

INTERNATIONAL CONFERENCE ON APPLIED SCIENCES - ICAS 2023 -



Hunedoara, May 24-27, 2023

P R O G R A M

and

short abstracts of ICAS2023

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MEETING SCHEDULE:

May 24

18:00–19:00 Registration of participants (Best Hotel Hunedoara)

19:30 Welcome Reception (Best Hotel Hunedoara)

May 25

8:00–9:00 Registration of participants (Faculty of Engineering Hunedoara)

9:00–9:30 Opening Ceremony (Faculty of Engineering Hunedoara)

9:30–9:45 Group photo

9:45–10:15 Coffee break

10:15–11:45 Plenary Session (Faculty of Engineering Hunedoara)

12:00–14:00 Lunch (Best Hotel Hunedoara)

14:00–16:00 Parallel Sessions (Faculty of Engineering Hunedoara)

16:00–16:30 Coffee break

16:30–19:00 Parallel Sessions (Faculty of Engineering Hunedoara)

20:00 Gala Dinner (Best Hotel Hunedoara)

May 26

9:30–11:30 Round table: How to increase the level of international cooperation?

11:30–12:00 Coffee break

13:00–15:00 Visit at the Corvin Castle Hunedoara: The medieval fortress of Hunedoara and the most spectacular Gothic-style castle in Romania

May 27

9:30–11:30 Round table (only for the organizing team): About ICAS 2024

11:30 End of the conference

PARALLEL SESSIONS:



Session 1. FUNDAMENTAL SCIENCES

Chairmen:

Diana BISTRIAN, University Politehnica Timisoara

Biljana VOJVODIC, University of Banja Luka

Hall: B 2–12

14:00–14:15 (online presentation)	Speaker: D Hodžić Title: The 23 Factorial Design in R Authors: D Hodžić, A Crmkić, H Rošić and R Hasanagić
14:15–14:30 (online presentation)	Speaker: L. Janjetovic Title: The significance of digital communication competences and skills for the teaching process in the international university studies Authors: L Janjetovic, M Popa, S Vilic, D Sredic, A Staszewska and A Dascal
14:30–14:45	Speaker: S Jitian Title: Infrared spectra of the optical properties of poly(methyl methacrylate) thin films Authors: L M Strugariu, S G Șerban, A M Berdie and S Jitian
14:45–15:00 (online presentation)	Speaker: J Orwat Title: Deviations' analysis of a single-family building in the mining area Author: J Orwat
15:00–15:15 (online presentation)	Speaker: M L Costea Title: Concept for the Integration of Meteorological Information in Air Traffic management Authors: G L Stroe and M L Costea
15:15–15:30	Speaker: R Munteanu Title: Evaluation of the transition process towards a climate-neutral economy in Hunedoara County through the Just Transition Operational Program 2021–2027 Authors: R Munteanu and S Muntean
15:30–16:00	Coffee break End of the Session 1





Session 2. COMPUTERS ENGINEERING

Chairmen:

Manuela PĂNOIU, University Politehnica Timisoara

Tihomir LATINOVIĆ, University of Banja Luka

Hall: B1–10

14:00–14:15	Speaker: M Sajic Title: Using Speech–To–Text AI Cloud Technology to Implement Speech Control on Self–Service Digital Devices Authors: M Sajic, D Bundalo, D Lalic , Z Bundalo , R Bojanic and L Sajic
14:15–14:30	Speaker: K Sehairi Title: Cats and Dogs detection for accident prevention and advanced driver–assistance systems Authors: K Sehairi, T Bouwmans and J Meunier
14:30–14:45 (online presentation)	Speaker: C C Niculescu Title: Streamlining Quality Assurance in Software Development Process of the Intelligent Transportation Systems Authors: C C Niculescu and O P Prostean
14:45–15:00 (online presentation)	Speaker: T Latinovic Title: The meaning of the new era of Industry 4.0, Healthcare 4.0, and Education 4.0 concerning the development of 5G networks, IOT, and Smart Everything Authors: T Latinovic, M Todoc and M Dobrnjac
15:00–15:15 (online presentation)	Speaker: R Holubek Title: Influence of working height on the energy consumption of an industrial robot Authors: R Bočák, R Holubek and M Kusá
15:15–15:30	Speaker: M D Stroia Title: An automated approach for traffic light control at pedestrian crossings Authors: M D Stroia, C Hațiegan, M F Preduș and C Muscai
15:30–15:45	Speaker: R Rob Title: Webserver for Temperature and Humidity Monitoring Authors: R Rob, A Berdie and C Rat
16:00–16:30	Coffee break
16:30–16:45	Speaker: M Boleraczki Title: Development of a knowledge base for an expert system supporting the decision of industrial mobile robot selection Authors: M Boleraczki
16:45–17:00 (online presentation)	Speaker: M Csekei Title: The effect of changing the movement mechanism of the 3D printer on the quality of the printed model Authors: M Csekei, J Šido, R Ružarosvský, D Michal and J Milde

17:00–17:15	Speaker: B T Gavrila Title: A Review on artificial pancreas mathematical models Authors: B T Gavrila, V E Balas and M M Balas
17:15–17:30 (online presentation)	Speaker: M Popa Title: Intelligent Rooftop Greenhouse: An Innovative Approach to Sustainable Urban Agriculture Authors: M Popa, V E Balas and M M Balas
17:30–17:45 (online presentation)	Speaker: K Paszek Title: UWB system for frequent positioning of moving objects Author: K Paszek
17:45–18:00 (online presentation)	Speaker: D Rad Title: A Systematic Review on the Use of Artificial Neural Networks (ANNs) in Decision Adoption Systems (DAS) for Psychological Data Interpretation Authors: D Rad, N Paraschiv and C Kiss
18:00–18:15 (online presentation)	Speaker: D Dragu Title: Blockchain and Topic Maps for an Interoperable and Trustworthy EHRs Author: D Dragu
18:15–18:30	Speaker: G Militaru Title: Short term prediction for electric current in railway power supply sub-stations Authors: S Mezinescu, G Militaru, M Panoiu and C Panoiu
18:30–18:45	Speaker: I Muscalagiu Title: Distributed agent-based simulation with HPC Repast for the Protein Folding Problem Authors: I Muscalagiu, A I Muscalagiu and L Ghiormez
End of the Session 2	



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Session 3. ELECTRICAL ENGINEERING

Chairmen:

Sorin DEACONU, University Politehnica Timisoara

Branko BLANUSA, University of Banja Luka

Hall: B1–8

14:00–14:15 (online presentation)	Speaker: D Bensafieddine Title: Design and characterization of tunable capacitively loaded loop metamaterial coplanar transmission lines Authors: D Bensafieddine, A Kaouka and F Djerfaf
14:15–14:30	Speaker: M Lolea Title: Fuzzy logic modeling and simulating the electricity availability in photovoltaic plants. Ways of applications in domain Authors: C Anghel–Drugărin, E Szabo, M Lolea and A Sărăcuț–Ardelean
14:30–14:45	Speaker: M Lolea Title: Fuzzy logic applications in the control of energy systems of the buildings Authors: C Anghel–Drugărin, E Szabo, M Lolea and A Sărăcuț–Ardelean
14:45–15:00 (online presentation)	Speaker: F Piroi Title: Impact of Electrical Equipment on the Power Factor Authors: E Spunej, I Piroi and F Piroi
15:00–15:15	Speaker: S Deaconu Title: Design, milestones, implementation and economic calculation for a photovoltaic park with a power of 0.4 MW Authors: S I Deaconu, M Topor, F Bu and A M Blaj
15:15–15:30	Speaker: S Lolea Title: Energy performances of hydropower plants. Assessment and improvement Authors: A A Minda, O I Amariei, D Negrea and S Lolea
15:30–15:45	Speaker: S Lolea Title: Fuzzy modeling and simulating of energy availability in wind conversion installations Authors: A A Minda, O I Amariei, D Negrea and S Lolea
15:45–16:00	Speaker: C Anghel Drugărin Title: Growth of RES addicted to grid development. Case Study: Romania Authors: C Anghel–Drugărin, C P Chioncel and G O Tirian
16:00–16:30	Coffee break
16:30–16:45 (online presentation)	Speaker: C Cuntan Title: Study of MOS and IGBT transistors at switching with variable fill factor Authors: C Cuntan, I Baciuc and M Osaci
16:45–17:00	Speaker: S Mortan Title: Efficiency and profitability of solutions to obtain hydrogen with electricity support Authors: M Ambro, A A Minda, S Mortan, A Dragoș, D Știrb and M Lolea

17:00–17:15	Speaker: S Mortan Title: A few ways to improvement the heat pumps integration in buildings in correlation with electrical facilities and smart control Authors: A A Sărăcuț, A A Minda, S Mortan, Gh Ias, D Haica and M Lolea
17:15–17:30	Speaker: C Bârz Title: Using ADVISOR for Battery Electric Vehicle configuration Authors: O Chiver, L Neamt and C Barz
17:30–17:45	Speaker: C Bârz Title: EasySoft using in lights control road Authors: C Barz, O Chiver, Z Erdei, O Onysko and P Živković
17:45–18:00	Speaker: G N Popa Title: Solutions to Improve Collection Efficiency for Industrial Plate–Type Electrostatic Precipitators Authors: G N Popa, C M Diniș, A Iagăr and C D Cunțan
18:00–18:15	Speaker: G N Popa Title: Digital multimeter made with Arduino Uno development board Authors: C M Diniș and G N Popa
18:15–18:30	Speaker: G Militaru Title: Researches regarding power quality at the hot rolling mills' power supply Authors: P I Ivascanu, G Militaru, M Panoiu and C Panoiu
18:30–18:45	Speaker: G Militaru Title: Real time detecting deformation on pantograph contact strip based on image processing technique Authors: G Militaru, M Panoiu and C Panoiu
18:45–19:00	Speaker: D Alexuta Title: Systematic Review on Aquaponics and their Automated Control Authors: D Alexuta, V E Balas and M M Balas
End of the Session 3	



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Session 4. MECHANICAL ENGINEERING

Chairmen:

