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ABSTRACT PROCEEDINGS

YOUng ResearcherS Conference 2019

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Belgrade Fair

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STRENGTHENING OF Al-Mg-Si AA6082 TYPE ALLOY BY ARTIFICIAL AND INTERRUPTED AGING PROCESSES

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Summary: Extrusions of Al-Mg-Si AA6082 type alloy, which have a wide range of applications in transport industry, were used in this study. AA6082 alloy shows highest strength level in among all Al-Mg-Si alloys (6xxx series), which can be achieved using different precipitation strengthening heat treatments. In this paper, two heat treatments were used to examine age hardening potential of AA6082 alloy: conventional artificial aging and interrupted aging. Solution treatment was performed at 510°C and 550°C/1h for all tested specimens, while artificial aging was done at 180°C. Interrupted aging was performed as a combination of short-term artificial aging at 180°C, natural aging for 7 and 15 days, and re-aging at 180°C. The hardening effects were estimated based on the hardness values, while processes of dissolution or precipitation of second phases, were followed by electrical conductivity/resistivity measurements.

Solution annealing at 550°C provided higher potential for age hardening under conventional artificial aging conditions than solution treatment at 510°C.

Interrupted aging performed to achieve T6I4 temper showed natural age-hardening effect only for specimen solution treated at 510°C and under-aged at 180°C/1h. In case of interrupted aging to achieve T6I6 condition, for specimens solution treated at 510°C, artificially aged at 180°C/1h and 4h, and naturally aged 7 and 15 days, re-aging at 180°C provided higher hardness compared to conventional aging at 180°C, except in case of re-aging for 4h. However, hardness level after solution treatment at 550°C and re-aging at 180°C, was lower or approximately the same level as under conventional aging conditions. Variations in electrical resistivity indicated precipitation of coherent second phase particles during under-aging at 180°C/1h, and also under interrupted aging conditions for specimens solution treated at 550°C and re-aged at 180°C/1h. In other thermal treatment conditions, electrical resistivity was decreased after artificial and interrupted aging, thus indicating precipitation of semi-coherent and non-coherent second phase particles.

Keywords: Al-Mg-Si alloys, heat treatment, interrupted aging.

GASOLINE FILTRATION ANOMALIES AND THE EFFECT ON THE OPERATION AND SUBASSEMBLIES OF ENGINES

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Summary: Filtration as a mechanical operation. Description of operation, basic classification and types of filtration. Trends in the selection of the type fuel for IC engines in Europe with reference to the Balkan countries. IC engines fuel purifier structure. Clarification of functioning, lifespan of the effective duration.

Projected flow of filtration operation in relation to the conditions of real exploitation of gasoline engines. Filtration of suspensions of very small concentrations and occurrence of anomalies. Cake filtration. Effect of filtration process anomalies on engine operation. Engine damage due to anomalies during filtration. Conclusion with recommendations for the maintenance technology of the fuel gasoline engine supply system.

Keywords: filtration, trends, anomalies, damages, consequences.

SYNTHESIS AND SUPERCAPACITIVE PERFORMANCES OF ELECTROSPUN CARBON NANOFIBERS DECORATED WITH SPINEL CO_{1.5}Mn_{1.5}O₄ NANOCRYSTALS

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Summary: Herein, a novel composite material of coupled carbon fibers and Co_{1.5}Mn_{1.5}O₄ spinel oxide crystals has been fabricated by a facile two-stage process. In the first stage, fibers were produced by single-spinneret electrospinning of polymer solutions with the cobalt and manganese acetate precursors. In the second stage, fibers were heat-treated to convert them into composite structure. Scanning electron microscopy (SEM) analysis confirmed the formation of composite fibers with spinel crystals deposited on the surface. Scanning transmission electron microscopy (STEM) and energy dispersive X-ray spectroscopy (EDS) analysis of composite fibers cross-section revealed that carbon occupies space inside spinel rings. The composite electrode delivers a specific capacity of about 740 mAh g⁻¹, at a current density of 5 A g⁻¹ in alkaline solution, which is more than 37 times superior to neat carbon fibers. Furthermore, the electrode retained 135% of its initial capacity, after 1000 cycles of galvanostatic charge/discharge at 5 A g⁻¹.

Keywords: electrospinning, carbon fibers, spinel, composite, supercapacitor.

FUEL CONSUMPTION AND EMISSION REDUCTION IN BUS FLEET MANAGEMENT: CBM VERSUS TBM

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Summary: All transit agencies are under the influence of government pressure to reduce operational costs and environmental impact. Therefore managers are forced to change or shape their operational and maintenance policy according to budget and environmental legislation. However, research focused on the operation and maintenance of the bus fleet still falls short to address the real problem of maintenance efficiency and emission reduction due to the poor and misunderstanding of bus fleet management. Therefore a lot of research papers seem to be lacking the full meaning of bus fleet management, which provoked the researcher to do the systematic literature review on bus fleet management. SLR as the evidence-based approach is used as a groundwork for future researchers as a framework that underpins key elements of bus fleet management. The second part of the paper is dealing with condition-based maintenance (CBM) implemented as a maintenance policy, which describes the real cost benefits in fuel consumption and emission reduction over time-based maintenance (TBM) in bus fleet management of a transit agency.

Keywords: fuel consumption, emission reduction, bus fleet, cbm, tbm.

RISKS IN CARGO INSURANCE

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Summary: Insurance is an economic activity that provides interested parties economic protection against various dangers that jeopardize their property or physical integrity. This protection is achieved by concluding an insurance contract, as one of the most important contracts of legal transactions. Insurance of goods in transport (cargo insurance) can be defined as a sub-branch of transport insurance that deals with the investigation of property relations between an insurer who has taken over transport and other risks characteristic for the transport of goods, and the contractor of the insurance or the insured, who for the amount of the paid premium gets security compensation for damage that can be suffered during the transport of goods. The name itself (insurance of goods in transport-cargo insurance) implies the knowledge and connection with traffic law and the insurance law. Therefore, in the paper is given a brief overview of the legal framework of the insurance of goods in transport (cargo insurance). The author aims to present the risks to which goods are exposed during the transport. It starts from the normative complex with the specifics and characteristics of this topic. The reason for processing the normative framework lies in the lack of more detailed research, due to which we have an unfavorable situation in practice. Therefore, this topic is particularly important for insurers, brokers and insurance agents, court practice, and above all for users of insurance services. The research is based on domestic and foreign literature, which was used in accordance with the adopted and accepted attitudes and norms of science and the theory of law.

