg, is used to carry out the gradual dissipation of vehicle's total energy. To assure the desired convective heat flux level for a certain time, the selected flight approach uses a prescribed guidance law which modulates the glider angle of attack as a function of Mach number. Analytical considerations based on a low-flight path assumption are derived to identifies the values of the surface-to-mass ratio, the aerodynamic efficiency, the entry angle, and spacecraft guidance capabilities required to achieve more performing re-entry trajectories for a crew return vehicle from the near-Earth space. Consequently, an optimization procedure developed to keep a costant heat flux with a parametric guidance law is performed. In particular, the SUMT (Sequential Unconstrained Minimization Technique) method and a Genetic Algorithm (GA) implemented for single-objective problems are used for the optimization procedure. The suggested approach is suitable to explore less demanding aerothermal environments to improve reliability and affordability of near-Earth space operations.

Keywords: guidance law, heat flux control, LEO re-entry, multi-disciplinary optimization, spacecraft

MODERN USE OF TEXTILE WASTE AS BUILDING INSULATION

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Abstract:

Concern in the recent decades towards environmental degradation have exponentially grown, fulminating since specific strategies for overcoming climate change have emerged such as the European Green Deal (2019-2020). Textile industry is one of the most important sectors of the global economy, reaching a fiber production of 53 milion tons worldwide that has growth and production rates linked to generating millions of tons of textile waste worldwide, adding negative impact on the environment, including Greenhouse Gases (GHG) emissions with a 17-tonne carbon dioxide generation per 1 tonne of textile production and a general 12% recycling rate. Textile waste (TW) can be generated during the manufacturing process as unused fabrics (postindustrial TW) or by clothing discarded after use (postconsumer TW), adding up to 6% of total municipal solid waste and more than 3% of GHC emissions. Disposal of waste materials directives and regulations have been already set in the EU, regarding landfill disposal, waste incineration and developing more sustainable waste management systems focusing on both environment protection and reuse of TW (The Waste Framework Directive, 2008).
With increasing environmental concerns regarding TW adoption of more sustainable behaviors and the reduction of GHG emissions as a priority, the possibility of reusing TW in the construction sector with different areas of application has been of great interest. Recent studies have developed building constructions improvement possibilities with use of raw TW material, from production of lightweight materials and bricks, to cement reinforcement, to one of the proximal worldwide applicability of TW by reinterpreting the primary function of clothing - to keep comfortable thermal conditions for the human body. The current survey of recent studies depicting improved thermal isulation proprieties in construction by using woven fabric waste (WFW), a waste of this residue - woven fabric sub-waste (WFS), cotton, viscose and elastane, outlines TW by-products as alternative solutions to commercial insulation materials, such as extruded polystyrene (XPS) or expanded polystyrene (EPS). Mapping the potential modern use of textile waste as building insulation, this article assesses the topical research and current development stage with perspectives on decreasing TW environmental impact, folowing sustainability trends and circular economy strategies.

Keywords: building insulation, recycled insulation materials, textile reuse, textile waste, woven fabric waste

CONSIDERATIONS ON CLASSIFICATION OF THE MAIN COMPONENTS OF THE VEHICLES BY THEIR VIBROACOUSTIC FINGERPRINT

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Abstract:

The modern car industry is evolving under a lot of new premises, such as new propulsion technology (hybrid, electric vehicle with battery or fuel cells) and therefore requires a new way of thinking. This involves offering the customer the complete package of solutions (such as charging station, service contract and remote diagnosis). Service of remote diagnosis is based mainly on two major points: avoiding of the vehicle breakdown and efficient management of repair and maintenance work. Remote diagnosis is based on a mobile device application that allows the owner or the responsible person (in case of commercial vehicles) to access the important parameters for monitoring the condition of the vehicle. This action is intended to avoid of the unnecessary downtime for repairs, which could result in additional costs for commercial vehicles in the case of unworked periods. This diagnostic technology is reaching its limits because it is generally based on detecting the electrical faults and these are only a quarter of the pool of possible vehicle failures. As a feature, they have a sudden appearance, which is quite challenging in terms of prediction. On the other side, mechanical, hydraulic and pneumatic failures have a slight degree of prediction based on preliminary signs of wear or fatigue. In view of the above observations, an improved method of diagnosis could be the study of the noise and vibration parameters of the main components of the vehicle subject to major faults. The paper deals with the classification of the main components of the vehicles by their vibroacoustic fingerprint. The main components of the vehicle are grouped by vehicle category (e.g. small car or truck) and their common patterns of vibroacoustic fingerprints must be permanently overseen and compared with those assigned to the status of good health. Abnormal vibroacoustic behavior should be observed by frequency analysis as a preliminary sign of failure and the specific trigger should immediately inform the person responsible for remote diagnosis to take appropriate action. These components have a common general characteristic including vibroacoustic fingerprint and could be part of the specific classification for ease of vibroacoustic diagnosis.

Keywords: automotive, classification, noise, vibration, vibroacoustic diagnosis

STATIC AND DYNAMIC FRICTION COEFFICIENT IN LOW LOADS AND SLIDING SPEED CONDITIONS

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Abstract:

In dry sliding process two friction coefficients can be evidences: static and dynamic friction coefficients. Usually the static friction coefficient has high value than dynamic friction coefficient. For many industrial applications literature indicates the approximate values both for static and dynamic friction coefficients. If the sliding speed has low values and the tribological system is sustained by an elastic support, the sliding speed is characterised by a fluctuation between stick and slip at the surfaces contact. As a consequence, an unstable sliding process named "stick-slip" is developed. A lot of parameters as nature of contact materials, roughness, real contact pressure, adherence time of the surfaces influence the static friction coefficient [1]. Dynamic friction coefficient is not a constant for various sliding speed. So at very low speed the dynamic friction coefficient is characterised by a Stribeck curve [3] with an initial decreases until a minimum limit followed by an increases over this limit. Using an unidirectional oscillator including a mass-spring system, the authors evidenced the important variations of the static friction coefficient both for very low contact pressure (0.004 MPa) and for high contact pressure (386 MPa).The experiments were realised by the CETR UMT-2 Tribometer with a variation of the sliding speed between 0.02 mm/s to 8 mm/s. The oscillator mass have 0.242 grams and the stiffness of the elastic spring had 77 N/m. The contact surface of the oscillator mass have a roughness Ra=0.1µm and the opposite plane surfaces have various roughness between Ra = 0.1 µm to Ra =3.4 µm. Two types of experiments were realized: the sliding between two plane surfaces with 0.004 MPa and the sliding between a plane surface and three steel balls of 6 mm with a maximum contact pressure of 386 MPa. To simulate the sliding speed the model of Zuleek [3] has been adapted to the experimental parameters and numerical integrated. For very low pressure the obtained static friction coefficient varied between 0.08 to 0.3 and the dynamic friction coefficient varied between 0.08 to 0.12. For high pressure the obtained friction coefficient varied between 0.2 to 0.4 and the dynamic friction coefficient varied between 0.15 to 0.2.

Keywords: dry sliding speed, dynamic friction coefficient, low speed, low loads, static friction coefficient

INVESTIGATION ON BRAKE PAD EMISSIONS ON THE ENVIRONMENT

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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 thesis will be to assess and at the end to develop a material that will reduce the emissions from the brake pads, with a low wear coefficient, without impacting the overall performance of the friction braking. There are four main types of brake pads that are used on vehicles: semi-metallic, non-asbestos organic (NAO), low-metallic NAO, and ceramic. The analysis of wear and emissions resulting from the brake pads can be performed in an airtight chamber, equipped with an exhaust and filtration system. The material deposited on the filters, as well as on the walls of the chamber, 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. Carbon was also present at significantly higher concentrations. However, there is very limited information on the specific organic constituents of PM10 brake wear, due to the limiting testing capacity of actual driving conditions. 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, health, NAO, pollution

IN VITRO CORROSION BEHAVIOR AND MECHANICAL PROPERTIES OF ZN3MGXY ALLOY IN SIMULATED BODY FLUID

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Abstract:

Recently, zinc (Zn) and its alloys have attracted considerable attention and are considered promising candidates for various medical applications, due to the much more suitable degradation rate compared to magnesium (Mg) and iron (Fe) alloys. However, it is important to note that its mechanical properties need to be improved to meet the standards for medical applications. The yield strength (MPa) of Zn-based alloys presents many variations based on their added elements and states (cast, heat treated, laminated, severe plastic deformation or powder metallurgy and additive manufacturing). Vickers hardness (HV) was also reported with different values from 30 to 150 HV. Biodegradable metallic materials represent a new class of biocompatible materials for medical applications based on numerous advantages. Among them, those based on zinc have a rate of degradation close to the healing period required by many clinical problems, which makes them more suitable than those based on magnesium or iron. Zinc and zinc-based alloys are very active metals in ionic media, especially in the presence of chlorine ions. In the last decade, in the field of biodegradable metals used to make implants that after a certain time must be removed from the body, more and more attention has been paid to zinc and zinc-based alloys The poor mechanical properties of Zn could be significantly improved by the addition of Mg and Y. In this research, we analyze the electro-chemical and mechanical behavior of a new alloy based on Zn3MgxY compared with pure Zn and Zn3Mg materials. Microstructure and chemical composition were investigated by electron microscopy and energy dispersive spectroscopy. The electrochemical corrosion was analyzed by linear polarization (LP), cyclic polarization (CP) and electrochemical impedance spectroscopy (EIS). For hardness and scratch resistance, a microhardness tester and a scratch module were used. Findings revealed that the mechanical properties of Zn improved through the addition of Mg and Y. Zn, Zn-Mg and Zn-Mg-Y alloys in this study showed highly active behavior in SBF with uniform corrosion. Zinc metals and their alloys with magnesium and yttrium showed a moderate degradation rate and can be considered as promising biodegradable materials for orthopedic application.

Keywords: biodegradable, corrosion, electro-corrosive behavior, microhardness, microstructure, zinc

A COMMUNICATION ON APPLICATION OF PHASE INVERSION TECHNIQUE IN FABRICATION OF CNT REINFORCED POLYMER COMPOSITE FILAMENTS FOR ADDITIVE MANUFACTURING

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Abstract:

Thanks to Additive Manufacturing (AM) of polymer composites, the fabrication of highly customized parts with remarkable mechanical properties, thermal and electrical conductivity compared to un-reinforced polymers has facilitated. Utilization of the reinforcements has been a key factor in improving the properties of 3D printed composite parts. Although most of the current 3D printing techniques could take advantage of the fiber reinforcement approach to improve the properties of final parts, the fused filament fabrication (FFF) method is reviewed to better understand its flexibility for the proposed application. Carbon nanotubes (CNTs) with outstanding mechanical, thermal, and electrical features are desirable candidates for this purpose. In the present study, numerous functionalization methods are discussed to prepare CNT reinforced composites.
Nonetheless, due to the non-uniform distribution and alignment of reinforcement fillers, the properties of the final produced part do not increase as theoretically expected. Application of phase inversion caused to propose a novel technique to produce CNT-reinforced filaments to increase the mechanical, thermal, and electrical properties simultaneously. Sonication techniques first obtain a homogeneous CNT dispersion in a dilute polymer solution. To continue, the CNT/polymer filaments with the desired CNT content can be obtained by extracting the polymer's solvent and drawing to make alignment of added fillers. Furthermore, optimizing the filament draw ratio can result in a reasonable CNT orientation along the filament stretching direction.