Camelia PINCA–BRETOTEAN, University Politehnica Timisoara

Branislav SREDANOVIC, University of Banja Luka

Hall: Fo–1

14:00–14:10	Speaker: A Kaouka Title: <i>Microstructure evolution and some mechanical properties of Ti6Al4V titanium alloy</i> Author: A Kaouka
14:10–14:20	Speaker: A Kaouka Title: <i>Corrosion behavior and growth kinetics of boride Ti6Al4V titanium alloy</i> Author: A Kaouka
14:20–14:30 (online presentation)	Speaker: A T Aman Title: <i>Identifying Mass Inhomogeneity in Beam-Like Structures Using an Artificial Neural Network Trained with Analytical Data</i> Authors: C Tufisi, A T Aman and G R Gillich
14:30–14:40 (online presentation)	Speaker: A T Aman Title: <i>Detection of Delamination Size in a Five-Layer Cantilever Beam Using Natural Frequencies and Artificial Neural Network</i> Authors: A T Aman, C Tufisi and Z I Praisach
14:40–14:50 (online presentation)	Speaker: W Łykowski Title: <i>Design and strength analysis of a new construction of a sweeper with an independent surface copying system dedicated to small loaders and front loaders</i> Authors: L Gierz, W Łykowski, G Ślaski, J Górecki and M Nowaowski
14:50–15:00	Speaker: A Bara Title: <i>The defects analyses of mechanical transmissions</i> Authors: A Bara, R G Gillich and C Hatiegan
15:00–15:10 (online presentation)	Speaker: P Walichnowska Title: <i>The determination of the most environmentally damaging stage of the shrink film packaging process using LCA</i> Author: P Walichnowska
15:10–15:20 (online presentation)	Speaker: T Vasiiu Title: <i>Determination of reliability of cement mills</i> Authors: T Vasiiu and A Budiul Berghian
15:20–15:30 (online presentation)	Speaker: D A Pîrsan Title: <i>The dynamic behavior of the truss treated in the numerical analysis which elements are defined as truss or beam</i> Authors: D A Pîrsan, Z I Praisach, L Cîndea and A T Aman
15:30–15:40	Speaker: S A Ratiu Title: <i>Alternative Fuels for Internal Combustion Engines: A Review</i> Authors: S A Ratiu, D M Stoica, A Josan and C Pinca–Bretotean
15:40–15:50	Speaker: I Zs Miklos Title: <i>Dynamic simulation of the differential gear in road vehicles</i> Authors: I Zs Miklos, C C Miklos and C I Alic

15:50–16:00	Speaker: A Gidali Title: Study on internal combustion engine lubricants and hybrid vehicle transmission oils Authors: D M Armioni, I Ionel, S A Rațiu and A Gidali
16:00–16:20	Coffee break
16:20–16:30 (online presentation)	Speaker: P Kostal Title: Group technology in intelligent manufacturing Authors: P Kostal, P Telek and M Matusova
16:30–16:40 (online presentation)	Speaker: M Popa Title: Combining terrestrial scanning with video images in traffic accident Authors: A Dascăl, M Popa and L Janjetovic
16:40–16:50 (online presentation)	Speaker: R Holubek Title: Design and analysis of equipment intended for the production of prototypes Authors: M Kusá, R Holubek and R Bočák
16:50–17:00	Speaker: A A Benescu Title: The importance of reverse engineering and 3D scanning in remanufacturing hydraulic drive system components in the circular economy context Authors: A P Chirita, A A Benescu, A M Bors and Ș M Șefu
17:00–17:10 (online presentation)	Speaker: P Nižňan Title: Description of current situation on field of prosthetic lower limbs Authors: P Nižňan, P Košťál and V Prajova
17:10–17:20 (online presentation)	Speaker: P Maćkowiak Title: Numerical simulation of the welding process for the prediction of temperature distribution on Al/steel explosion welded transition joints Authors: P Maćkowiak and D Płaczek
17:20–17:30 (online presentation)	Speaker: E Bajramovic Title: The importance of implementation EN ISO 3834 and EN 1090 standards in the production of steel structures Authors: E Bajramovic, E Bajramovic, E Bajramovic and F Islamovic
17:30–17:40 (online presentation)	Speaker: D Płaczek Title: Review of the use of welded joints with Al/Fe explosion-welded transition joints Authors: D Płaczek and P Maćkowiak
17:40–17:50 (online presentation)	Speaker: W Kruszelnicka Title: Selected aspects of grains breakage probability affecting the processing machines design Authors: W Kruszelnicka and P Leda
17:50–18:00 (online presentation)	Speaker: A N Luca Title: Modification of cavitation erosion resistance of aluminium alloy 2017 A by duration of artificial ageing heat treatment at 140°C Authors: A N Luca, I Bordeasu, B Ghiban and C Ghera
18:00–18:10	Speaker: O Onysko Title: Accuracy of the profile of lead screws during whirling machining Authors: V Panchuk, O Onysko, C Barz, V Kopei and J Kusyi
18:10–18:20	Speaker: I Timár Title: Coating stress analysis under temperature increase for diamond and silicon CVD coatings Authors: I Timár, M Boleraczki and É K Pfeifer
18:20–18:30	Speaker: A Pop Vădean Title: The human body a potential source for harvesting clean energy and sustainable use Authors: A Pop Vădean and I Smical
18:30–18:40	Speaker: I A Simon Title: Development of a highly automated construction and production planning framework for the production of floating houses Authors: I A Simon, M Boleraczki and I G Gyurika
End of the Session 4	



Session 5. MATERIALS ENGINEERING

Chairmen:

Erika ARDELEAN, University Politehnica Timisoara

Dragoslav DOBRAS, University of Banja Luka

Hall: B0–11

14:00–14:15 (online presentation)	Speaker: S Aluvihara Title: The Advanced Applications of Earth Materials based upon the Adsorption and Absorption Processes Authors: S Aluvihara, C S Kalpage, P W S K Bandaranayake and T Latinovic
14:15–14:30 (online presentation)	Speaker: F Bucur Title: Simulation of the casting and solidification process of the brake blocks intended for rolling stock Authors: F Bucur, A Socalici, A Josan, V Putan and C Birtok Baneasă
14:30–14:45	Speaker: G Mihut Title: The variation of the hardness of high–strength steels depending on the microstructures specific of tempering Authors: G Mihut, M Ardelean, E Popa and I Prejban
14:45–15:00	Speaker: M Ardelean Title: Study regarding the mechanical characteristics of high–strength steels Authors: M Ardelean, G Mihut, E Ardelean and A Josan
15:00–15:15	Speaker: I A Rus Title: Possibilities of exploitation of useful metals from used Li–ion batteries Authors: I A Rus, C Birtok Băneasă, A Socalici, E V Nicolae and O Gaianu
15:15–15:30 (online presentation)	Speaker: I Poenaru Title: Research regarding oxygen content reduction in steels Authors: I Poenaru, E Ardelean, M Magaon, A Budiul Berghian and Z Trisovic
15:30–15:45 (online presentation)	Speaker: G Cvetanovic Title: Clay in Phase Change Materials: Review Authors: G Cvetanovic, P Raskovic and P Zivkovic
15:45–16:00	Speaker: Z Trišović Title: Standardization in the field of composites Authors: Z Trišović, T Lazović, N Trišović and P Ljubojević
16:00–16:30	Coffee break End of the Session 5



INTERNATIONAL CONFERENCE ON APPLIED SCIENCES - ICAS 2023 -



SHORT ABSTRACTS

ISSN 2784-2797



Session 1 – FUNDAMENTAL SCIENCES

Title: *The 2^3 Factorial Design in R*

Authors: D Hodžić, A Crnkić, H Rošić and R Hasanagić

Abstract: The paper describes the factorial design of the experiment with three input factors that change on two levels. For given values of the input parameters, it is shown how to obtain a variance analysis table and which factors and interactions between factors are significant. The example was done in the software intended for the design of the experiment and in the software R. It is shown how to use the software R to arrive at the final solution of the given example.



Title: *The significance of digital communication competences and skills for the teaching process in the international university studies*

Author: L Janjetovic, M Popa, S Vilic, D Sredic, A Staszewska and A Dascal

Abstract: The coefficient of variation is an important and a widely used measure of data dispersion. It is free from the unit of measurement. The coefficient of variation can be useful to compare the variability between two groups of observations. Log-normal distribution is widely used to describe the data from positively skewed distribution. This distribution is in relat



Title: *Infrared spectra of the optical properties of poly(methyl methacrylate) thin films*

Authors: L M Strugariu, S G Șerban, A M Berdie and S Jitian

Abstract: Infrared spectra are presented for the main optical properties of polymethyl methacrylate films. They are obtained from the complex permittivity using the Drude–Lorentz model for permittivity. The classical dispersion analysis of the reflection–absorption spectrum of poly(methyl methacrylate) films cast on the metal mirror was used. This approach to obtaining the permittivity and then obtaining the main optical properties from it is original.



Title: *Deviations' analysis of a single-family building in the mining area*

Authors: J Orwat

Abstract: In this article changes of the inclinations and curvatures values of a mining terrain and a residential building have been presented. They were caused by exploitation of the 405/1 hard coal seam located at the depth of 550 m and carried out on a south of the building by use of the longwall system. The inclinations and curvatures values on a base of results of the geodesic surveys conducted from March to August 2019 have been calculated. There were measured vertical displacements and horizontal distances between the measuring points which in the ground and on the building walls have been established. Points in two perpendicular directions have been stabilized. Observational network consisted of 12 points (3 points in each direction in the ground and on the walls). It was shown that inclinations and curvatures have the different values on a terrain surface and in a building, which could mean that the deformation process takes place differently in the ground than in a building.



Title: *Concept for the Integration of Meteorological Information in Air Traffic management*

Authors: G L Stroe and M L Costea

Abstract: This study present different types of gusts acting on the studied aircraft, from discrete to stochastic ones, and shows that the aircraft tolerates extremely critical loads of wind in wind gusts, thus giving the crew a pleasant journey. The numerical simulations made in MATLAB present the way to attenuate the wind gusts, being necessary to know the dynamics of the controlled aircraft, simultaneously with the multitude of interactions of the flexible modes of the aircraft with its flight mechanics.



Title: *Evaluation of the transition process towards a climate-neutral economy in Hunedoara County through the Just Transition Operational Program 2021–2027*

Authors: R Munteanu and S Muntean

Abstract: The Just Transition Operational Program 2021–2027 represents a strategic programming document that will aid in the transition to a low-carbon economy and the achievement of related environmental goals in accordance with the territories' development plans for the years 2021–2027. It does this by promoting environmentally sustainable economic diversification to boost the competitiveness and ability of affected local economies to generate new revenue. This paper seeks to emphasize the Just Transition Operational Program 2021–2027's transition process in Hunedoara County toward a climate-neutral economy by presenting the socioeconomic aspects as well as the development requirements and goals necessary to meet the program's stated objectives.