Keywords: cargo insurance, risks, goods, transport, law.

REDUCTION IN WALL THICKNESS IN TANKS FOR TRANSPORT OF DANGEROUS GOODS DUE TO THE INFLUENCE OF THE TRANSPORTED SUBSTANCE - INSPECTION AND RECLASSIFICATION

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Summary: According to the requirements of the ADR/RID agreement, tanks for transport of dangerous goods of Class 2 (gases) are made from steel. The required wall thickness obtained by the calculation is increased, by the valve which includes the predicted reduction of the wall thickness due to the negative impact of the material being transported. Due to long-term exploitation, the wall thickness of the tank can be reduced below the minimum required value, i.e. the tank will no longer meet the criteria for the transport of the substance for which it was originally designed. The ADR/RID agreement prescribes the minimum test pressure for each substance, and if the calculation determines that the measured wall thickness no longer satisfies this pressure, the problem can be solved in several ways. Inspections of the interior and ultrasonic wall thickness measurement are therefore crucial for evaluation of the tank condition. This paper presents the examples of tanks in which the thickness of the wall was measured below the required value for a certain substance and suggests solutions to these problems.

Keywords: dangerous goods, ADR, RID, corrosion.

KARTING VEHICLE DESIGN PHASES WITH A SPECIAL FOCUS ON TESTING OF VEHICLE PERFORMANCE AND APPLICATION OF CAE TECHNOLOGY IN VEHICLE DESIGN

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Summary: Vehicle design is a complex process characterized by a series of activities in order to obtain the required performance of vehicles that dictate the market. By analyzing the experiences of various companies and authors dealing with vehicle design, an overview of the design of karting vehicles was performed in this paper. Based on the analysis of available literature, the authors gave their own example of the phases to be guided during the design of karting vehicles. As noted above, it is very important that the newly designed vehicle fulfills its specific market requirements to be dominant on the same market. Based on this, the authors of this paper, in addition to the design phase of karting vehicles, also gave principles for analyzing the performance of karting vehicles in terms of tractive effort characteristics, safety and stability performance, which are corroborated by the examples. An example of the testing of a virtual newly design karting vehicle using CAE technology was also shown as another possibility of testing a new model, i.e. tests of the influence of air pressure on vehicle body and ergonomic tests of the karting vehicle were carried out.

Keywords: CAE, Karting, design, testing, performance.

ANALYSIS OF CONTAINER LOADING – ROUTING IN GROUPAGE SHIPPING (CHINA – BELGRADE HUB – EUROPE)

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Summary: A company will demand of the freight forwarder to arrange either FCL transport, or LCL transport if the company ships goods of sub-optimal size with respect to standard container sizes. Whichever it may be, 90% of non-bulk cargo gets containerized. This paper analyses cost-effectiveness of the leading Balkan region Non-Vessel Operating Common Carrier (NVOCC) considering less than container load (LCL) shipments. Our research has it's emphasis on proving a more cost-effective hub for transport and unboxing of LCL shipments. The main goal is to define an optimal number of containers, with respect to the loading-routing problem, needed to transport a set of LCL shipments of different size, weight, cost, loading port and final point in order to maximize the profits of NVOCC. An appropriate mathematical model was formed through the use of the Lingo programming environment and the programming language C. As a result of this analysis NVOCC could form the OPTIMAL final price for each LCL shipment.

Keywords: container loading, groupage, shipping.

CATALYST SUPPORT BASED ON COMO CARBIDE

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Summary: CoMo carbide was prepared by impregnation with aqueous solution of metal salts and sucrose into ordered mesoporous SBA-15 silica template using carbothermal hydrogen reduction. Synthesis of CoMo carbide was done by chemical method, followed by high temperature treatment. Obtained CoMo carbide was supported with 10% Pt and further examined. Since high temperature preparation of the carbide usually produces low surface area materials, our intention is to develop a specific silicon dioxide based template for unique mesoporous CoMo carbide with Co/Mo molar ratio of 1.0. All obtained samples were characterized by X-ray diffraction, scanning electron microscopy and energy dispersive X-ray analysis. Electrochemical characterization of obtained materials was performed by cyclic voltammetry in acid solution.

Keywords: como carbide, carbothermal hydrogen reduction.

ANALYSIS OF VARIOUS IMPACTS ON ENERGY CONSUMPTION OF ELECTRIC VEHICLES

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Summary: Due to the predicted increase of electric vehicle worldwide market share, it is very important to analyze the energy consumption and the factors affecting it. The results of the research can contribute to a better understanding of the energy resources needed and vehicle autonomy, and also to the education of drivers and potential users. This paper deals with the analysis of various factors that influence the energy consumption of electric vehicles and the examination of certain mathematical models, developed to predict the autonomy of such vehicles. In addition to environmental, road and vehicle design factors, the influence of the driver on the energy consumption is also considered. Based on the conducted analysis, appropriate conclusions are drawn and a proposal for future research is given.

Keywords: electric vehicles, energy efficiency, energy consumption.

APPLICATION OF WHALE OPTIMIZATION ALGORITHM (WOA) IN OPTIMAL DESIGN OF LEAF SPRINGS OF RAILWAY VEHICLES

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Summary: This paper deals with application of biologically inspired algorithms in solution the problem of optimal design of leaf springs of railway vehicles. Approach in this research is based on method of optimization of the whale – Whale Optimization Algorithm (WOA). The main target function in application of WOA is minimization of mass of leaf spring, while retaining all the designed characteristics necessary for quality functioning of suspension of railway vehicles. The main characteristics of leaf spring are analyzed and appropriate mathematical model of optimization is established. The proposed model is applied in three concrete examples of leaf springs for axle loads of 20 t, 22.5 t and 25 t. Obtained results has shown that application of developed model based on WOA regard to conventional method of design of leaf springs provides significant reduction of mass, thus significant material savings in production of these elements of suspension of railway vehicles can be achieved.