Keywords: additive manufacturing, carbon nanotubes, high-performance polymer, mechanical properties, 9nanocomposite, thermal properties

CYLINDRICAL ROLLER BEARINGS WITH OPTIMIZED PROFILE TAKING INTO ACCOUNT THE MATERIAL STRUCTURE AND OPERATING TEMPERATURE

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Abstract:

The present paper proposes a method for an almost uniform pressure distribution between the rolling elements, based on the modification of the roller's initial straight profile and accounting for material parameters related to the operating temperature. The optimization process is analyzed by including the possible misalignment and/or tilting angles of the roller due to operating conditions.
A computer program was developed in the Borland C++ programming language. The contact pressure distribution is evaluated by using a three-dimensional contact analysis model based on the Boussinesq force-displacement relations for a half-space combined with the flexibility approach. For a fast analysis, the algorithm uses a Conjugate Gradient Method in deriving the contact pressures and the real contact area.

Keywords: material structure, misalignment, profile optimization, skew, temperature influence

MAGNETIC PULSE WELDING OF DISSIMILAR MATERIALS: A REVIEW

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Abstract:

Conventional welding processes are limited by high working temperatures, thermal and metallurgical incompatibility of materials, environmental pollution, etc. Magnetic pulse welding (MPW) is a method of innovative high-speed welding, primarily used to join dissimilar conductive materials (without heat or consumable materials). The metal is accelerated to a speed that will form a metal joint between the two materials without the addition of filler metal, with the appearance of a wavy interface or a flat interlayer. The processing at high speed and under a certain angle creates a jet along the surfaces of the material that removes surface contaminants and eliminates the need for pre-welding preparation of surfaces. MPW welding has high structural strength because the welding interface does not melt and thus preserves the material properties. However, that the welding area achieves high strength only if the distance selected between the pairing members is large enough to allow the workpiece to achieve sufficient impact velocity and kinetic energy before the impact with the target workpiece occurs. Two theories have been considered to explain the mechanism of MPW. The first is based on the concept of a solid state mechanical mixing process. The second theory holds that bonding in MPW is dominated by local melting and solidification on a submicron scale creating a metallurgical joint. The formation of an intermetallic phase in the case of welding dissimilar materials may lead to cracking inside and around the welding area. In recent years, there has been an increased interest in the potential applications of MPW and on optimizing the welding parameters for increasing resistance, especially in the case of dissimilar materials joining. The objectives of this paper are the description of the MPW process, highlighting the optimum working parameters of the electromagnetic installation, the metallurgical characterization of the magnetic pulse welding.

Keywords: dissimilar materials, intermetallics, magnetic pulse welding, microstructure, wavy interface

COMPARATIVE STUDY OF BUILDING INTEGRATED SYSTEMS, PHOTOVOLTAIC (BIPVS) VS. PHOTOVOLTAIC-THERMAL (BIPV-T)

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Abstract:

As Earth degradation level increases, both in resources depletion and climate changes with continuously rising global temperatures, the opportunity for implementation of energy usage from renewable sources begins to be taken into account by more and more people. It is noted a growing concern in academic research and industrial manufacturing to find new areas of use, new materials and technologies for more efficient conversion of solar energy. By using "green energy" or non-polluting, renewable energy sources, consumers can reduce the environmental impact associated with conversion of energy from classic sources, as well as increase the energy independence. Incident solar energy may be converted in electric energy (with photovoltaic panels) and thermal energy (with thermal solar collectors). Depending on geographic location, climate conditions and energy demand, the conversion systems may employ different mounting options. In civil engineering, use of building integrated photovoltaic (BIPV) systems provides opportunities for façade innovating design, thermal and sound insulation, sun protection and increased comfort, reduced building carbon dioxide level, and electricity generation. Adding a thermal component to the system (BIPVT) improves thermal insulation and sound protection, while providing hot water for either building heating or domestic water demands. While BIPV systems ensures an energy conversion efficiency of about 15-20% (commercially), the overall efficiency, electrical and thermal, may be boosted up to over 50%, by tapping into the "waste" heat from the PV panels. The comparison in theoretical modelling of BIPV and BIPVT systems depends on type of hybrid system (active vs. passive), type of hybrid collector (glazed vs. unglazed, one fluid pass vs. multiple passes, shape and number of flow passages, etc.), on type of fluid used on thermal side, etc. When applied to buildings in the agricultural sector, the use of BIPVT systems may provide benefits not only in energy conversion (lower operational temperature for PV panels incurs improved electrical conversion efficiency, as well as supplemental thermal energy), but also will mitigate the CO_2 emissions associated with fossil fuels and more efficient classic fuel consumption.

Keywords: comparison, design, photovoltaic, solar energy, thermal insulation

EXPLOSION RISK ASSESSMENT - AN IMPORTANT CHAPTER OF THE EXPLOSION PROTECTION DOCUMENT

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Abstract:

In order to improve the safety and health protection of workers who may be exposed to a potential risk due to explosive atmospheres, in every industrial area where such atmospheres may occur the employer ensures the elaboration and updating of a document called Explosion Protection Document. The main chapter of this document is the Explosion Risk Assessment. Risk assessment is a complex process that involves identifying the risk, analyzing the risk and estimating the risk, the main purpose of assessing the level of risk being to establish the necessary protection measures to reduce it to acceptable levels. As there is no specific assessment method, regardless of the explosion risk assessment method applied, the probability of explosive atmospheres and their persistence, the probability of an ignition source including electrostatic discharges, installations, substances used, processes and possible interactions must be determined. and the extent of the consequences if they occur at the same time. In the assessment process, the examination of the consequences is of secondary importance because it is expected that the explosions will cause considerable damage, both material damage and human damage that can cause death.