INTERNATIONAL CONFERENCE ON APPLIED SCIENCES - ICAS 2023 -



Session 2 – COMPUTERS ENGINEERING

Title: *Using Speech-To-Text AI Cloud Technology to Implement Speech Control on Self-Service Digital Devices*

Authors: M Sajic, D Bundalo, D Lalic, Z Bundalo, R Bojanic and L Sajic

Abstract: The purpose of this paper is to point out the possibilities of practical application of already created tools that use modern technology, API functions, artificial intelligence and cloud solutions, whose purpose is to convert speech into text. Using the specific Google Speech-to-text application, the Payton programming language, its libraries and a multifunctional digital self-service device, a practical solution for using voice commands in working with the device is presented. The role of the aforementioned multi-functional digital self-service devices is to replace and fully automate the work of counter workers. With the additional option of recognizing voice commands, that work is further automated and makes it easier for the client to communicate with the device in an even more natural way. Also, this way of working is more hygienic, because there is no contact with the device, which could be a source of viruses and bacteria. This way of working is especially important during pandemics (covid, flu, etc.).



Title: *Cats and Dogs detection for accident prevention and advanced driver-assistance systems*

Authors: K Sehairi, T Bouwmans and J Meunier

Abstract: Accidents caused by cats and dogs have led to many injuries and even deaths, especially in rural areas. In this work, we develop an object detection system that can recognize cats and dogs and alert drivers. For that, a new dataset has been collected which takes into consideration the environment, such as roads, and soil type. Using this dataset, we applied transfer learning to different Convolution Neural Network CNN models with different input sizes. The aim is to define the best architecture in terms of accuracy, memory usage, and time of computation. A high-power Graphics Processing Unit has been used, which allowed us to train and test these networks using TensorFlow 2. The results of testing the first CNN, the MobileNetV2-SSD, showed an acceptable detection rate with low computation time, however, the second CNN, The CenterNet Hourglass, showed a great performance with high computation time. We believe that such systems can prevent animal-vehicle collisions and help the driver avoid hit accidents.



Title: *Streamlining Quality Assurance in Software Development Process of the Intelligent Transportation Systems*

Authors: Constantin-Cătălin Niculescu, Octavian-Petru Prostean

Abstract: Intelligent Transportation Systems (ITS) have changed the face of modern transportation networks by increasing efficiency, safety, and sustainability. The necessity for comprehensive quality assurance (QA) techniques in the software development process becomes critical as the complexity of ITS systems develops. This article investigates the possibilities of smart contracts in ITS software development, leveraging current automotive industry standards and frameworks such as ISO 26262, ISO 21434, and Automotive SPICE. We begin by offering an overview of the issues that ITS software development faces, emphasizing the necessity of quality assurance in assuring safety and reliability. Following that, we introduce the concept of smart contracts, highlighting key characteristics such as

automation, transparency, and security. We explore how these qualities might be used to overcome the highlighted issues in the development of ITS software. We illustrate the use of smart contracts for various QA processes, such as requirements management, design verification, and testing. We explain how the QA process can be made more effective, reliable, and transparent by combining smart contracts with industry standards. Furthermore, we present a comparison of smart contract-based QA with traditional QA methods, emphasizing the benefits of this novel approach. Our findings indicate that smart contracts have the potential to significantly improve the QA process in ITS software development, hence contributing to increased safety and reliability in transportation systems. This article provides significant insights for software engineers, ITS developers, and transportation industry decision-makers, as well as a framework for the deployment of smart contract-based QA solutions.



Title: *The meaning of the new era of Industry 4.0, Healthcare 4.0, and Education 4.0 concerning the development of 5G networks, IOT, and Smart Everything*

Authors: T Latinovic, M Todic and M Dobrnjac

Abstract: Industry 4.0 refers to the industry's revolutionary shift toward automation and digitalization. This revolution has an impact on every aspect of our lives. Most countries around the world lack a digital culture, which makes implementing Industry 4.0 difficult. The Fourth Industrial Revolution will inevitably bring about changes in many aspects of human life. The education system is the most important. Examining numerous papers and publications in the subject reveals that future curriculum must consider not just students' academic talents, but also practical skills and the capacity to work in groups, as well as critical and creative thinking. A teacher must have a variety of skills. Aside from continuous education, one must also have certain transferable skills, such as globalization ability, expertise in new technologies and their applications, and future strategies and competency not only of professors but also of advisors. Education 4.0 provides all of this. Healthcare delivery, like manufacturing, is changing and becoming smarter and more connected to healthcare, which we call Health Care 4.0. The definition of Industry 4.0 is the integration of physical and digital technologies. As seen above, 5G connectivity is critical to Industry 4.0. This is particularly evident in the rise in sales of automatic robots, wearable devices, and VR headsets, which have risen dramatically as a result of combining virtual reality with real-life, real-time production and where high data transfer speeds are required, such as remotely controlled production. To manage automatic robots and processes in Industry 4.0, a 5G network in conjunction with IOT is required. It will be impossible to participate in the technological development of production, health needs, and the new education system without the technologies mentioned in the paper.



Title: *Influence of working height on the energy consumption of an industrial robot*

Authors: R Bočák, R Holubek and M Kusá

Abstract: Electricity consumption is a big problem not only for the economy, but also for the environment. More and more electricity is used, so it is necessary to find a way to save it. This article focuses on the electrical energy consumption of an industrial robot by changing its working height. The goal is to find out at which height it is most suitable to work in order to achieve the lowest possible energy consumption. Research is realized on industrial robots of various sizes and lengths using simulation tools such as ABB RobotStudio and Process Simulate, where different trajectory heights are simulated. The trajectories are parametrically dimensioned according to the size of the robot. Also, the trajectories are designed to maximize the use of the robot's axis. This method makes it possible to reduce energy consumption even before the robot is physically located in the factory and its position cannot be changed.



Title: *An automated approach for traffic light control at pedestrian crossings*

Authors: M D Stroia, C Hațiegan, M F Preduș and C Muscai

Abstract: Although technology has evolved explosively in past years in all aspects of our lives and should make our work easier, it still seems like we don't have enough time and we are in a constant rush. We hurry when we go to work or shopping, when we drive, when we cross the street. Nevertheless, we have clear traffic rules that aim to protect us from possible road accidents, has the thought ever occurred that we could cross the street if no one is crossing, even if the traffic light is red? In this idea, we thought of a different approach to control the alternation of the traffic light, other than through the timer, so as to reduce the waiting times at the traffic light crossing. This traffic light automation solution is detailed in the present paper in which we describe the structural components and operating principles of an improved traffic light model. The main objective for implementing this improved model is to eliminate the waiting dead times at the traffic light crossing.



Title: *Webserver for Temperature and Humidity Monitoring*

Authors: R Rob, A Berdie and C Raț

Abstract: This work proposes a functional system which permits the user to measure the air temperature and humidity using an acquisition system with DHT11 sensor and ESP8288 Node MCU. This device ensures the connecting to an existing WLAN network, with or without Internet. The application has a programmed webserver that allows data monitoring on any device connected to WLAN network by specifying the ESP8266 IP. Data are transmitted in real-time to ThingSpeak cloud platform. Data is displayed on numeric and graphic indicators, each information is correlated with the time when generated. The system permits the user to be notified by SMS when the temperature occurred a threshold value. The alert was programmed using the IFTTT free applet and it is connected to ThingSpeak platform.



Title: *Development of a knowledge base for an expert system supporting the decision of industrial mobile robot selection*

Authors: M Boleraczki

Abstract: With the growth of industrial mobile robots, more and more manufacturing companies are producing such robots. As a result, there is a growing market variety for companies wanting to adopt these robots. It is an economic advantage if a robot selected for a specific task can be operated optimally. To this end, the selection process must already be carried out with optimal operation in mind. In my research, I develop such an industrial mobile robot selection support system, which generates a knowledge base from a database and then supports the selection decision with an expert system. In this paper, I describe the structure, interrelationship and test results of this database and knowledge base.



Title: *The effect of changing the movement mechanism of the 3D printer on the quality of the printed model*

Authors: M Csekei, J Šido, R Ružarovský, D Michal and J Milde

Abstract: This article focuses on comparing the quality of 3D printed models made by the Fused Filament Fabrication (FFF) method. The samples were 3D printed by 4-axis robotic arm and conventional 3D printers. The aim of the experiment is to compare the impact of devices design on the quality of 3D printed models, to determine the advantages / disadvantages and to define the application possibilities of the compared devices. The 3D model contains geometric shapes to check the accuracy and repeatability of applying individual layers and at the same time to define geometric tolerances or determine shape deviations. The samples were 3D printed under the same conditions and parameters. The manufactured samples will be 3D digitized by optical scanner ATOS II Tripple Scan and then compared with sw GOM Inspect to obtain data on geometric tolerances. The obtained data will be evaluated and used for further planned experiments.



Title: *A Review on artificial pancreas mathematical models*

Authors: B T Gavrilă, V E Balas and M M Balas

Abstract: The development of an artificial pancreas (AP) has been a topic of interest in the field of diabetes management for several decades. An AP system is designed to mimic the function of the pancreas by continuously monitoring blood glucose levels and delivering insulin or glucagon in response to changes in glucose concentration. Mathematical models play a crucial role in the development and evaluation of AP systems, as they enable the simulation and prediction of the system's performance. This review paper provides an overview of the mathematical models used in AP research. The paper discusses the strengths and limitations of each type of model, as well as their applications in AP research. The review also highlights the challenges and opportunities in AP model development, such as the need for personalized models and the integration of data from multiple sources. Overall, this review provides a comprehensive understanding of the role of mathematical models in AP research and their potential for improving diabetes management.



Title: *Intelligent Rooftop Greenhouse: An Innovative Approach to Sustainable Urban Agriculture*

Authors: M Popa, V E Balas and M M Balas

Abstract: The paper presents a novel approach to improve the performance and sustainability of urban agriculture that is to integrate rooftop greenhouses with buildings, and to manage this system in an intelligent manner. The integration of greenhouses with buildings has become increasingly popular in urban areas to promote sustainable food production and mitigate the negative environmental impacts of the industries with strong carbon footprint caused by fuel burning. However, the performance of rooftop greenhouses may be limited by the harsh rooftop environment, such as temperature fluctuations and exposure to wind and sunlight. To overcome these challenges, this paper presents an intelligent rooftop greenhouse system iRTG that is integrating the greenhouse and the building to increase the building's metabolism. iRTG utilizes intelligent algorithms, sensors, actuators, and Internet of Things to optimize the growing conditions of the plants, the air quality and to maximize the iRTG carbon offset effect at the same time. The paper discusses the design and implementation of the iRTG system, as well as its potential benefits and limitations.