Keywords: Whale Optimization Algorithm; WOA; Leaf springs; Railway vehicles.

MAINTENANCE OF ELECTRIC CITY BUSES – COST BENEFIT ANALYSIS

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Summary: The city transport electric-drive bus is a more and more present concept in many European cities and the world, and has a constant trend of increase. Although this drive concept was known well earlier, its significant presence in Europe has been highlighted since 2013. In addition to the proven environmental and energy benefits of use, in comparison with a diesel-drive bus, a significant advantage of the electric-drive bus is simpler maintenance and lower costs. This paper will present the Cost Benefit Analysis of electric buses from the aspect of maintenance and exploitation on the example of CTC Belgrade.

Keywords: cost-benefit; diesel bus; electric bus (eBus); maintenance.

MULTI-OBJECTIVE CONSTRAINED OPTIMIZATIONS OF VERTICAL-AXIS WIND TURBINE COMPOSITE BLADES BASED ON FINITE ELEMENT ANALYSIS AND PARTICLE SWARM OPTIMIZATION

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Summary: Extracting energy from wind is the central topic of many contemporary research papers. An attractive alternative to horizontal-axis wind turbines (the main development course) are, somewhat less known, vertical-axis wind turbines (VAWTs) particularly suitable to small consumers or off-grid areas. Although their geometry is fairly simple, aerodynamic analysis may be quite complex, thus making the subsequent structural analysis difficult to validate. This paper provides a review of possible multi-objective optimization strategies for the design of small-scale VAWT laminate blades in terms of choosing its main structural parameters: ply-order and ply-number. The starting geometric model is elementary – the blade is rectangular with constant airfoil along the blade. For numerical determination of rotor aerodynamic performances (aerodynamic force and generated mechanical power) CFD approach is employed which presents a standard, sufficiently accurate tool used in the design phase for its ability to provide transient results. Blade structure is a laminate determined by several parameters: ply numbers and their corresponding orientations. Numerous structural analyses of the composite turbine blades were performed by simultaneously applying computed maximal (or mean) aerodynamic forces with gravitational and inertial loads. Multi-criteria constrained optimizations are performed with respect to blade total mass, maximum blade tip deflection under static loading, computed natural frequencies and failure index along the blade. One of the heuristic, evolutionary algorithms is chosen – particle swarm optimization (PSO), inspired by the behavior of a group of individuals in the search for food. By combining different input and output parameters several multi-objective optimization strategies were realized, analyzed and compared and their applicability was demonstrated. Some comments, gained experiences while dealing with a real engineering problem and results concerning possible wind turbine blade structural designs are presented and discussed.

Keywords: VAWT blade, CFD, FEM, Multi-objective PSO.

THE DETECTION OF SENSOR SIGNAL ATTACKS IN INDUSTRIAL CONTROLSYSTEMS

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Summary: To improve productivity and efficiency in industrial manufacturing, the fourth industrial revolution leads to the implementation of Cyber Physical Systems (CPS) and Internet of Things (IoT) in the industrial environment. Ubiquitous communication makes CPS susceptible to external influences, which can have a negative intention; for instance, CPS are prone to various attacks and malicious threats by different adversaries. The impact of an attack on the system can lead to anomalies and serious consequences for system parts or the system as a whole. Security mechanisms must be developed in order to timely detect different attacks and to keep the system safe and protected. In this paper, we propose a method for sensor signal attacks detection in a continuous time controlled systems. The method is based on Support Vector Machines (SVM) and tested on the data obtained from the Secure Water Treatment (SWaT) testbed, a scaled-down plant that produces purified water. In this paper, we consider the attacks on raw water tank level sensor, where the proposed method successfully detects a number of attacks (without false positives).

Keywords: Cyber Physical Systems, Support Vector Machines, Industrial Internet of Things, Cyber Security, Industrial Control Systems.

PRODUCTION OF INTELLIGENT PEDESTRIAN CROSSINGS WITH IMPROVED PHYSICAL AND MECHANICAL PROPERTIES

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Summary: An intelligent pedestrian crossing is a combination of hardware and software solution with the aim to increase the safety of pedestrians when crossing the street on poorly lit pedestrian crossings. The pedestrian is being automatically detected which activate the illumination and thus informing the driver about the presence of pedestrians at the crossing. New and improved technology, obtained from the collaboration of scientific research organization and company, includes the optimization of the design of the polymer material with improved properties related to UV stability, low thermal expansion, wear resistance, impact strength, and hardness. Good mechanical properties of the materials are required due to the constant load of everyday traffic, which is of great significance to the supporting structure of the smart system of the pedestrian crossing. The importance of improving UV stability is reflected in the fact that polymers are sensitive to UV radiation of the environment, whereby they can change transparency and thus disturb light signaling. The temperature stability of the material is required due to the maintenance of relatively constant dimensions which would not impair the connection to the asphalt of the street into which it is installed. Epoxy resins, polycarbonates, and polyurethanes were tested as the polymeric materials that can meet all the requirements. The testing of the obtained polymeric materials will be carried out based on the knowledge of the conditions for the exploitation of smart systems for pedestrian crossings, which relate to a static and dynamic load, wear resistance, UV and temperature stability. The influence of commercial and synthetic additives from natural sources, which contribute to the improvement of antioxidative and UV stability, which prolongs the service life of the product, was examined. The use of additives from natural sources contributes to more economic production and sustainability on domestic and especially on the foreign market.

Keywords: pedestrian crossings; smart systems; mechanical properties; safety.