This paper identifies the factors that may influence the level of risk of explosions in the workplace in order to establish the protection measures required to reduce the risk to acceptable levels. The main aspects that must be taken into account regarding both the technical measures to be taken (such as installations and equipment used in potentially explosive atmospheres) and the organizational measures to be taken (elaboration of work instructions, staff training, organization) were highlighted. inspection, maintenance and verification of installations). Explosion risk assessment must be performed by competent persons with knowledge of technical, electrical and mechanical engineering and who understand the general principles of explosion protection.

The implementation of the factors identified in the paper in the method of explosion risk assessment leads to the correct assessment of the explosion risk, with direct implications on the level of safety of workers in industrial spaces at risk of potentially explosive atmosphere.

Keywords: equipment, explosive atmosphere, explosion risk, protection, risk assessment

INVESTIGATION OF BIODEGRADABILITY PROPERTIES FOR FEMNSI ALLOY

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Abstract:

Interest in biodegradable materials for medical applications continues in the scientific world. Fe-based alloys have been studied in several aspects such as how to obtain them, mechanical properties, corrosion behaviour and phase transformations that correspond to the shape memory effect required for some medical implants. There are many studies in the literature on biodegradable FeMnSi alloys, and satisfactory results have been obtained from both in vitro and in vivo osseointegration tests. Encouraging conclusions have also been reached for Fe-Mn-Si alloys that have adequate mechanical, magnetic and corrosion properties to be considered a good candidate for being a biodegradable material. A good corrosion rate of Fe-Mn alloy obtained using powder metallurgy was obtained. In this paper, we studied FeMnSi-based alloy as a potential biodegradable material and showed results about the corrosion behavior manifested in vitro and the pH variation values throughout the experiment were purchased and processed. We also evaluated the initial surface of the sample, after the formation of the corrosion layer and after the removal of the compounds in an ultrasonic bath with the help of optical microscopy (OM) and the scanning electron microscopy (SEM). The initial and subsequent chemical analysis of the immersion with the formation of salts, chlorides and carbonates and the cleaning of some of them by ultrasound was done with energy dispersive spectroscopy (EDS). Differential Scanning Calorimetry test was performed. Iron-based materials are present after rolling an endothermal transformation in the solid state caused by the martensitic transformation from 0 to 25 ℃ domain temperature. In the melted state, usually for iron-based SMA, no SME was observed. The corrosion rate was calculated according to the mass loss. The results show a proportional increase in the time of exposure of the samples to the electrolytic medium, with the highest corrosion rate being recorded on the rolled sample 72 hours after immersion. The differences in rate between the first days are due to the chemical reactions occurring at the contact of the alloy with the Ringer solution.

Keywords: biodegradable, corrosion rate, Fe-Mn-Si alloy

3D PRINTING OF SMART METALLIC MATERIALS

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Abstract:

Global economy shift from mass production of products to personalized production challenges traditional manufacturing processes.Three-dimensional printing also known as Additive Manufacturing (AM) has revolutionized the world of manufacturing of complex geometries with the minimum waste material. When combined with computational methods, AM can optimize the time, cost, and energy of production. In the last decades, advanced manufacturing and additive printing technologies have made significant inroads in the fields of engineering, transportation, and healthcare. Recently, one of the actively researched areas lies in the additive manufacturing of smart materials and structures. Shape memory alloys (SMA) are intelligent materials that use martensitic transformation from nanoscale to perform a movement at macroscale. A phase transformation which occurs between the two phases-austenite and martensite- upon heating/cooling is the basis for the unique properties of the SMAs. Thanks to their properties, are used in many field of tehnology. From 1963, when William J. Buehler and Frederick Wang discovered the shape memory effect in Ni-Ti alloys to this day, nitinol is the most used alloy in technology. Nitinol (NiTi) is widely used in medical devices due to its superior superelasticity, shape memory effect, low stiffness, damping, biocompatibility and corrosion resistance. Major applications of Nitinol include stents, guidewires, orthodontic archwires and bone staples. This is primarily due to the influence of alloy chemistry on functional properties, creating a barrier to large scale production of 3D-printed Nitinol devices. The fundamental mechanism for NiTi shape memory effect is the thermal or stress-induced phase transformation between the “austenite” high-temperature phase and “martensite” low-temperature phase, which is sensitive to element composition. Based on expected difficulty in the obtaining and machining of these kind of materials, the appliance of AM methods can be a real great accepted solution method for their realization. In this work we present the main findings in the field of additive manufacturing of shape memory materials and few preliminary experimental results.

Keywords: 3D printing, additive manufacturing, Nitinol, smart materials, shape memory effect

ANTHROPOMETRIC STUDY OF THE FOOT

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Abstract:

This paper presents the methodology of collecting anthropometric data on the human foot using 3D scanning systems. The anthropometric data of the foot play a significant role in footwear design and modelling, being essential in assessing the behavior of footwear and certain components of it while walking. Anthropometric measurements of the human foot, such as perimeter, length, width, height, diameter, and angles, are used to correlate the inner dimensions of footwear with the shape of the foot, and to design the soles, their inner parts and different models of footwear. Obtaining anthropometric data and contouring the 3D shape of the foot can be done using various specialised equipment and methods. This research aims to obtain the average foot pattern and to identify statistically significant differences between the averages of the anthropometric data of the left foot and the right foot. By using the statistical analysis of the taken anthropometric data, specific typologies and characteristics can be established for the studied group of subjects. The anthropometric study was carried out on 32 female subjects aged 18-30 years, wearing foot sizes 36, 37, and 38 in the French system, for left and right barefoot. The Infoot scanning system and the Measure 2.8 application allowed the 3D shapes of the feet to be obtained. The statistical significance of the anthropometric data was verified by applying the Student and the Fisher test. As the null hypothesis was confirmed, it was decided that in the next steps of the statistical analysis, the mean values for the left and right foot would be considered, as there were no significant differences between them. The statistically analysed population was described as very homogeneous, and the values obtained were considered representative for the studied group of subjects.