Title: *UWB system for frequent positioning of moving objects*

Authors: K Paszek

Abstract: Object positioning is an essential issue in the context of autonomous vehicles and AGVs in Industry 4.0 and smart cities. Based on the position, it is possible not only to track objects, but with appropriate positions accuracy and frequency, it is possible to prevent dangerous situations. The information about the possibility of a dangerous situation must be available in advance so that the superior system, driver, or operator can take the appropriate action. A UWB is a promising technology for object positioning, even though UWB systems are used for positioning objects in a limited area, mostly indoors. Nothing stands in the way of creating many small areas in sensitive places, e.g. intersections and manoeuvring yards. This ultrawide-band technology allows to objects positioning with high accuracy – several centimeters. However, the accuracy of this system depends on the speed of movement of the positioned object and the ranging frequency to individual stationary reference nodes – anchors. Therefore, it is important to exchange messages in the network of UWB nodes during ranging runs as quickly as possible. This article analyses the modified UWB positioning system, which maximizes the frequency of acquiring the distance between nodes and thus the frequency of determining the object's positions.



Title: *A Systematic Review on the Use of Artificial Neural Networks (ANNs) in Decision Adoption Systems (DAS) for Psychological Data Interpretation*

Authors: D Rad, N Paraschiv and C Kiss

Abstract: In recent years, there has been increasing interest in the potential of artificial neural networks (ANNs) to enhance decision-making processes in a variety of domains, including decision adoption systems (DAS). This systematic review focuses on the utilization of ANNs in DAS for the interpretation of psychological data. The primary objective of this review is to identify the current state of research on the use of ANNs in DAS for psychological data interpretation and highlight the advantages and limitations of using ANNs in this context. Through a comprehensive search of relevant databases, a range of studies were identified that have employed ANNs in DAS for psychological data interpretation. These studies demonstrate the potential of ANNs to improve decision-making processes in psychological data interpretation, resulting in more accurate diagnoses. Nonetheless, several challenges and limitations were also noted, including the requirement for large amounts of high-quality data and the potential for bias in the training data. The need for further research in the area of ANNs in DAS for psychological data interpretation was also highlighted. The systematic review provides insights into the current state of research on the use of ANNs in DAS for psychological data interpretation, offering a comprehensive understanding of the potential of ANNs in enhancing decision-making processes in this context. As such, the findings of this review have significant implications for future research on ANNs in DAS for psychological data interpretation, which may result in the development of more effective decision-making tools for this purpose.



Title: *Blockchain and Topic Maps for an Interoperable and Trustworthy EHRs*

Authors: D Dragu

Abstract: The paper presents a survey regarding the combined use of Blockchain and Topic Maps in order to enhance the interoperability and trustworthiness of electronic health records (EHRs). Medicine leverages on information to provide timely and accurate patient care, but the lack of standardization and interoperability among different EHR systems often leads to an inefficient healthcare delivery. On the other hand, privacy and security of medical records are crucial to maintain the trust and confidentiality of patients. Blockchain technology has the potential to enable secure and decentralized sharing of EHRs among different healthcare providers, while topic maps can facilitate semantic interoperability by providing a standardized way of representing and linking healthcare concepts.



Title: *Short term prediction for electric current in railway power supply sub-stations*

Authors: S Mezinescu, G Militaru, M Panoiu and C Panoiu

Abstract: In this paper, a study into the technique of estimating current from railway power supply sub-stations is presented. The electric locomotive acts as a nonlinear load, which causes the electric current to be distorted and have a waveform that is not sinusoidal. This is the case most of the time. In this scenario, such a prediction can be used to estimate the power factor and reactive power. Narx neural networks were used to develop the prediction. Based on data collected from the railway power supplying substation, the prediction was made using Matlab software. Electric current and voltage measurements were performed.



Title: *Distributed agent-based simulation with HPC Repast for the Protein Folding Problem*

Authors: I Muscalagiu, A I Muscalagiu and L Ghiormez

Abstract: The protein folding problem is one of the most challenging problems in current biochemistry and is an important problem in bioinformatics. The increasing availability of high-performance computing (HPC) has accelerated the potential for applying computational simulation to capture ever more granular features of large, complex systems. In this paper we present an initial implementation of a distributed general-purpose ABM toolkit developed with Python for protein structure prediction, using Distributed Constraints (DisCSP/DisCOP). The paper will provide -an agent-based modelling framework written in HPC Repast4Py that provides the ability to build large, MPI-distributed ABMs that span multiple processing cores. The framework can be used for the implementation and simulation of the protein structure prediction that can run on a single computer or on a cluster computing environment. This open source tool can be used for structure prediction experiments.



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Session 3 – ELECTRICAL ENGINEERING

Title: *Design and characterization of tunable capacitively loaded loop metamaterial coplanar transmission lines*

Authors: D Bensafieddine, A Kaouka, F Djerfaj

Abstract: In this paper, a tunable filter based on coplanar transmission line and loaded with circular capacitively loop (CLL) metamaterials unit cell has been designed and characterized for microwave application. The unit cell is a “capacitively loaded loop (CLL)–shape” with a various surface capacitors integrated across a gap. This CLL unit cell behaves similarly to the SRRs but greatly simplify fabrication issues. We used the lumped equivalent circuit models to analyze the frequency responses of the proposed structure. It has been shows that by loading the various surface capacitors C_0 component at the circular capacitively loaded loop (CLL) metamaterials unit cell, the resonant frequency of the structure can be electronically adjusted. The resonance frequency is reduced down to 1.92 GHz for the proposed tunable structure with $C_0=0.01$ PF and to 1.79 GHz for $C_0=0.09$ PF. The electrical circuit parameters of our model have been extracted using a specific method based on the pseudo inverse technique and Smith chart analytical method. The equivalent circuit models are validated through electromagnetic simulation and the parameters of the equivalent circuit model are representative of the different physical elements of the structure.



Title: *Fuzzy logic modeling and simulating the electricity availability in photovoltaic plants. Ways of applications in domain*

Authors: C Anghel–Drugărin, E Szabo, M Lolea and A Săracuț–Ardelean

Abstract: The authors propose several directions for the use of fuzzy logic for energy management in photovoltaic installations. The paper presents and gives examples of: assessing the degree of exposure of solar panels to solar radiation during the day in various seasons, adjusting the angle of inclination of photovoltaic panels, modifying and improving the availability of electricity according to climatic factors or to obstacles in the location. The work of authors has theoretical, analytical, computational and experimental approaches. The end of the paper is dedicated to the conclusions resulting from the study.



Title: *Fuzzy logic applications in the control of energy systems of the buildings*

Authors: C Anghel–Drugărin, E Szabo, M Lolea and A Săracuț–Ardelean

Abstract: Several components are included in the energy system of buildings: heat, electricity, mechanical energy. As examples, in the mechanical energy part where the ventilation or water supply system is also included. All of this can be controlled through remote communication systems that allow optimal adjustment of energy parameters. Finally, the goal is to optimize costs and energy efficiency in building maintenance. The authors proposed with the help of fuzzy logic, the realization of energy control systems in buildings so that the mentioned goals are achieved.



Title: *Impact of Electrical Equipment on the Power Factor*

Authors: E Spunei, I Piroi and F Piroi

Abstract: A large proportion of electricity consumers alter the electricity quality through the equipment they use. The alteration is caused by a drop in the power factor, which leads to additional losses in the power grid and additional reactive power costs. In order to identify the consumers' receiving electrical devices that alter the power factor, we monitor their electricity use in a production hall looking at the variation of the effective average values of voltages, currents, powers and power factor. The analysis of these records gives us the difference between the power factor and $\cos \varphi$ (the phase difference between phase voltage and phase current in single-phase operation). Our monitoring shows, at the same time, the necessity of an individual analysis of each electrical device in the production hall under observation, as well the necessity to locally compensate the power factor.



Title: *Design, milestones, implementation and economic calculation for a photovoltaic park with a power of 0.4 MW*

Authors: S I Deaconu, M Topor, F Bu and A M Blaj

Abstract: The design of photovoltaic parks has become in Romania, at the moment, one of the most profitable and safe investments in the field of renewable energy sources, not only at present, but even more so in the future. Solar, photovoltaic parks are favored by maximum exposure to solar radiation, a minimal impact on the environment, allowing the production of energy with a cost per kWp lower than that of other installations. The execution period of a photovoltaic park varies between 3–6 months depending on location and weather conditions. Romania has a high degree of solar radiation, suitable for investment in photovoltaic parks. There are three categories of documents required for the establishment of a photovoltaic park: those related to the land on which the park is built, the solution study for obtaining the technical approval for connection (ATR) to the electrical network and obtaining the establishment authorization. The realization costs involved in building and designing a photovoltaic park are between 1.1–1.9 Euro/Watt. The quality of the equipment used in construction, the shape of the land, the costs of connection to the national energy system, are factors that can constitute the cost of realization. Another important factor in terms of income is the level of operational expenses, which is between 2% and 8% of the annual income and includes: security, equipment and land maintenance, system monitoring. The paper will present a technical and economic calculation for a photovoltaic park with a power of 400 kW.



Title: *Energy performances of hydropower plants. Assessment and improvement*

Authors: A A Minda, O I Amariei, D Negrea and S Lolea

Abstract: The energy performances of the hydropower generators must be maximum. Given that for the energy system in Romania, energy from hydraulic resources is the cheapest, this fact is justified. That is why in the paper the authors propose the evaluation of the energy performances of the hydropower plants in order to improve them, based on case studies. Methods of practical evaluation and calculation of the mentioned performances are presented at the beginning. Then, the hydropower plants on which the studies were carried out are described. They belong to the Power System of Bihor County, Romania. Next the results of the studies follow and at the end the authors' conclusions regarding the data obtained. For the indicators of energy availability in hydropower plants, the authors also propose improvement solutions.



Title: *Fuzzy modeling and simulating of energy availability in wind conversion installations*

Authors: A A Minda, O I Amariei, D Negrea and S Lolea

Abstract: In the paper, the authors propose an approach regarding the assessment and increase of energy availability in wind energy conversion installations with the use of fuzzy logic. This type of approach is effective if the controllers are built with the principles that allow the maximum use of the natural wind potential in the conversion processes into

electricity through wind turbines. As a structure, the paperwork has a general theoretical part dedicated to fuzzy logic principles and their applications combined with the structure and functions of wind power plants. Then, practical and theoretical evaluation models of the availability of wind power plants are presented. On practical models, an algorithm established by the authors will be applied to assess with the help of fuzzy logic the availability of energy in the conversion aggregates on the two components: mechanical and electrical. After own interpretations, at the end of the work the conclusions of the study are presented.