MODELING THE INFLUENCE OF THE ENERGY SOURCES AND CONSUMPTION ON THE RESULTING ECOLOGICAL FOOTPRINT

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Summary: The ecological footprint analysis is an important part of sustainability, as it allows to calculate the resources used for the needs of a country and its residents, and to compare it to the biocapacity of the same country. Multiple factors can affect the level of the ecological footprint, such as energy production, pollutants' emissions, transportation, industrial production and similar.

The logistics processes of production and transportation have a major impact on the ecological footprint because of their environmental impact, especially due to higher consumption of energy resources and, consequently, higher carbon emissions.

This paper introduces a novel approach of ecological footprint analysis in terms of energy efficiency, from the aspect of the production 4.0 and including the logistic process. The analysis of obtained data is facilitated by using the multiple linear regression approach. The aim of the analysis is to create a prediction model based on the values of specific types of energy inside the concept of Industry 4.0, aiming to decrease the ecological footprint of analyzed economies.

Keywords: Ecological footprint, Industry 4.0, logistic processes, multiple linear regressions.

POTENTIALS IN EVALUATION OF THE WOOD QUALITY IN LIVING TREES BY USING SEMI- AND NON-DESTRUCTIVE METHODS IN ORDER TO REDUCE WOOD-PROCESSING COSTS

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Summary: Being a natural, ecological and renewable resource, wood is increasingly replacing artificial and toxic materials in the manufacture of various types of packaging and other products; thus, its proper and economically justified use has become necessary. The best utilization of wood raw materials has been sought both in practice and theory, which led to development of a number of non-destructive and semi-destructive methods for the wood quality assessments in various stages of wood exploitation. In this paper, two instruments for inspection of the internal condition of standing trees were analyzed. Resistograph was designed for detection of the internal defects. In addition to assessing the condition of living trees of different species, the instrument is used to assess the wood density in various materials. The observed resistance during drilling is proportional to the change in the wood density or the relative mass of the element analyzed. The results of drilling in different spots or directions, through the cross-section and along the element, can be used to map the properties of the element. Fractometer is a device designed for measuring the strength and other mechanical properties of wood in core samples taken by increment borer from a certain part of the tree or branch examined. Fractometer can determine the maximum fracture force and bending and pressure strength of wood. It is also possible to identify the stage of decay. Due to its heterogeneous structure and anisotropy, the wood compressive and bending strengths differ between different anatomical directions even within a single species. The results of previous research in literature indicate that there is a significant positive correlation between the radial bending strength and the longitudinal compressive strength of wood. This actualizes the need for the use of different types of trees in construction, depending on the load that the wood element will be exposed. These devices provide high precision and quality in measurement and can achieve good correlation between the measured values and the mechanical properties of wood. This way, science and practice could be provided by significant data on the properties and quality of wood, while its consumption is minimized.

Keywords: fractometer, resistograph, wood quality determination and evaluation, wood consumption, wood-processing costs.

NOVEL TECHNOLOGY WITH SOLVENT EXTRACTION OF USED TIMBER RAILWAY TIES TO OBTAIN RAW MATERIAL

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Summary: Creosote is a distillation product of coal tar, thick, oily liquid and is one of the most widely used wood preservatives in the world. According to US Environmental Protection Agency (EPA), its major preservative application is for the treatment of wooden railway sleepers (railway cross ties). Timber railway ties have a limited lifespan of approximately 50 years, mechanical and biological degradation is the main disadvantage in using timber for sleepers. Chemical composition of creosote is a highly complex mixture that can contain up to 85% of polycyclic aromatic hydrocarbons (PAHs) together with 10% phenolic and 5% N-, S-, O-heterocyclic compounds. The sum of sixteen PAH compounds (US EPA) is used as an expression of its total creosote content. Timber railway ties can be reused after removal toxic substances from wooden material. Toxic substances were removed after repeated solvent extraction with dichloromethane or hexane. Cutting and grinding used wooden railway sleepers into wooden chips before solvent extraction gave high yields in PAHs recovery. Refined medium is odorless and has a natural color and structure of wood and can be used for other purposes as raw material. References: 1. E. P. Mateus, M. D.R. Gomes da Silva, A. B. Ribeiro, P. J. Marriott, Qualitative mass spectrometric analysis of the volatile fraction of creosote-treated railway wood sleepers by using comprehensive two-dimensional gas chromatography, *Journal of Chromatography A*, 1178 (2008) 215–222. 2. T. Thierfeldera, E. Sandström, The creosote content of used railway crossties as compared with European stipulations for hazardous waste, *Science of Total Environment*, 402 (2008) 106 – 112. 3. A. Manalo, T. Aravinthan, W. Karunasena, A. Ticoalu, Evaluation of using waste timber railway sleepers in wood–cement composite materials, *Composite Structures* 92 (2010) 603–611.

Keywords: timber railway ties, polycyclic aromatic hydrocarbons (PAHs), solvent extraction.

NOVEL PEM FUEL CELL CATALYSTS FOR MILITARY APPLICATIONS

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Summary: Fuel cells offer a significant reduction in weight, volume and cost compared to conventional power sources. The low heat and noise signature of fuel cells makes this technology perfectly suitable for a wide range of critical military applications such as unmanned aerial and ground vehicles, soldier portable power, silent camp, silent watch applications, and many more portable and stationary applications. Providing electrical power to meet the tactical requirements of the future battlefield will become a critical enabling technology. The most important parameters for electrical power sources in these applications are reliability and life expectancy. Corrosion of the electrocatalyst layers is one fundamental mechanism that strongly influences performance in the long run and is a major obstacle in the commercialization of PEM fuel cells. In military applications, tolerance to CO contamination is of great importance. The main objective of this work is to develop and produce several types of anode catalysts with the aim of improving HOR kinetics and CO tolerance of the anode catalyst.

Keywords: PEM fuel cells, ground vehicles, unmanned aerial.