Keywords: 3D scanner, anthropometry, barefoot, footwear

SELECTION AND CHARACTERISATION OF FABRICS FOR COSMETOTEXTILE WITH ANTIMICROBIAL PROPERTIES

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Abstract:

The latest trend in the cosmetics industry is a hybrid of textiles and cosmetics, called cosmetotextiles. This new hybrid can provide new or improved functions compared to the untreated textile material. Therefore, many textile materials with specific applications in the cosmetic field have been developed recently, and a variety of cosmetic textile products are currently available on the market. A cosmetotextile is a product that contains a substance or mixture intended to be permanently delivered to the skin. Based on this definition, it can be said that textiles are an important interface between people and their environment and can provide protection and comfort. In other words, cosmetotextiles are made to deliver different substances or solutions over time. Their aim is to improve properties such as cleaning, perfuming, protection and elimination of body odors.
Special attention is paid to cosmetotextiles with multifunctional effects to produce textiles with higher added value. Current demands call for innovative and high-performance textiles that can improve our lifestyle and make it more comfortable. There are mainly two different ways to apply a cosmetic substance to a textile material: by using microencapsulation technology or by coating the fabric with active finishes. The aim of this study is to compare three different textile materials, a natural fabric (100% cotton), a synthetic fabric (100% polyester) and a blended fabric (50% cotton and 50% polyester), in order to find the most suitable material and treat it with blue clay and natural active ingredients in order to produce a new cosmetotextile. All three fabrics were evaluated using the techniques SEM, FTIR and XRD and were also subjected to physical-mechanical characterization. Tests confirmed that polyester fabric is the lightest and thinnest, almost twice thinner than the other two. These properties could influence the adherence of antibacterial dispersions to the surface and/or depth of textiles. Further studies will be conducted to optimize a clay-based dispersion used to treat the textile materials and choose the most suitable option for the antimicrobial cosmetotextile.

Keywords: antimicrobial textiles, blue clays, cosmetic effects, cosmetotextiles, functional textiles

CREATING ADDICTIVE BEHAVIOR TO ENHANCE SUSTAINABLE FASHION CONSUMPTION

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Abstract:

What makes us to want more and more fashion produscts and what creates that addictive behavior? It seems that social media and video games producers, among others, influence the human behavior and use a predictive formula for boosting it. The term of "addiction" usually has a negative connotation because it is used to express destructive substance- related addictions such as abuse of alcohol, drugs and nicotine or behavioral addiction such as gambling, technology etc. which can have serious negative consequences. Over time, the fashion industry has implemented various strategies to attract and retain their customers, becoming experts in mastering habit-forming product design and making their goods indispensable. In doing so, the products and services offered by those companies altered consumer's everyday behavior creating addiction. So far, this addiction led to increasing production, consumption and disposal of apparel products which has a number of negative environmental and social impacts. In return, addiction can also be used in constructive behaviors that can be life-giving such as healthy living habits (healthy eating, sports, healthy relationships with people around us, healthy buying behavior etc.). Consumers, an important component of the fashion supply chain, are the key-players which can transform the fashion industry into a sustainable one. From purchase and maintainance to disposal, their decisions have impact on the environment and is linked to various variables such as culture, education, gender, value, beliefs, norm, economy etc. This article explores the healthy-side of addictive behavior to enhance sustainable fashion consumption by studying the strategies, such as those used by social media and video games producers, that have demonstrated their efficiency. The findings turned out to fulfill some of the well-known "Maslow's Pyramid of Needs" and, as a consequence, the strategies can be structured by using the hierarchy of needs. The behavioral addictions open avenues for further pluri-disciplinary research which can be used to create broader theoretical models for responsive approaches regarding habits of purchasing, consumption, maintanance, prolonging life of products, disposal etc., and how can those be used to lead to a more sustainable fashion industry.

Keywords: addiction, behavior, consumption, fashion, sustainable

FUNCTIONAL REQUIREMENTS AND DESIGN PARAMETERS FOR THE MANUFACTURE OF DAMASCUS STEEL

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Abstract:

According to the information identified in some bibliographic sources, Damascus steels are obtained by hot forging of steel strips with different carbon contents. In this way, Damascus steel is characterized by properties specific to a composite material. The forging process is performed until the solidarity of the sheet metal strips is obtained and the behavior of the part thus obtained as a unitary block. Axiomatic design was used to design the hot manufacturing process of prismatic test pieces of Damascus steel. Axiomatic design is a method originally proposed and promoted by American professor born in Republic of Korea Nam Pyo Suh, in the 1970s. If at the beginning the axiomatic design was mainly used in the design of manufacturing technologies, later it was used in the field of constructive design, but also in many other fields, some of these fields no longer having connection with technical problems. In principle, axiomatic design takes into account two axioms, namely the axiom of independence of functional requirements and the axiom of minimum information. The use of axiomatic design requires that, by defining the needs of a so-called customer, the functional requirements be defined and the ways of solving each functional requirement be identified, respectively. Ways to solve functional requirements are known as design parameters. In the case of Damascus steelmaking, the necessary operations were established and, subsequently, the equipment usable for the materialization of each operation was identified. Another stage of application of the axiomatic design involves the establishment of some process variables, these referring to the values of some control parameters related to the operations through which the Damascus steel is obtained. The design matrix was developed and the correlations that must exist between the functional requirements, the design parameters and the process variables in the case of the manufacture of Damascus steel test pieces, were examined. The test pieces actually obtained by manufacturing processes specific to Damascus steel are to be subjected to different categories of mechanical tests.