Title: *Growth of RES addicted to grid development. Case Study: Romania*

Authors: C Anghel–Drugărin, C P Chioncel, G O Tirian

Abstract: The paper presents Romania as a case study for the integration of new production capacities from renewable energy sources in the context of an accelerated energy transition process. The increased efficiency of renewable energy production systems needs improved transmission & distribution networks, increasing interconnection capacity, and allowing the development of new / repowering of existing power plants. The authors of this paper also consider the behavior according to different seasons, winter/summer, of the renewable energy amount in the grid. The content of the article is based on the analysis and correlation of different sources of information at national and European level, showing clearly that the new advantage of the area can be quickly erased by reaching the limits of the network's capabilities. In conclusion, we consider that in the next period, 2023–2025, the investments in the new electricity transmission plants, from west part of Romania, will satisfy the demand for electricity consumption at the level of the quality indicators.



Title: *Study of MOS and IGBT transistors at switching with variable fill factor*

Authors: C Cunțan, I Baci and M Osaci

Abstract: In this paper, the functionality of MOS and IGBT transistors is examined under identical working conditions, both in terms of command frequency and load circuit. A variable duty cycle and variable frequency signal generator is used to control transistors. Various electronic components and Arduino–UNO modules, as well as the 16x2 LCD screen, were used to create the signal generator. The control signal is amplified by a current amplifier to adapt the output voltage to the value required to control the transistors. The operation of MOS and IGBT transistors at various operating frequencies with resistive or inductive loads is compared. Thus, the communication times of the transistor capsules were determined at various operating temperatures. The temperature was determined indirectly by connecting a thermistor to the transistor capsule.



Title: *Efficiency and profitability of solutions to obtain hydrogen with electricity support*

Authors: M Ambro, A A Minda, S Mortan, A Dragoș, D Știrb and M Lolea

Abstract: The paper presents some classic ways to obtaining hydrogen in comparison with the use of electricity obtained from renewable energy sources, such as solar energy and photovoltaic panels together with electrolyzers. The case where renewable energies appears is where hydrogen is generically named as "green" because the processes for obtaining it are ecological. For each situation presented, the authors make cost and energy efficiency analyses. For electrolysis, are proposed solutions to increase energy efficiency and profitability through the use of automatic control systems that allow the maximum use of Renewable energy Sources. Solutions for the final utilization of hydrogen and oxygen resulting from electrolysis are also presented. The conclusions resulting from the study are presented at the end along with the authors' own observations.



Title: *A few ways to improvement the heat pumps integration in buildings in correlation with electrical facilities and smart control*

Authors: A Sărăcuț–Ardelean, A A Minda, S Mortan, G Ias, D Haica and M Lolea

Abstract: In the paper, the authors propose a few solutions to increase the energy performance of heat pumps integrated into buildings and to which electrical processes are applied through the actuations and commands. Comparisons are also presented between electric heating systems with those through heat pumps and boilers with a case. The characteristics of heat pumps and the way to reduce the external intake of electrical facilities are analyzed to increase energy efficiency and reduce operating costs. Applications with the use of automation and smart control with the electronic equipment involved in the schemes are presented. The conclusions of the paper are given in correlation with the calculation results and the performed analyzes.



Title: *Using ADVISOR for Battery Electric Vehicle configuration*

Authors: Chiver O, Neamt L and Barz C

Abstract: ADVISOR (Advanced Vehicle Simulator) is a software realized by the Department of Energy with the National Renewable Energy Laboratory (USA), and industry partners. The goal is the configuration, test, and characteristics determination of all types of cars. The software is created to run under Matlab and holds a library that includes the main components of a vehicle. All these systems are based on the elementary components from the Simulink library. In addition, the user has access to the source codes of the systems, so he can change specific parameters, or redefine a certain command logic so that he can create a customized car. In the current work, the program will be used for the purpose of configuring electric cars, choosing the suitable motor, and estimating the performance of the completed model. This work is intended to be an appeal and an example for electrical engineering students in using this program; the main stages of vehicle configuration, the tests for choosing a specific motor drive in terms of the car's destination, and the possibilities of changing some parameters, will be presented, so the user student understands the importance of the used components or changed parameters. The authors consider that such a program, made especially for configuring and estimating the performance of vehicles (in this case electric), with results unanimously accepted as very accurate, should be used in the didactic activity considering the challenges that arise as a result of the desire to accelerate the transition to a transport "as much as possible electric".



Title: *EasySoft using in lights control road*

Authors: Barz C, Chiver O, Erdei Z, Onysko O and Živković P

Abstract: With the increase of the population, the special magnitude of the urbanization phenomenon, the problem of displacement must be taken seriously because the motorization increases, and the infrastructure of the circulation system and subsystems do not unite in a unitary system and are not built according to economic, social and ecological needs. That is why traffic light intersections need regulation by traffic light flow lines, by knowing the level of traffic flow and its management. With the advent of the automobile and the transition to series production of various car brands, the road transport networks developed in parallel, connecting the large urban agglomerations. Urban populated centers, but also rural ones, are directly affected by the exponential increase of population mobility and by the increasing circulation of goods. Road traffic is the orderly movement of vehicles and people, focused on land specially designed for this purpose, roads. Paper present automation of the traffic lights using an intelligent relay from the Easy820–DC–RC gamma, which is programmed with EasySoft through the Ladder Diagram language.



Title: *Solutions to Improve Collection Efficiency for Industrial Plate–Type Electrostatic Precipitators*

Authors: G N Popa, C M Diniş, A Iağăr and C D Cunţan

Abstract: Plate–type electrostatic precipitators are the largest and most used industrial control dusts, most applications are in the production of electricity (thermoelectric power plants). In many industrial applications, plate–type precipitators have three sections and silicon–controlled rectifier power supplies type. Although, the collection efficiency obtained by these type of precipitators are more than 95%, most of the dust particles with diameter less than 10 μm remain un–collected. To improve the collection efficiency it can be use different electrical and/or mechanical options. To improve the collection efficiency of industrial plate–type precipitators, the paper presents two practical options. The first solution would be replacing the power supplies – silicon–controlled rectifier – with other special power supplies (intermittent power supplies, high frequency power supplies) depending on the dust resistivity; the second solution would be to add a new section at precipitator – an expensive solution, usually the last. The technological and electrical sizes, simulated and measured, are present for proposed solutions.



Title: *Digital multimeter made with Arduino Uno development board*

Authors: C M Diniş and G N Popa

Abstract: This paper presents a digital multimeter made using the Arduino Uno development board. This digital multimeter can measure DC voltage, DC current, DC power and also AC voltage, AC current and apparent power. For the practical realization of the digital multimeter, two constructive variants of electronic schemes are proposed in the paper. In the first constructive variant, a single Hall current transducer is used, both for the measurement of the AC current and for the measurement of the DC current, its role being established by a switch S with two positions and several normally–closed and normally–open contacts (6 contact groups). The main disadvantage of this constructive variant is the limitation of the consumer's power, because a current greater than 0.5A cannot pass through the S switch. The second constructive variant eliminates the disadvantage of the first variant by using one Hall current transducer for current measurement, one for AC current and one for DC current. Experimental measurements were made with the digital multimeter built in both AC current and DC current.



Title: *Researches regarding power quality at the hot rolling mills' power supply*

Authors: P I Ivăscanu, G Militaru, M Panoiu and C Panoiu

Abstract: The research that is presented in the paper was based on measurements performed in a hot rolling line feed station. The measures are suitable for using to analyze power quality. An analyzer for three phase power quality was used to take the measurements. The voltage and current values, as well as the active, reactive, and apparent powers, were all measured. The nonlinearity of the load has an impact on the power quality, according to the analysis of the measurements taken. Because of this, the reactive power is high and the power factor is low. A reactive power compensation system and harmonic current filtering system are necessary for this. Measurements were taken both with and without the load (when hot rolling was not in use) in order to more thoroughly examine how the load affects the power quality. It is clear from the analysis of these results that the presence of the load affects the power quality.



Title: *Real time detecting deformation on pantograph contact strip based on image processing technique*

Authors: G Militaru, M Panoiu and C Panoiu

Abstract: The traction power supply system of railway vehicles has two main components, the catenary contact and pantograph. During the operation, contact is influenced by electromechanical wear phenomena. Deformation on the pantograph contact strip affect its power transmission quality because of contact loos with the catenary, overall reliability of the railway system is reduced. Their maintenance and inspection are usually done for periods of time with negative consequences in terms of costs and safety. Thus, in this study we developed a contact strip monitoring

method based on image processing for inspection to measure the contact strip thickness. The measurement system is made through a single camera which acquires images from contact area measuring the thickness of the contact strip using image processing techniques.



Title: *Systematic Review on Aquaponics and their Automated Control*

Authors: D Alexuta, V E Balas and M M Balas

Abstract: Aquaponics represents the integrated production of fish and hydroponic crops using recirculation of a nutrient solution in such a way that fish excretions are used as fertilizer for plants. There is a great interest in aquaponics in the EU and around the world due to increased interest in sustainable agriculture. Such systems can operate in any area and can be controlled remotely via mobile applications. In this article, we will introduce the different types of aquaponic systems: media-based aquaponic systems, nutrient film techniques, and deep-water culture. We will also present various developments of aquaponic systems in Romania. Additionally, we will provide a review of recent literature in the field of aquaponics, including different statistics. Many studies have been conducted on such aquaponic systems, reviewing the general concept, components, types of parameters, and factors influencing the productivity and efficiency of such systems. We will discuss the water parameters in aquaponics that are important for both plants and fish. Maintaining water quality parameters is crucial to provide sufficient nutrients for growing fish and plants, and monitoring these parameters is essential for the health of the aquaponic system.



INTERNATIONAL CONFERENCE ON APPLIED SCIENCES - ICAS 2023 -



Session 4 – MECHANICAL ENGINEERING

Title: *Microstructure evolution and some mechanical properties of Ti6Al4V titanium alloy*

Authors: A Kaouka

Abstract: Ti6Al4V titanium alloy is widely used in biomedical field. Owing to their outstanding mechanical qualities. However, Ti6Al4V titanium alloy a weak formability/plasticity at room temperature, and it requires a significant quantity of energy to make. An investigation was carried out on the mechanical behavior and microstructure development. The flow behavior will be greatly affected by different starting microstructures and deformation process factors. The impacts of pulse current on the yield strength and microstructure of the titanium alloy are studied. It was discovered that as current intensity increases, the yield strength of the titanium alloy diminishes. In addition, the optimum hot processing areas, unstable regions, and the connection between power dissipation efficiency and the deformation mechanism in the hot processing map are described. This study has been conducted to analyze the microstructure evolution law and deformation mechanism during hot deformation, including dynamic recrystallization and dynamic recovery in the single-phase region and dynamic evolution of the phase in the two-phase region, in order to precisely control the microstructures.