SELECTION OF POTENTIAL AREAS FOR ESTABLISHING FOREST PLANTATIONS FOR SATISFACTION OF ENERGY NEEDS – THE EXAMPLE OF LAZAREVAC MUNICIPALITY

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Summary: The needs for energy sources in Serbia are constantly increasing. Wood as the most important (the cheapest, easiest and most affordable) energy source is not only used for energy purposes, but also for the wood industry, and it is clear that pressure on the resource is increasing. In 2016, the Institute of Forestry in Belgrade carried out a preliminary study on the establishment of forest plantations for energy needs. The municipality of Lazarevac was selected as a pilot project for the establishment of forest plantations for energy purposes. It was estimated that this municipality, given its geographical position and ecological conditions, is absolutely in line with the planned production. In selecting potential areas for the establishment of forest plantations, strict attention was paid to the current use of the available areas. The study area includes the areas that can be determined but are not necessarily required for the needs of such production. Out of a wide range of autochthonous and allochthonous species, the tree species that are most capable of exploiting the potentials of the site and provide high energy values in the given ecological conditions were selected.

Keywords: forest plantations for energy needs, potential vegetation, tree species.

DEVELOPMENT OF A NATIONAL INDEX OF FOREST FIRE RISK ASSESSMENT ON THE EXAMPLE OF SOUTHERN SERBIA

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Summary, The paper presents the results on the study of the possible application of the Canadian Forest Fire Weather Index (FWI) and the Modified Angstrom Index (Mod Ang) in forest fire risk assessments. The daily values of these indices for the period 2005-2015 were related to the forest fire database. It was found that there is a relatively weak to moderate correlation between forest fires and the values of the Canadian Forest Fire Weather Index (FWI).

In order to improve the wildfire risk assessments (including forest fires), the index was modified (Ratknić T., 2018). The modified index has a significantly greater correlation with the actual events of forest fires and consequently a much wider application in southern Serbia. The modified index can be of great importance in the future concepts of forest fire risk management.

Keywords: forest fire, assessment, risk, modified index.

ON THE IN SITU IONIC ACTIVATORS FOR ALKALINE HYDROGEN EVOLUTION

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Summary: The idea of improvement of electrocatalytic activity of conventional electrodes for alkaline hydrogen evolution by in situ electrodeposition of selected d- metals has been attracting the attention of researchers for about two decades. These efforts already resulted in a number of affordable and inexpensive solutions that enable better catalytic performances and higher energy efficiency compared to the state-of-the-art catalytic materials. In this contribution we pay a particular attention to the processes on the atomic level, and (electro)chemical factors in general, that enable observed improvement of the electrocatalytic activity of the systems activated with in situ ionic activators, using a combination of experimental and computational techniques.

Keywords: ionic activators, alkaline hydrogen evolution.

SOFTWARE SUPPORT FOR MANAGEMENT OVER MANAGEMENT SYSTEMS IN LARGE VEHICLE FLEETS

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Summary: Management systems from year to year experience increasing expansion. Almost all market-oriented companies have implemented some of the ISO standards (ISO 9001, ISO 14001, ISO 27001, ISO 45001, ISO 55001 ...). On the other hand, with the parallel development of information technologies, forms a need to develop appropriate software support for document management and processes of the management system. Literature has always recognized the need for parallel development of the information system and management system, but what is nowadays important is the development of a software solution in the service of the management system.

Keywords: Management systems, document management, software solution, ISO.

EVALUATION OF DRIVER'S ECO-DRIVING SKILLS BASED ON FUZZY LOGIC MODEL – A REALISTIC EXAMPLE OF VEHICLE OPERATION IN REAL-WORLD CONDITIONS

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Summary: It is well known that fuzzy logic is meant for processing in circumstances lacking of clear linguistic information, as well as making conclusions based on imprecise assertions and rough data. Eco-driving rules that the drivers should comply with are not always made of concrete values (exact acceleration / deceleration rates, torque or headway / distance kept from the vehicle ahead, etc.), but often linguistically expressed and subjective (e.g. soft acceleration, mid-range engine speed, soft deceleration, sufficient distance, etc.). Therefore, the authors recognized fuzzy logic potentials as an efficient tool to overcome all mentioned barriers. The primary objective of this paper is to raise the awareness on the potentials and efficiency of fuzzy logic systems' use in eco-driving as a tool for achieving more ecologically & economically sustainable road transport. The rules that drivers should follow in order to achieve and maintain eco-driving goals, as well as the parameters to be monitored to assess driver's behavior i.e. the compliance with eco-driving rules are presented in the paper. The authors propose a driver rating system based on the fuzzy logic model constructed within Mat Lab, where input parameters involve, among others: actual acceleration/deceleration rates and pressure on the acceleration pedal, while model output are driver ratings or scores (ranging from -10 to +10 points) after completed the driving cycle. A real-world example based on data collected via vehicle OBDII connector by a TEXA logging device in realistic vehicle operation conditions and consequent actual results of drivers' behavior rating tool based on the proposed model are presented in the paper.

Keywords: eco-driving, support, driving habits, driver rating system, vehicle energy efficiency.

APPLICATION OF SMALL UNMANNED AERIAL SYSTEMS IN LOGISTICS AND PLANNING

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Summary: The application of modern technologies makes it easy to collect, process, present, and apply data for logistics in hard to reach areas. Proper delivery of equipment, personnel, and materials directly affects the quality of work. The need for precise and real information about the condition of the terrain and the conditions of the environment has always existed since this knowledge enables proper planning, forecasting and task performing in the field. Improvement in the digital industry enables fast and easy transfer of unchanged digital data from the field to the information processing centers, which consequently improves decision making and planning processes. New workflows made proper logistics even more important because it increased the precision of field work and better anticipation of previously unforeseen circumstances. Work on hard to reach areas, with large slopes, non-existent and non-persistent infrastructure, and different degree of vegetation coverage requires precise planning and organization of works, in order to minimize the number of unforeseen situations and make the most expeditious workflows. This paper presents the practical application of small unmanned aerial systems for collecting a large amount of data in a short time, the processing of the data, and the production of relevant information for decision making. There are two most important aspects of this paper. First one is fast, easy, safe and precise collection of large amounts of data which is an alternative to the traditional methods. The second is computer data processing, which enables a fast and automatic transformation of raw data into relevant information in digital formats that are suitable for further processing and easily accessible to decision makers. This work shows that it is possible to record quickly and in detail a large area, and obtain real, current, accurate and high-fidelity information about each point of terrain, with high precision and reliability.