Keywords: axiomatic design, damascus steel, design parameter, functional requirement, manufacture, process variable

IMPORTANCE OF THE CHARACTERISTICS OF STAINLESS STEEL USED IN THE FOOD INDUSTRY FOR PERSONAL PROTECTIVE EQUIPMENT

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Abstract:

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. 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. 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. 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. This paper aims to identify the types of stainless steels used in the protective equipment industry in line with European regulations and standards. 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: corrosion, elasticity, hardness, metallic materials, personal protective equipment, stainless steel

COMPARISON BETWEEN PRANDTL'S MIXING LENGTH MODEL AND DNS DATA FOR A CHANNEL FLOW UP TO $Re_\tau \approx 5200$

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Abstract:

This paper presents a theoretical study of fully developed turbulent flow in a channel at friction Reynolds numbers of 1000, 2000, 5200. The study of turbulence flow is of great importance, especially in engineering where parameters like friction coefficients and heat convection coefficients are needed for designing machineries and optimizing various processes. The main approach for modelling turbulent flows is by RANS (Reynolds Averaged Navier-Stokes) equations, which are similar with Navier-Stokes equations, but the dependent variables are time averaged quantities and in the conservation of momentum equation an additional term is introduces, named Reynolds-stress tensor. This tensor represents the additional apparent stress caused by the velocity fluctuations. This tensor can be modelled in various ways, one of the most used one being the Boussinesq hypothesis, where the Reynolds-stress tensor is expressed in a similar manner with the viscous-stress tensor. In this case, the constant of proportionality is called turbulent viscosity or eddy viscosity and it's a flow propriety, not a material one. The turbulent viscosity can be calculated in different ways, using different models. In this paper, a theoretical study of fully developed turbulent flow in a channel at friction Reynolds of 1000, 2000 and 5200 is conducted. The flow model uses the RANS equations with Boussinesq hypothesis incorporated. The turbulent viscosity is modelled using Prandtl mixing length with Van Driest's modification to capture the damping effect of turbulent stresses near wall. In Prandtl mixing length model, the turbulent viscosity is calculated from an algebraic equation, meaning that the model is a "zero equations" model. The justification for using this class of models is given by their simplicity and a low usage of computational power.
The velocity profile was computed by solving the non-linear ODE for momentum using Euler's method. The results were compared with the latest available DNS data from the wall to mid-channel, as well for the inner region.

Keywords: channel flow, friction Reynolds, mixing length, Prandtl, turbulent flow

ANALYSIS OF THE SUPPLIER RELATIONSHIP MANAGEMENT FUNCTION AND ACTIVITIES

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Abstract:

In today's industry landscape, the ability to foster supplier relationships and manage these relationships at the appropriate level expected by the business representatives, through the adequate use of communication channels, and subsequently using tools, has led to the skills which are associated with the "business relationship management" concept that become some of the most sought after in activities which imply direct collaboration with suppliers. But how did it get here? What drove a skill such as "supplier relationship management" came to play a central role in the engineering industry? What kind of tools can be used to measure and maximize the value and opportunity which a supplier is providing?

The main purpose of this article is to give an overview on the research conducted in the area of "supplier relationship management" in the industrial engineering field. To this overview, three main areas will be addressed:

-the evolution of the "supplier relationship management" function from being a technical knowledge broker across a business unit or organisation, to acting as a facilitator for the business' strategic decision which need to be taken primarily within the supply chain management area;

-how to set up a supply chain management governance system and what to consider for this system, in order to optimize the relevant activities and provide the expected supplier qualitative results;

-review on a set of tools and techniques for the supplier relationship management area, which, if implemented and used accordingly, can generate both short- and long-term benefits for its impacted stakeholders;

Through this paper, the awareness on the subject of "supplier relationship management" in the industrial engineering field will be increased, as well as several main benefits organization can achieve following the implementation of a supplier relationship system will be highlighted, too.

Keywords: governance, stakeholder, supply chain, supplier quality, supplier relationship management

ANNEALING EFFECT OF 3D PRINTED COMPOSITES

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Abstract:

Fused deposition modeling (FDM) is one of the most popular additive manufacturing processes, with which it is possible to obtain complex three-dimensional models without significant waste production. This technique has been introduced commercially in early 1990s by Stratasys Inc., USA. The quality of FDM processed parts mainly depends on careful selection of process variables. Thus, identification of the FDM process parameters that significantly affect the quality of FDM processed parts is important. Furtehrmore, the poor mechanical properties of the components produced by this technique are still a major limitation to its advancement and industrial application. In order to overcome this problem, it is suggested by the literature the use of postprocessing treatment. Thermal annealing is the one that is highly associated to the FDM process. Therefore, this study analyses the annealing effect on the geometrical parameters and mechanical properties of PETG, carbon fibre reinforced PETG (PETG+CF) and Kevlar fibre reinforced PETG (PETG+KF). Regardless of the material, the final dimensions vary with temperature and exposure time, indicating that the addition of fibres had no significant impact. In opposition, the presence of fibres affects the radius of curvature and, in particular, the type of fibre. In terms of hardness, in general, higher temperatures and exposure times lead to higher values, achieving improvements of about 20% over untreated material. Concerning the flexural properties, while they enhance with exposure time and temperature for composites, in the case of neat PETG they increase with temperature and decrease with exposure time. For the maximum bending strength, an increase of 10.2 %, 31.8 % and 11.1 % was observed for neat PETG, PETG+CF and PETG+KF over control specimens, while for the maximum modulus the values were 17.6 %, 61.1 % and 62.6 % for neat PETG, PETG+CF and PETG+KF, respectively, over control specimens. Finally, benefits were also observed in terms of impact resistance, stress relaxation and creep behaviour of all materials. After annealing, less stress relaxation and creep displacement are observed.