Title: *Corrosion behavior and growth kinetics of boride Ti6Al4V titanium alloy*

Authors: A Kaouka

Abstract: Boride layers prepared by pack boriding at 950 °C for 4 h in Ti6Al4V titanium alloy. The growth kinetics and morphology of TiB and TiB₂ whiskers in the boride layers were investigated as one of the important ways to improve surface properties of Ti6Al4V titanium alloy. The growth and morphology of TiB whiskers are significantly affected by alloying elements in the alloys. This study investigated the impact of alloying elements in Ti6Al4V titanium alloy on the development kinetics of TiB whiskers and the thickness of the boride layer. On the Ti surface after boriding, an outer TiB₂ layer and an interior TiB whisker + Ti layer are produced. The diffusion rate of active B atoms, and stall the growth rate of TiB whiskers even more. In addition, corrosion characteristics of boride layers immersed in a neutral solution of sodium sulfate and sodium chloride are investigated in this study. When the corrosive atmosphere produced by the combustion reaction of sodium, sulfur, and oxygen. Tribocorrosion experiments were also carried out using a revolving tribometer and a standard three-electrode electrochemical cell.



Title: *Identifying Mass Inhomogeneity in Beam-Like Structures Using an Artificial Neural Network Trained with Analytical Data*

Authors: C Tufisi, AT Aman and GR Gillich

Abstract: This paper presents a novel approach for identifying mass inhomogeneity in beam-like structures using an artificial neural network (ANN) model. The proposed method is based on an analytical relation which allows to determine the natural frequencies of a beam with changed mass on different sections of the structure. The modified mass influences the natural frequencies of the beam, which can be utilized to identify and locate the mass inhomogeneity. The proposed approach comprises two main stages. In the first stage, the analytical relation is

employed to generate data for training the ANN model. In the second stage, the trained ANN model is put to the test using both finite element analysis (FEM) and experimental measurements to validate the accuracy of the model predictions and demonstrate the effectiveness of the proposed approach in a practical setting. The findings illustrate that the proposed approach has a high level of accuracy in identifying mass inhomogeneity in beam-like structures, with a very high accuracy rate. The proposed approach has the potential to improve the accuracy and efficiency of mass inhomogeneity identification in various industries, such as civil engineering and aerospace, which can lead to enhanced safety and reduced maintenance costs.



Title: *Detection of Delamination Size in a Five-Layer Cantilever Beam Using Natural Frequencies and Artificial Neural Network*

Authors: AT Aman, C Tufisi and ZI Praisach

Abstract: Delamination is a common type of damage that occurs in composite materials, which can lead to catastrophic failures if not detected and repaired in time. The use of natural frequencies and artificial intelligence techniques, such as artificial neural networks (ANNs), has shown great potential for detecting delamination in composite materials. In this paper, we present a study on the use of natural frequencies and ANN to detect the delamination size in a five-layer cantilever beam made up of three 1 mm steel layers and two 1 mm PVC layers. The proposed approach involves analyzing the natural frequencies of the beam and training an ANN model using the obtained data to predict the delamination size. The accuracy of the proposed approach is evaluated by comparing the predicted delamination size with the actual delamination size determined by means of FEM simulations. The results show that the proposed approach has a high level of accuracy in detecting delamination size, with an average error of less than 5%. The proposed approach has the potential to improve the accuracy and efficiency of delamination detection in composite materials, which can lead to enhanced safety and reduced maintenance costs in various industries, such as aerospace, automotive, and construction.



Title: *Design and strength analysis of a new construction of a sweeper with an independent surface copying system dedicated to small loaders and front loaders*

Authors: Ł Gierz, W Łykowski, G Ślaski, J Górecki and M Nowaowski

Abstract: Most enterprises and farms have paved parking lots, yards, warehouses, or sidewalks that need to be cleaned or cleaned. There are many sweepers available on the Polish and European markets, but there is still a lack of a solution that would be mounted on pallet forks and would have an independent copying system to support sweeping surfaces with different inclinations. The aim of the work was to develop a conceptual design for a new sweeper equipped with an independent surface copying system dedicated to small loaders and front loaders, as well as strength analysis of the main frame. The conceptual design included an analysis of available solutions, development of a 3D CAD model of the new sweeper, and a detailed strength analysis of the sweeper's main frame using the finite element method (FEM). The sweeper model was made in the Autodesk Inventor program, while the FEM strength analysis was made in the Siemens NX program. The designed frame model did not have nodes in which the stresses would be greater than 25% of the allowable stress in the material structure and 33% of the maximum allowable stress in the structure of the joints. The sweeper developed new design fulfills all the assumed functions and has a good chance of application.



Title: *The defects analyses of mechanical transmissions*

Authors: A Bara, R G Gillich and C Hatiegan

Abstract: This study aims to present the defects that can occur in mechanical transmissions and their classification. Mechanical transmissions are a set of mechanical elements kinematically linked to each other, having strictly

determined movements. Each machine part can be designed and executed separately, but within the assembly, its operation is influenced by the operation of the other machine parts that are part of the transmission. In the context in which the geometric and kinematic parameters required to be achieved by a mechanical transmission are increasingly high and the operation at these parameters must be achieved without accidental stops, a more accurate knowledge of all the defects that may occur is required. Knowing the faults of the transmissions and identifying the causes that generate these faults will allow establishing the measures that must be taken to eliminate them.



Title: *The determination of the most environmentally damaging stage of the shrink film packaging process using LCA*

Authors: P Walichnowska

Abstract: The process of packing bottles in heat-shrinkable film, like any technological process, affects the environment. That is why it is so important to monitor these impacts at every stage of the process and, if necessary, introduce changes to minimize them. The article presents an analysis of the impact of individual stages of the mass packaging process on ecosystems, human health and resources, performed in the SimaPro program. The process of packaging bottles in heat-shrinkable foil was divided into five stages. The analysis shows that the most impactful stage of the process is the stage of sealing the film in all three categories.



Title: *Determination of reliability of cement mills*

Authors: T Vasiu and A Budiul Berghian

Abstract: For any industrial entity put into operation, the problem is that it fulfils its specified function, under certain conditions of use and for a specified period of time, i.e. to have an appropriate reliability. In calculating the reliability of industrial entities in general and cement mills in particular, the main problem is to obtain the necessary information. They may be obtained from laboratory tests or tests under normal operating conditions, from maintenance teams, or from specialized control institutions. The general opinion is that only tests under normal operating conditions can provide real data on the behaviour of entities, subassemblies, and their component parts, which is why; in general, reliability calculations are based on data obtained from so-called operation / failure reports. Therefore, considering this opinion, the reliability of cement mills was assessed following the operation of such a machine.



Title: *The dynamic behavior of the truss treated in the numerical analysis which elements are defined as truss or beam*

Authors: D A Pîrsan, Z I Praisach, L Cîndea and A T Aman

Abstract: Finite element modal analysis can be performed on a truss, which elements can be treated as either a truss or a beam. In this paper, we considered a Warren-type truss that is hinged at both ends. We presented the natural frequencies and modal shapes for the truss when the elements are considered as a truss and a beam, where the elasticity modulus for one element was reduced by 25%. We analyzed the dynamic behavior of the structure for the first six vibration modes. The results indicate that if an element of the structure becomes more elastic, the natural frequencies of the trusses increase, and the percentage deviation is not directly correlated with the modified element and the vibration modes.



Title: *Alternative Fuels for Internal Combustion Engines: A Review*

Authors: S A Rațiu, D M Stoica, A Josan and C Pinca-Bretotean

Abstract: In the context of the aggravation of the global environmental crisis triggered by ongoing climate changes, the need to identify eco-friendly solutions for current problems has become more and more pressing. One of the

causes of climate change is the increase in the atmospheric concentration of pollutants from the exhaust gases generated by the burning of conventional fuels in internal combustion engines. Thus, it became imperative to adapt fuels to environmental needs, which led to the design and application of alternative fuel production technologies. This article is a review of the most important alternative fuels for internal combustion engines, as well as a presentation of the technologies by which they can be obtained.



Title: *Dynamic simulation of the differential gear in road vehicles*

Authors: I Zs Miklos, C C Miklos and C I Alic

Abstract: The differential gear is a mechanism that is part of the kinematic chain of the vehicle's transmission. The differential gear has the role of dividing the self-propulsion power flow received from the main drive into two branches, each transmitted to a motor wheel, giving them the possibility to rotate with different angular speeds, depending on the self-propulsion conditions. The present work presents the possibilities of computer-aided design and 3D modeling of the main drive and differential gear, respectively the bevel pinion, the crown wheel, the planet pinions and the satellites, using Autodesk Inventor Professional. The 3D model of the main drive – differential gear assembly, considered as a mechanism, was subjected to a dynamic study, using the Dynamic Simulation module. This involves the modeling of the kinematic couplings, the definition of the drive movement parameters and the external loads, respectively the graphical visualization of the kinematic and kinetostatic results for the various components of the mechanism, in real operating conditions, during a kinematic cycle. At the same time, based on the obtained results, the analysis by the finite element method of the most requested component elements, under the conditions of driving in a straight line, respectively in a turn, is presented.



Title: *Study on internal combustion engine lubricants and hybrid vehicle transmission oils*

Authors: D M Armioni, I Ionel, S A Rațiu and A Gidali

Abstract: In the next few decades, the automotive industry will be very different than it is today, due to the rapid growth of electric mobility solutions such as hybrid and electric cars. Featuring unconventional systems, these new vehicles present unique lubrication and cooling challenges. Particularly, the heat engine of a hybrid car operates in a lower temperature range than a traditional car, which presents difficulties for engine oils produced to function in a standard regime at higher temperatures, perpetually, and with smaller fluctuations in temperature. This article compares the specifications for lubricants for the internal combustion engine and for the transmission oils of hybrid vehicles, highlighting the particularities of each of them and their importance for the proper operation of the engine.



Title: *Group technology in intelligent manufacturing*

Authors: P Kostal, P Telek and M Matusova

Abstract: Current engineering production is characterised by rapid changes. These changes arise due to the shortening of product life cycles. Manufacturers are forced to introduce upgraded products at shorter intervals based on customer requirements. In this paper, we focus on the possibilities of production upgrading by using a group technology in the flexible manufacturing system. The production capabilities of one of the production machines in the manufacturing system will be analysed. This production machine is a lathe that produces one of the essential parts of a finished product. Determine what variations of this part can be produced without changing the physical configuration of the machine.