Keywords: unmanned aerial systems, Agisoft Metashape, logistics, terrain mapping, terrain modeling.

HIGH SURFACE AREA TRANSITION METAL FOAMS FUNCTIONALIZED BY Pd FOR HYDROGEN PRODUCTION AND ALCOHOL OXIDATION

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Summary: Contemporary challenges for electrochemical power sources include increasing the efficiency and reducing the cost of electrocatalysts. These requirements are crucial for the introduction of new energy conversion technologies in transportation, automotive industry and military industry. One of the strategies to achieve this goal is using lower amounts of noble metals and finding a way to maximize their utilization. In this work, we showed how to use Ni, Co, and Fe, abundant transition metals, in combination with low amounts of Pd, to achieve high activities for hydrogen evolution and alcohol oxidation reactions, in alkaline media. Using high potentials for electrodeposition, in a procedure known as bubble templating [1], we created highly porous surfaces of transition metal foams, which showed more than 100-fold increase in electrochemically active surface area, compared to flat electrodes, with pores in the μm range. These foam electrodes were then submerged in a dilute solution of Pd ions, allowing galvanic corrosion and spontaneous deposition of Pd atoms: This further increased the surface area, while the Pd agglomerates provided additional catalytic sites. Investigation by scanning electron microscopy showed formation of Pd nano-dendritic structures at the edges of pores. These electrodes were tested for hydrogen evolution, as well as methanol and ethanol oxidation, in 1M KOH. Excellent activities were demonstrated, with a good stability for all electrodes used. Relatively simple synthesis steps can be further modified by fine tuning the electrodeposition conditions, as well as using different catalytically active metals for functionalizing metallic foams. [1] B. J. Plowman et al., Chem. Commun., 2015, 51, 4331.

Keywords: hydrogen production, alcohol oxidation.

RESULTS OF TESTING OF AN SAFETY VALVE WITH A PASSIVE RUPTURE DISC OF THE IC ENGINE EXHAUST GAS CONDITIONING CHAMBER

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Summary: The combination of rupture (bursting) disc and safety valve ensures reliable operation of the valve and overload protection of pressure installations, such as steam generators, chambers, pipelines, and pressure vessels. Certain guidelines for designing and testing safety devices with a bursting disc exist in the literature, but the design of the disc can only be determined experimentally. This paper presents the results of testing of the disc design intended for the use on the IC engine exhaust gas conditioning chamber. It is required that the burst pressure of the disc membrane at a temperature of 950°C has to be 1.05 MPa. A total of 75 samples, of different thicknesses and depths of the disk weakening, at different temperature loads, were examined. It is required that the burst pressure of the disc membrane at a temperature of 950°C has to be 1.05 MPa. A total of 75 samples, of different thicknesses and depths of the disk weakening, at different temperature loads, were examined.

Keywords: rupture (bursting) disc, pressure equipment, safety valves.

SEED PRESERVING AS A RESOURCE THROUGH BIOLOGICAL METHODS OF USING THE MOST EFFECTIVE BRUCHINE SUBFAMILY SEED BEETLES IN SERBIA - STORED PRODUCT INSECTS PESTS MANAGEMENT THROUGH NATURAL ENEMIES AS FAVORABLE LEGUMINOUS HOST PLANT TRAITS

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Summary: The entire Pannonian basin is inhabited by native, or introduced, and ecologically-economically different, harmful or useful leguminous plants of herbaceous forms, perennial, bush and high vegetation. Particular importance are the numerous types of legumes that have different types of economic importance: as food (beans, soybeans, peas...) or just as seeds stored in seed banks such as Svalbard Global Seed Vault (Norwegian), which serves to store the genetic potential of species in the goal of preserving biodiversity in the future, which are all together the basics of the setting of a sustainable development discourse. For-storage pests, taxons that infest numerous cultivated species around the world are included here. More suitable as biological control agents or seed suppressors are indeed, bruchine beetles that we have been suggested and used as controlagents of leguminous plants. Furthermore, the present study indicates the possibility that those seed beetles could have role of a pre- and post-dispersal seed predators. As in a case of entomofauna of *Amorpha fruticosa* L., with particular emphasis on description of new recorded seed predation on indigo bush in Republic of Serbia and understanding of potentials and priority of biological control measures of suppressing this aggressive invasive plant in our country and region in general. Parallel studies of others legume woody or shrub seed beetles and their idioecological preferences were addressed by an example of false indigo (*A. fruticosa*) and it's weevil, also leading to an insight into the existence of four more trophic chain-linked "pairs" - host plant (legumes) and its spermatophagous (Coleoptera : Chrysomelidae: Bruchinae). The registered four new species as seed pests of trees from fam. Leguminosae were investigated with their first bionomy and eco-characteristics in numerous localities in Serbia. The methodology of quantification, different models and patterns, showing how precise biological measures against or preserving these plants can be successful, are shown in the research results. A special emphasis is placed on the biological struggle against seed plants themselves and/or against Bruchinae itself using their parasitoids as a factor in regulating their abundance. Biology, bionomy, hypothesis of legumes seed pests, have been proven theoretically and experimentally, and then described in detail as sets of facts from all aspects as a result of almost decade of studies..

Keywords: bruchinae species, stored seeds, biological measures, parasitoids.