Keywords: additive manufacturing, fused deposition modelling, mechanical properties, PETG, thermal annealing

MANAGER VERSUS LEADER: A PARADIGM OF INCREASING THE EFFICIENCY OF MULTINATIONAL ORGANIZATIONS

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Abstract:

In this research paper, the comparison between Manager and Leader will be considered. Although the two concepts may seem identical at first glance, there is a difference between them. Thus, in an attempt to give a definition, we can say that leaders are pleasant, charismatic people with a great ability to communicate and with skills necessary to understand and influence people and human groups, while managers are characterised by authoritarian, transactional style, focused on effort and work, but also on the need not to leave a comfort zone. The leader is the one who outlines the future, sets goals, and action plans; the manager puts them into practice. The manager has operational skills, the ability "to know how to do" (savoir faire). Leadership would rather be the human dimension, the side of involvement and engagement in the activity; management would be the effective exercise of functions.

The objective of our research is to discover the leadership skills of managers in multinational organisations and to compare them with managers in order to increase their effectiveness. It will take into account the valorisation of individual differences, building team cohesion, managing the expectations of the managed team, and motivating team members by resolving communication conflicts. The research methodology will use an exploratory mixed methods approach. To this end, we will initiate a pilot study, including qualitative interviews. This study will explore the desired leadership skills for managers of multinational organizations to effectively lead their employees in the company. The initial focus area for the study will focus on unique multicultural issues to capture in detail issues related to effective managerial leadership in a multicultural work environment, as well as perceptions of employees at multiple levels of management within multinational organizations, where survey data will be collected and analysed. As a result, we aim to inform multinational companies about the skills needed in a leadership development initiative.

Keywords: efficiency, leadership, manager, multinational organisations, skills,

VEHICLES LOADS INFLUENCE ON BOX GIRDERS BRIDGES

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Abstract:

Box girders bridges are widely used in modern highway systems because of their efficiency and attractive appearance. Usually, this type of bridge is built from girders in hollow box shape. Steel, prestressed concrete or a combination of them are the common materials used for the fabrication process of box girder bridges. Commonly, the box has trapezoidal or rectangular form for the girders. The popularity of this type of bridge has significantly increased over time because it offers better serviceability, structural efficiency, rigidity on torsion and a faster construction process. Vehicles loads represent one of the mainly factors that influence the structure reliability of the box girders bridges. Due to the different types and weights of the vehicles, the loading of the bridge is not constant and conducts to different results when multiple analyses are made. Calculation of bridge resistance with different stress due to vehicles loads as close as possible to the real ones constitue the premise of a correct design of the structure. The goal of this study is to realize a literature review regarding the behavior of box girders bridges analyzed under different vehicles loads conditions. Nowadays the finite element methods (FEM) are highly used because of their capacity to simulate and evaluate the structure efficiency before the beginning of construction process. Our attempt is to detail analyzes made by other experts that used finite element methods generated with software such as: CSi Bridge, Midas/Civil and Ansys. Simulation of stress conditions that may occur on the bridge using finite element analysis, interpretation of the obtained results and the related conclusions, resistance evaluation of the structure designed in order to highlight the points where the maximum stress values appear will serve as reference for the constructor to avoid dangerous sections and to improve the reliability of box girders bridges. Based on this study, we will outline future research directions, aiming to identify and improve the mechanical and strength characteristics of such a structure.

Keywords: box girder, finite element method, highway bridges, prestressed concrete, vehicles load

THE CONTENT AND EXECUTION OF A MAINTENANCE CONTRACT: A CHALLENGE FOR INDUSTRIAL COMPANIES

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Abstract:

Maintenance is defined as a set of activities or tasks used to maintain or restore a system to a state in which it can perform its designated functions. Because the succes of all companies is related to their production systems, which are strongly linked to features like flxibility, productivity and quality, maintenance plays a crucial role in guranteeing availability and reability of production facilities. Outsource maintenance is performed through service contracts by service providers considering specific knowledge, staff, competencies, technological capabilities and increasingly reduced costs on a long term. When outsourcing maintenance, the most important part is designing the service contract that establishes the relationship between the beneficiary and the service provider. Based on a literature review, this paper will analize the key aspects that must be specified in the maintenance service contract. As found out, the most important part in designing this type of contract is to determine the activities subject to maintenance and the technical characteristics of the machinery / equipment / systems. After agreeing on the subject of the contract, the parties can negociate the rights and the obligations they have in relation to that. The contractual relationship must be clearly determined from the beginning as a valid contract concluded represents the law of the parties. As a result of this effect of the contract, the parties will be required to fulfill their obligations even if the execution has become more onerous either due to the increase of the costs for fulfilling its own obligation or due to the decrease of the counter-performance. The purpose of this paper is to provide an instrument, in this case a model contract for maintenance service, which covers the legal aspects related to the maintenance activity and which is likely to be enforced if either party refuses to fulfill their contractual obligation.