Title: *Combining terrestrial scanning with video images in traffic accident reconstruction*

Authors: A Dascăl, M Popa, L Janjetovic

Abstract: In the activity of expertizing road traffic accidents, it is known that many times the technical expert is faced with the lack of data necessary to create a reconstruction that faithfully reproduces the dynamics of the accident, which is superimposed on a deficient investigation by the police bodies in front of place and approximate measurements make his work difficult. However, there are situations when road traffic accidents were caught by digital on-board cameras implemented in road vehicles or even CCTV video recordings obtained by traffic monitoring systems, these constitute a valuable source of data for the expert because they lead to the possibility of determining the speed the vehicle in the moments leading up to an accident and/or even at the time of the accident. On the other hand, the increased development of photogrammetric techniques and the use of drones in terrestrial scanning of the accident site currently offer a great facility in the reconstruction of road traffic accidents. The present paper presents an alternative method to the classical one, which combines classical research with video image processing and the photogrammetric technique provided by Agisoft Metashape, achieving qualitative results in accident reconstruction by obtaining a physics-based 3D projection of simulated vehicle motion on the real vehicle motion recorded by CCTV camera. Thus, the accident reconstruction using combined methods, although it requires an effort of time and especially resources from the expert, allows a thorough reconstruction of the vehicle's movement. For this reason, the widespread application and improvement of road traffic monitoring equipment is necessary, especially in congested urban areas or prone to road accidents.



Title: *Design and analysis of equipment intended for the production of prototypes*

Authors: M Kusá, R Holubek and R Bočák

Abstract: In mechanical engineering, one of the essential components of every manufactured part is their structural design, the production of prototypes and, of course, the testing of durability, bearing capacity and load. One of the effective and affordable technologies that could be used to eliminate this deficiency is the additive manufacturing technology, which enables the creation of three-dimensional objects using various additive methods. This technology becomes a very powerful tool for the modern approach to the development of prototype products in all branches of industry, allowing a significant reduction in development and implementation time. The basic prerequisite for the success of a new product is that it achieves the highest possible quality, both in terms of utility for the consumer and in terms of technology in relation to the production process. The article will deal with the design of the device working on the principle of Fused Deposition Modeling and its peripherals. Among the most important performing activities of the designer is the analysis of the proposed model with regard to the strength and the resulting accuracy of the created three-dimensional object. The input requirements that the proposed device should meet were defined. Based on these criteria, a numerical and strength analysis was developed using the FEM finite element method. The simulation was carried out on the basis of the hypothesis of shear stress transformation work, which is among the more accurate for the tough materials used. The analysis monitored and evaluated the deformations in the extreme positions where the largest deformations were expected to occur.



Title: *The importance of reverse engineering and 3D scanning in remanufacturing hydraulic drive system components in the circular economy context*

Authors: A P Chiriță, A A Benescu, A M Borș and Ș M Șefu

Abstract: Reverse engineering and 3D scanning are critical tools for remanufacturing components in the context of the circular economy. By disassembling and measuring existing components, companies can design and develop new parts replacing the old ones, parts that are compatible with the original equipment, either to repair faulty subassemblies, or to improve efficiency or functionality. 3D scanning captures all information needed to reproduce components, allowing them to be created using additive manufacturing processes. Combining these technologies reduces waste by maximizing the use of existing products, and it reduces the amount of new raw materials and energy required for remanufacturing as well. The circular economy encourages companies to embrace a sustainable

approach by considering the entire product lifecycle. Adopting these principles leads to a more environmentally friendly business model, avoids waste, reduces material consumption, and creates new revenue streams for remanufactured products. The current paper shows a way of adapting the principle of reverse engineering and a particular way of involving 3D scanning for the remanufacturing of hydraulic system components by using additive manufacturing. The use of 3D scanning is necessary in the reverse engineering process especially for components with complex geometry; in the present paper, the geometry of such a component is created.



Title: *Description of current situation on field of prosthetic lower limbs*

Authors: P Nižňan, P Košťál and V Prajova

Abstract: This article describes an actual situation in prosthetic limbs field focused on lower limbs prosthetics. In the first part of article there is a description of main issues causing lower limb loss. Lower limb loss brings many problems that affect person's quality of life on daily basis. Following description comes explanation of types of amputations and exarticulations that are essential to set right composition of prosthesis. Next part of the article focuses on setup for prosthesis, their composition and possibilities of used parts as well as types of controlling the prosthesis. The last part of the article is based on examples of already existing prosthesis. Description of their functionalities and their improvement that they bring into prosthetic industry in comparison with regular prosthesis. Finally, main ideas for improvement in that field are included.



Title: *Numerical simulation of the welding process for the prediction of temperature distribution on Al/steel explosion welded transition joints*

Authors: P Maćkowiak and D Płaczek

Abstract: In modern constructions, combinations of various materials are used to reduce the weight of technical objects while maintaining high strength. Joints of materials with different mechanical and chemical properties are a significant engineering problem. An example of such a connection is a welded joint of an aluminum alloy and steel using an explosively welded transition joints. The welding temperatures of steel and aluminum differ significantly from each other. When designing a welded joint using an explosion-welded connector, the aluminum alloy must not be overheated. Experimental studies can be conducted to minimize the dimensions of the joints. However, these studies are very expensive and time-consuming. This is due to the need to produce explosively welded plates and welded joints. An alternative method is to carry out numerical analysis. The aim of the work is to present a method of modeling temperature distributions during welding joints with the use of explosively welded transition joints. The method of manufacturing the connector and the Al/Fe welded joints was described. The method of modeling the connection and material properties in the Abaqus program was presented. The results are the temperature distribution in the explosively welded transition joints. In addition, the maximum temperatures were compared with the limit value allowed for the aluminum alloy.



Title: *The importance of implementation EN ISO 3834 and EN 1090 standards in the production of steel structures*

Authors: E Bajramovic, E Bajramovic, E Bajramovic and F Islamovic

Abstract: Fractures of welded structures in operational conditions most often occur in the welded joint or in its immediate vicinity. That is why special attention is paid to ensuring the quality of the welded joint. The application of the EN ISO 3834 and EN 1090 standards in the production of steel structures aims to ensure the highest possible quality of welded joints, and thus the quality of the structures as a whole. The quality of the weld is achieved by welding, and the quality control of the weld provides a check on the reliability of the product. Increasing requirements in terms of reliability, better use of materials, lower weight and cost of constructions, but also high use of supporting structural elements, and thus of welded joints, leaves less and less room for defects in welded joints, which is why constant control and follow-up with documented procedures is required.



Title: *Review of the use of welded joints with Al/Fe explosion-welded transition joints*

Authors: D Płaczek and P Maćkowiak

Abstract: Joining structural elements using dissimilar materials is important in mechanical engineering. In order to meet the trend of improving the performance of manufactured structures, materials with a high mass are replaced with lighter ones that meet the strength requirements. An example of such a solution is explosive welding. Explosively welded materials have been used not only in the form of plates, but also in the form of transition joints. This solution is an alternative option for twisting and riveting dissimilar materials burdened, among others, with the problem of galvanic corrosion. Compared to riveted, screwed, keyed, wedge joints, welded joints ensure monolithicity of materials, greater stiffness and strength, watertightness and easier protection against corrosion. The aim of the work is to present the possibility of using welded joints of steel and aluminium alloy with the use of explosively welded Al/Fe transition joints. The paper pays special attention to the area of application of this type of connection and the dimensions of the transition joints, especially their thickness. The greater the thickness of the base materials, the less the effect of welding on the transition zone. This zone is a critical element from the point of view of the load-bearing capacity of explosively welded materials. This has an impact on the difficulty of making welded steel/aluminium alloy joints using explosive welded transition joints with reduced dimensions.



Title: *Selected aspects of grains breakage probability affecting the processing machines design*

Authors: W Kruszelnicka and P Leda

Abstract: The breakage of biological grains (cereals) appears very often during processing operations such as harvesting, transporting, dehulling, milling, extraction. This phenomenon is an effect of subjecting the grains to stresses of different directions, frequency and amplitudes. The breakage probability in the industrial machines depends strictly on the design and operational features of machines and primarily on the mechanical properties and breakage behavior of processed materials. For the cereals the factors affecting the breakage probability are still under research. In this study the selected aspects of cereals breakage probability will be discussed based on the static compression tests results of different types of grains with moisture content from the range of 8% to 26% and different sizes ranges, subjected to repeated loadings. The results showed that the breakage probability varies for different types of grain, moisture content, size and number of impacts. The results show a direction for the improvement of machines design bearing in mind the variability of grain mechanical resistance to loads.



Title: *Modification of cavitation erosion resistance of aluminium alloy 2017 A by duration of artificial ageing heat treatment at 140 °C*

Authors: A N Luca, I Bordeasu, B Ghiban, C Ghera and C L Salcianu

Abstract: Aluminum-based alloys are known for their applications in most fields, due to their physical-mechanical properties and their technological capability to lend themselves to the realization of various parts, with geometrical configurations ranging from simple to complex.

These parts include those working in hydrodynamic flow fields, characterised by certain degrees of destruction by erosion created by microjets and shock waves. Such parts are the propellers of motor boats, the impellers of household pumps, radiators and pumps in the cooling system of motor vehicles. As erosion causes the surface of the part to change, causing it to fail, research is currently being developed to increase service life by increasing the resistance of the structure to cavitation erosion. This is the direction of the present work, the results of which show the effect of artificial ageing treatment at 140 °C, with a holding time of 12 hours, of aluminium alloy 2017 A. Comparison with similar results obtained previously on the delivery condition and on artificial ageing at the same temperature, with holding times of one hour and 24 hours, shows that the structure obtained by the analysed heat treatment regime is a variant for increasing the service life to cavitation stresses.



Title: *Accuracy of the profile of lead screws during whirling machining*

Authors: V Panchuk, O Onysko, C Barz, V Kopei and J Kusyi

Abstract: Modern high-performance production of threaded lead screws is carried out using the whirling process. At the same time, the deviation of the profile angle can reach $\pm 0.5^\circ$. The paper proposes an algorithm for recalculating the profile of the tool, the novelty of which is the application of a non-Archimedean approach to the shape of the screw. The geometric analysis of the screw surfaces and the kinematic analysis of the movement of the cutting edge relative to the part clearly show that the only correct point of view from the point of view of theoretical justification and from the possibilities of practical support is the view that the shape of a real screw corresponds to a convoluted helicoid surface (the type of worms with such a shape is called ZN). At the same time, the Archimedean screw (e.g. ZA worm) as well as the involute screw (e.g. ZI worm) are singular theoretical cases of the convolute screw (ZN worm). The screw profile deviation will be minimized, if the ZN model used.