DESIGN OF SENSORIZED INSOLE FOR NEUROPROSTHETIC APPLICATION

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Summary: The loss of lower-limb is a disabling condition that considerably alters the quality of the affected people's lives because of the limitations in performing the most common tasks. It is estimated that there are over 10 million amputees worldwide, among which four times numerous are the leg-amputees than arm-amputees. The only present solution to replace the lost limb is with a prosthetic equivalent. Despite the high technological level reached in the field of the lower-limb prostheses development, current prosthesis for this use do not restore any sensory feedback. Moreover, they cut off the CNS from the correct sensorimotor integration. That is the reason why these people suffer from neuromuscular disorders - asymmetric walking that often leads to joint degeneration and back pain. The ideal prosthesis should provide a reliable support on both legs during the gait and of course, it should enable natural sensory feedback through afferent pathways in real-time. A neuroprosthesis is a device or system that interfaces with the nervous system and substitutes or supplements some functionality in patient's body, recovering the lost correspondence between input and output in the sensorimotor process. Most of them rely on the stimulation of nerves by means of electrodes and the using of different sensors placed on the foot. The aim of this work is to construct a part of wearable closed loop neuroprosthesis for lower-limb amputees with the goal of restoring natural sensory feedback in amputees and visualizing the data obtained from the force sensors on the insole. The first purpose is to design such electronics to reduce dimensions of the prosthesis - integrating all needed components into one board and then to develop communication software between the new insole electronics and system controller. Of course, the new device has to be reliable, cost-effective and mobile. The subject can rely on the sensations conveyed to feel the prosthetic foot as his/her missing one, and step on over objects, climb the stairs or ramps without the visual stimulus. In this way, the sensorimotor loop is closed and the patient gets more control over the artificial limb and perceives it less as a foreign object - more as a part of its body.

Keywords: sensorized insole, neuroprosthesis, sensorimotor process.

DEVELOPMENT OF THE ROBOT FOR THE EUROBOT 2019 COMPETITION

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Summary: At the Faculty of Mechanical Engineering in Belgrade, within the course of the Mechatronics, we are trying to get students interested in this topic and introduce as many practical exercises as possible. From the last generation who listened to Mechatronics course, a couple of students decided to develop a robot that will participate in the EUROBOT 2019 competition. EUROBOT is an international competition of youth from the domain of robotics, which is held annually. Each team is allowed to have not more than two robots at the polygon. Robots must be completely autonomous and able to adapt to the specific polygon. This paper presents the robots development process, the students' ideas for polygon solving, and the problems they encountered. The robot development process is divided into four phases: the first phase involves setting up the conceptual framework of the plan, other one component procurement, third the mounting a robot and fourth testing a robot.

Keywords: robots, mechatronics, students, programming.

THE INCREASE OF ENERGY EFFICIENCY IN TRANSPORT OF DANGEROUS GOODS USING INFORMATION SYSTEM AND COMPATIBILITY DATABASE

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Summary: Road transport of dangerous goods is only one, but very important, kind of traffic that is expanding from day to day. Very important task, in that manner, is creation and maintenance of successful and regular system of road transport of dangerous goods. Only one, but very important part of that system is information system with compatibility database as the most significant part of it. This database establishes relations between dangerous goods that should be transported and vehicles indented to use for that transport. List of dangerous goods prescribed by the ADR is one part of that database. The other, also, very important part are information about construction and compatibility parameters of the vehicles involved. This approach has many advantages and some of them are presented in this paper.

Keywords: energy efficiency, transport, information system, database.

COSTS CALCULATION FOR ELECTRIC RESISTANCE SPOT WELDING IN CAR BODY

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Summary: In the automotive industry, resistance spot welding process is used for joining parts of the car body. Purpose of this paper is to see structure of costs in resistance spot welding and comparison of welding costs without and with expulsion of material. Since the series of car production is high, it is convenient to see how occurrence of expulsion influences on total welding costs of a car body.

Keywords: resistance spot welding, expulsion, costs.

Pd-IMPREGNATED X ZEOLITE AS ANODE ELECTROCATALYST FOR DIRECT BOROHYDRIDE-PEROXIDE FUEL CELLS

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Summary: Although fossil fuels have been widely used as energy sources up to now, their future usage encounters problems related to finite reserves and environmental pollution. Fuel cells represent renewable and sustainable energy sources, where the chemical energy is converted into electricity by spontaneous redox reactions occurring at the electrodes. Typical fuel cells use hydrogen (H₂) as the fuel and oxygen (O₂) as the oxidant, but the safety issues and high costs of gas storage limit their large-scale application. Direct borohydride/peroxide fuel cells (DBPFCs) involve usage of alkaline borohydride solution as a liquid fuel, and are characterized by high theoretical specific energy, having advantages of simplified storage, good stability in strongly alkaline media with water-soluble discharge products, representing at the same time promising solution for the specific applications where O₂ is not available, such as submarines.

For high efficiency of DBPFCs, the anode material is a crucial factor. In this work, palladium ion-exchanged X zeolite (PdX) was studied as an anodic electrocatalyst for the DBPFCs. The material prepared by the zeolite impregnation with palladium acetylacetonate was characterized structurally and electrochemically. The morphology and crystallinity of the parent NaX were retained after the ion-exchange process. Borohydride oxidation reaction (BOR) at PdX was observed to be 1st order reaction with respect to borohydride concentration. The number of electrons exchanged during BOR at PdX is influenced by borohydride concentration, ranging from 3 to 5. Chronoamperometry measurements revealed good stability of the PdX electrocatalyst in the 0.03 M NaBH₄ + 2 M NaOH solution. Finally, a laboratory DBPFC with PdX anode exhibited power densities in the 214-263 mWcm⁻² range at operating temperatures between 25 and 45°C. In spite of low Pd content of the studied electrocatalyst, its good activity for BOR is encouraging for the future application of zeolite-supported electrode materials in DBPFCs and their development for portable applications and vehicles.

Keywords: PdX electrocatalyst, zeolite, fuel cells.