Keywords: contract, maintenance, outsource, rights and obligations

INFLUENCE OF H_2S ON P265GH STEEL

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Abstract:

The steels are the most used materials for the industrial equip-ment with a worldwide production of 1.95 billion tons in 2021. Depending of the alloy elements and microstructure it canbe obtained a broad field of properties. A commercial Fe-C material (P265GH) used for natural gas delivery and transportation systems was analyzed in H2S atmosphere in order to establish the corrosion resistance. In most of the industrial processes for gas purification the corrosion rate is speed up by the presence of sulphur (S) especially as ions (HS-, SO3 2−) or different species like H2S. The H2S (hydrogen sulphide) is, beside a very toxic compound, a very active element in the acceleration of metallic materials deterioration. For experiments we used a three electrodes cell with Na2SO4+ Na2S solution at pH 3 for two different temperatures, room temperature ~25 °C (sample 1) and at 60 (sample 2) ±1 °C in order to realize EIS (electrochemical impedance spectroscopy) and potentiodynamic polarization. After electro-chemical tests and corrosion resistance characterisation the material surface was analyzed using scanning electron microscopy (SEM), X-ray diffraction (XRD) and energy dispersive spectroscopy (EDS). The results can be summarized as fallow: alloy corrosion rate increase significantly with the presence ofH2S concentration and with the increase of the environmenttemperature (an acceleration effect on the cathodic hydrogenevolution was observed); OCP, Rp and EIS results present similar trends in corrosionbehavior of the commercial low carbon steel P265GH. In both experimental cases (temperature variation) the corrosion resis-tance decreases with the increase of H2S percentage.– underneath the oxides layer formed on the surface, withoutmechanical stability, the low carbon steel present numerous pit-ting holes that present an agglomeration tendency in order toform a future crack; because the anodic reactions are placed at the interface betweenthe metal and the film and cathodic reactions are placed at theinterface between the film and solution it is possible to connectthe corrosion products with the electro-chemical mechanisms; linear (Tafel) and cyclic polarisation present for both experi-ments an active-passive behaviour with a significant increase ofthe critical current density. Increasing the environment temper-ature lead to the formation of more sulphur-based species onthe metallic surface by activating the reactions from the materialsurface with the temperature supplement; after sonication cleaning only the sample experimented at 60°C present stains of sulphur and all the oxides, carbonates andsodium based compounds disappear from the surface.

Keywords: corrosion, EIS, EDS, H_2S, OCP, petroleum products, SEM

NUMERICAL MODELLING OF THE SLIDING SPEEDS AND FRICTION TORQUE WHILE CONSIDERING THE CENTRIFUGAL EFFECTS IN ANGULAR CONTACT BALL BEARINGS

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Abstract:

Simulating the behaviour of various types of bearings while they are in use is very important because it can predict the running patterns, the durability of the bearings as well as the reliability of the machines and devices that are using the bearings, therefore, the need for simulation programs. Simulation models are the basis for the software developed by the main bearings manufacturers, software that are later used by machine designers. Depending on the type of bearings, there are a quite a few parameters that need to be considered when designing a simulation model. Some of these parameters are applicable to multiple types of bearings (rotational speed, lubrication, materials, temperatures, forces and moments, displacements) while some are bearings specific (geometry, supported loads and their types, applications, types of rolling elements). By considering the centrifugal forces, this paper presents a new approach for calculating both the sliding speeds and friction torque in high-speed angular contact ball bearings. Taking into account the influence of each of the above parameters, the bearings behaviour can be determined. While in use, there will be certain interactions between the ball bearings components. The model presented in this paper was developed considering the outer ring of the ball bearing to be able to tilt relatively to the inner ring which describes a equation with five degrees of freedom consisting of the two tilting angles generated by the outer ring in relation to the inner rings well as three deformations. Also, as mentioned before, an important part of every simulation model represents the internal geometry of the bearings. The geometrical parameters that were considered for the current model were made simpler in order to ease the calculations. The selected parameters are: inner and outer rings diameters and mean radius, pitch diameters, number of rolling elements, osculation factors, curvature radius, average mass of the rolling elements. At high rotational speeds, the rolling elements, in this case the 12 balls of the 7206 angular contact ball bearings will tend to exercise a proportional pressure inducing an elastic deflection (because of the centrifugal forces), on the outer ring, also increasing the internal clearance of the bearing. This, in turn, changes the contact angles and the contact loads in the angular contact ball bearing. The results obtained with this current model were compared with the ones obtained with other comprehensive models showing similar data for the same conditions, concluding that it can be used for practical applications.

Keywords: angular contact, ball bearings, centrifugal effect, friction torque, high speed

RECENT RESEARCH OF GRAPHENE NANOFLUIDS FOR HEAT TRANSFER APPLICATIONS

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Abstract:

Nanofluids are a new technique for heat transfer enhancement and a lot of research was dedicated to these new fluids. During the last two decades, scientists switched attention to the graphene which is a potentially powerful carbon nanoparticle for the development of nanofluids that enhance thermal performance in fluid flow system. The addition of solid particles of highly thermal conductive material, specifically at nano-size particles, result in nanofluid. Among nanoparticles, graphene based materials have shown very high potential due to the very high thermal conductivity, up to 5,000 W/m.K. In most research, water is used as preferred base fluid and the two-step preparation method has been accepted by a majority of the researchers. The physical techniques used to boost stability of nanofluids are stirring, mechanical agitation, and ultrasonic vibration. State of the art clearly show that results in terms of rheological behaviour of the samples is analysed at different temperatures and shear rates and was found that the relative viscosity does not change with temperature, unlike the absolute viscosity that decreases with temperature due to the viscosity change of the base fluid. Graphene-water nanofluids exhibit Newtonian behaviour for particle mass fractions below 1.0% and shear thinning behaviour at higher concentrations. Nevertheless, both thermal and rheological behaviour of the graphene nanofluids are investigated experimentally and, at various weight concentrations, thermal conductivity is enhanced with increasing concentration. The heat transfer performance of graphene in base fluid has been experimentally analysed, finding enhancement in heat transfer capability compared to the base fluid. The results demonstrate an outstanding potential for the use of graphene nanofluids as suitable replacements for the conventional fluids in heat exchanger applications and all show significant enhancements in thermal conductivity upon increase of the additive concentration and nanofluids temperature, compared with that of base fluids. Concluding, tremendous research is needed to outline both advantages and drawbacks of graphene nanofluids.

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

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SOME KEY FIGURES:

- ✓ **199 papers**
- ✓ **participants from 11 countries (authors and co-authors)**
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