Title: *Coating stress analysis under temperature increase for diamond and silicon CVD coatings*

Authors: I Timár, M Boleraczki and É K Pfeifer

Abstract: The CVD-coated parts are found in a wide range of applications and must meet high quality requirements. The stress state due to temperature changes on diamond and silicon dioxide coated parts is studied. For single-layer coatings, the stress state under tensile load is analysed. In addition, the strength of the diamond-coated part under bending stress is also investigated.



Title: *The human body a potential source for harvesting clean energy and sustainable use*

Authors: A Pop Vădean and I Smical

Abstract: In recent years energy harvesting has attracted well-deserved attention as a technology capable of replacing or supporting a battery for the operation of various mobile electronic devices. In environments where stable electricity supply is not possible, energy harvesting technology can guarantee safe leisure for human beings. Harvesting multiple watts of power is essential for efficiently charging mobile electronic devices such as laptops or cell phones. The reality is that with every heartbeat or every step taken, human beings are constantly dissipating energy. Harvesting this energy from daily human activities and converting it into electrical energy is also becoming a viable solution for medical electronic devices closely related to human health. In this article, we will review the energy sources of the human body, its distribution, and applicable energy harvesting technologies.



Title: *Development of a highly automated construction and production planning framework for the production of floating houses*

Authors: I A Simon, M Boleraczki and I G Gyurika

Abstract: Floating houses can be used not only as residential properties but also as commercial purposes. The following factors are important for the design and construction: the elements must be prefabricated with high quality and precision, easy to transport, easy to assemble and install on site. A number of requirements arise during the design process, for example when choosing the size and position of the windows and the design of the balcony. Both the size and position of the door and the window can be changed in the wall panel and the tracking of these changes can be automated in the 3D model. There are several options for automating the wall panel. The automation can be Excel driven, i.e. data is retrieved from an Excel spreadsheet. In addition, a solution with logical parameters can be implemented. The third solution is the iLogic system built into Inventor, which is an environment that can be programmed in Visual Basic. Our aim is to develop a framework for the highest possible level of automation in the design of floating houses.



Session 5 – MATERIALS ENGINEERING

Title: *The Advanced Applications of Earth Materials based upon the Adsorption and Absorption Processes*

Authors: S Aluvihara, C S Kalpage, P W S K Bandaranayake and T Latinovic

Abstract: Earth materials are unevenly distributed in the world in different forms and phases. Solid earth materials play an outstanding preface among earth materials in other phase because of the availabilities in their manifold forms both natural or manmade forms such as the bulky forms and powdered forms. Adsorption is an outstanding characteristic regarding some solid materials based upon the adsorption capacities of such materials with respect to some specific compounds that presence in liquids and gases. Clays and dolomites are predominantly having multi physic–chemical characteristics. As the general outcomes of most of recent researches regarding earth materials, there were observed some specific characteristics from clays, dolomites, feldspar and some other minerals including the adsorption character. In the existing research there were expected to characterize three different selected clay varieties and a selected dolomite variety in microscopically and chemically. The clay samples and dolomite samples were collected from the relevant locations in Sri Lanka and a few of representative samples were characterized using X-ray fluorescence (XRF) spectrometer, Fourier transforms infrared (FT-IR) spectrometer and scanning electron microscope (SEM). Our results confirmed that the presence of Fe as the most abundant element in three different clay types and Ca as the most abundant element in dolomite according the XRF characterization, presence of kaolinite, montmorillonite and some other Fe minerals in all of clays such as muscovite and calcite as the major mineral in dolomite according to the FT-IR characterization and there were observed some porous structures in all of clays and some cleavage planes in dolomites according to the SEM micrographs. Based upon above results and literature reviews of them, it is possible to recommend some clay species and dolomites with similar compositions of these clays and dolomites for the developments in water treatment applications to remove some heavy metals, pathogens, organic pollutants and hardness from different types of waste water due to the adsorption capacities of such clays and dolomite which can also be enhanced with some possible alterations such as the nano-particles, nano-filters and pallets.



Title: *Simulation of the casting and solidification process of the brake blocks intended for rolling stock*

Authors: F Bucur, A Socalici, A Josan, V Putan and C Birtok Băneasă

Abstract: The paper presents the results obtained from the simulation of the casting and solidification process of the phosphorous cast iron brake blocks intended for rolling stock. The simulation of the casting and solidification process was carried out using the SolidWorks and Altair Inspire Cast programs. A S1 type brake shoe was chosen for this process. The solidification of phosphorous cast iron brake blocks is influenced by a number of constructive and technological factors. The simulation allows analysis of technological characteristics of casting and solidification of the alloy. The solidification process influences the micro and macrostructure of the parts, their compactness, mechanical strength, dimensional accuracy and surface quality.



Title: *The variation of the hardness of high–strength steels depending on the microstructures specific of tempering*

Authors: G Mihut, M Ardelean, E Popa and I Prejban

Abstract: The properties of steel depend on its chemical composition and structure. The modification of the structure in order to change the properties in a certain way is not only the main purpose of heat treatment, but also the only purpose, because the heat treatment regime influences the variation of properties through the variation of the steel structure. It is only by correlating the variation in structure with hardness that we can answer how heat treatment influences hardness, which also depends on the stress state. The tempering results are mainly influenced by the heating temperature, holding time and less sensitively by the tempering cooling rate (air, oil) as shown in the research carried out and presented in this paper. Tempering reduces hardness, internal stresses, the amount of residual austenite and increases elongation, necking and toughness at the expense of strength. The characteristics of tempering structures are clearly superior to equilibrium (annealing) structures in that the degree of dispersion of the structure is greater and the shape of the carbides and constituents is fine globular. For this research samples were taken from specimens broken at low temperatures and prepared metallographically in the break zone. They were etched with 2% NITAL and examined under a metallographic microscope at 500x magnification, then photographed. By correlating the hardness values with the microstructures obtained over the entire recovery range, it appears that the temperature of 625 – 635 °C can be considered optimal for the final heat treatment of the rolled blanks that were the subject of this research.



Title: *Study regarding the mechanical characteristics of high–strength steels*

Authors: M Ardelean, G Mihut, E Ardelean and A Josan

Abstract: Due to the continuous development of the automotive and machine building industry, there has been an urgent need to develop steels with increasingly high strength, without compromising toughness and ductility characteristics. On the other hand, it is necessary for these steels to show high strength even at high temperatures. In this context, there is great interest in high–strength steels, with numerous studies and research in this field of research. The numerical values of the mechanical characteristics of a steel are determined through a series of tests differentiated by the type of macroscopic deformation generated, the method of applying the load, the testing temperature, etc. The most common tests used are static tensile tests and dynamic impact bending tests. This paper presents an optimization of mechanical characteristics based on the chemical composition of the steel, various heat treatment options, and testing conditions.



Title: *Possibilities of exploitation of useful metals from used Li–ion batteries*

Authors: I A Rus, C Birtok Băneasă, A Socalici, E V Nicolae and O Gaianu

Abstract: The paper presents the possibilities of recovering cobalt from used batteries. Given the evolution of the electric car market, the demand for cells of those raw materials for batteries such as cobalt, nikel, lithium will increase in the coming years. Efforts must be made by all actors involved to meet these needs in a sustainable manner. Recycling used batteries leads to the use of useful elements contained in them. Electric car batteries are part of the circular economy in which battery materials are recovered and reused to produce other batteries. Recycling is important because it reduces the pressure on the demand for raw materials.



Title: *Research regarding oxygen content reduction in steels*

Authors: I Poenaru, E Ardelean, M Magaon, A Budiul Berghian and Z Trisovic

Abstract: Actual paperwork reflects obtained results of technological analyze of reducing oxygen content in steel for pipe manufacturing, enterprised in a steel furnance equipped with a triple aggregate EAF–LF–VD. Oxygen content was measured during manufacturing process in Loading Furnace and Vacuum Degasing and has been analysed in

comparison with several parameters. The results are presented using Matlab through regression surfaces and correlation equations and highlights the influence of analyzed factors on oxygen content variation in steel.



Title: *Clay in Phase Change Materials: Review*

Authors: G Cvetanovic, P Raskovic and P Zivkovic

Abstract: The article discusses the potential of clay micro particles for use in phase change material (PCM) encapsulation. Clay micro particles possess a porous structure, a high surface area, and good adsorption abilities, making them suitable for PCM encapsulation. The robust mechanical properties and high chemical and thermal stability of clay composites make them compatible with various processes, such as mixing, extrusion, and molding. PCM/clay composites can be easily incorporated into building materials as clay is a component of many of them. Various methods, such as vacuum impregnation, melting intercalation, melting adsorption, and combinations, can be used for preparing PCM/clay composites. The main thermal properties of PCM/clay composite materials include phase change temperature, fusion and freezing heat, cooling temperature, thermal reliability and stability, and thermal conductivity. Loading efficiency and crystallinity are important parameters affecting the latent heat storage and heat release efficiency of the composite material. The crystallinity of encapsulated PCMs may be lower than that of pure PCMs, resulting in the formation of an amorphous PCM layer and lower latent heat storage than expected.



Title: *Standardization in the field of composites*

Authors: Z Trišović, T Lazović, N Trišović and P Ljubojević

Abstract: The modern era of composite materials begins at the end of the 19th century with the production of the first polymer-based artificial resins. Since then, the types and technologies of composite materials have been continuously developed and improved, until today. Their use in modern industry is progressively growing. That is why orderliness and regularity are necessary for the development, production, meeting of market requirements, exploitation and recycling of these materials. It can only be achieved through standards and standardization. Within the technical committee TC 61 of the International Organization for Standardization – ISO, the subcommittee ISO/TC 61/SC 13, which deals with composites and reinforcing fibres, operates. The American Society for Testing and Materials – ASTM International also publishes international standards. The D30 committee for composite materials operates within this organization. ISO/TC 61/SC 13 has existed since 1985, and ASTM/D30 since 1964. In this paper, an analysis of the number, types and dynamics of the publication of standards in the field of composites and related fields was carried out. Based on the analysis carried out, it was concluded that a large number of significant standards have been published, that the number of standards is increasing and following the development of new composite materials, as well as that further expansion of the concept of standardization in the field of composites can be expected. The results shown here are the result of research supported by COST action CA21155 – Advanced Composites under High STRAin RaTEs Loading: a route to certification-by-analysis (HISTRATE).



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