THERMODYNAMIC MODELING OF PB/AG - JAROSITE SULFIDATION FOR VALUABLE METALS RECOVERY

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Summary: In this paper thermodynamic modeling of sulfidation of non-standard Pb/Ag - Jarosite is shown, in order to propose optimal technological process for valuable metals recovery. Given the current state of natural resources, demand and consumption, sustainable production of critical metals, especially technological metals, is focus of this research. Neutral leaching residue, Pb/Ag - Jarosite, as a primary zinc production by-product is usually disposed at landfills, despite the fact that contains recyclable base (Zn, Pb, Cu), precious (Ag) and technological, critical metals (In, Ge, Ga). Thermodynamic data for detailed sulfidation behavior of technological metals contained in Pb/Ag - Jarosite were calculated using HSC Chemistry Software v. 9.0 in order to recommend optimal recycling process conditions. The main objectives were determination of temperature effect, input material/sulfidation agent ratio and modeling of phase stability diagrams of chosen technological metal sulfides. Synergetic metallurgy activities including utilization of primary and secondary raw materials can be result of this process modeling.

Keywords: jarosite, thermodynamic modeling, recycling, technological metals, sulfidation.

PRODUCTION OF TECHNOLOGY METALS FROM WASTE ELECTRONICS

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Summary: The rising criticality of technologically inevitably metals and the continuous growth of the waste electronics promote a scientific need for development of innovative recycling process, both efficient and selective. Experimental results showed primarily that by pyrometallurgical treatment it is difficult to achieve selectivity, and secondary that the distribution of metals in melting products is too complicated, deviating from the experiential and expected. Therefore, application of an integral pyro - hydrometallurgical treatment is suggested for improved raw materials efficiency. Successful implementation of the developed state-of-art technological process, guarantee more efficient approach to recycling processes, production of new materials which supports the concepts of sustainable development and cleaner production. Proposed technological solution is applicable in industry with relatively low investments compared to expected revenues, allowing companies to become competitive in the regional market and beyond, which is particularly important for small and medium enterprises with lower operating capacities. Techno-economic justification and integral pyro - hydrometallurgical process for waste electronics recycling is presented. This paper explains measures for the further development of the recycling industry as a part of circular economy strategy in Serbia.

Keywords: recycling, technology metals, waste electronics, circular economy.

A NEW TOOL FOR EVALUATING THE GOODNESS OF HEURISTIC SOLUTIONS IN MANUFACTURING CELL FORMATION

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Faculty of Organizational Sciences, University of Belgrade

Summary: Manufacturing cell formation is the first foremost and complex issue in designing cellular manufacturing system. The main objective in the cell formation problem (CFP) is to group parts into part families and machines into machine cells, and then to assign the part families to the appropriate machine cells so that the minimum of both intercell and intracell flows will be achieved. The purpose of this paper is on the design and application of a new support tool for evaluating the goodness of heuristic solutions in manufacturing cell formation. Therefore, a new tool which incorporates performance measures suitable for evaluation and comparison cell formation solutions is presented. Further, the application of this new tool is demonstrated through one case study. This new tool for evaluating the goodness of heuristic CFP solutions, offered here, can help interested practitioners and researchers to evaluate, compare and select the most suitable CFP solutions.

Keywords: cellular manufacturing, cell formation problem, new tool EvaGoS, performance measures, evaluation of heuristic CFP solutions.

11:00-11:30 - GRAND OPENING

Prof. dr Gradimir Danon, Editor in Chief of Journal of Applied Engineering Science

Prof. dr Nenad Zrnić, Vice rector of the University of Belgrade

Prof. dr Vladimir Popović, State secretary for science of Ministry of education, science and technological development of Serbia

11:30-13:30 - PAPER PRESENTATION

- 1 Marko Ćirić
REDUCTION IN WALL THICKNESS IN TANKS FOR TRANSPORT OF DANGEROUS GOODS DUE TO THE INFLUENCE OF THE TRANSPORTED SUBSTANCE - INSPECTION AND RECLASSIFICATION
- 2 Miloš Vasić
SOFTWARE SUPPORT FOR MANAGEMENT OVER MANAGEMENT SYSTEMS IN LARGE VEHICLE FLEETS
- 3 Saša Vasiljević, Nadica Stojanović, Ivan Grujić
KARTING VEHICLE DESIGN PHASES WITH A SPECIAL FOCUS ON TESTING OF VEHICLE PERFORMANCE AND APPLICATION OF CAE TECHNOLOGY IN VEHICLE DESIGN
- 4 Aleksandar Ćitić
STRENGTHENING OF Al-Mg-Si AA6082 TYPE ALLOY BY ARTIFICIAL AND INTERRUPTED AGING PROCESSES
- 5 Renata Gagić-Serdar, Ivana Živanović, Ilija Đorđević, Goran Češljar, Natalija Momirović, Tomislav Stefanović, Ljubinko Rakonjac
SEED PRESERVING AS A RESOURCE THROUGH BIOLOGICAL METHODS OF USING THE MOST EFFECTIVE BRUCHINE SUBFAMILY SEED BEATLES IN SERBIA - STORED PRODUCT INSECTS PESTS MANAGEMENT THROUGH NATURAL ENEMIES AS FAVORABLE LEGUMINOUS HOST PLANT TRAITS
- 6 Đorđe Radojković, Biljana Cvetić, Miloš Danilović, Oliver Ilić
A NEW TOOL FOR EVALUATING THE GOODNESS OF HEURISTIC SOLUTIONS IN MANUFACTURING CELL FORMATION
- 7 Mladen Rasinac
COSTS CALCULATION FOR ELECTRIC RESISTANCE SPOT WELDING IN CAR BODY MANUFACTURING
- 8 Radmila Janković
MODELING THE INFLUENCE OF THE ENERGY SOURCES AND CONSUMPTION ON THE RESULTING ECOLOGICAL FOOTPRINT

9 Marko Stokić
EVALUATION OF DRIVER'S ECO-DRIVING SKILLS BASED ON FUZZY LOGIC MODEL – A REALISTIC EXAMPLE OF VEHICLE OPERATION IN REAL-WORLD CONDITIONS

10 Aleksandar Jovanović, Igor Pašti, Lidija Rafailović, Tomislav Trišović
HIGH SURFACE AREA TRANSITION METAL FOAMS FUNCTIONALIZED BY Pd FOR HYDROGEN PRODUCTION AND ALCOHOL OXIDATION

13:30:14:30 - LUNCH BREAK

14:30-17:30 - PAPER PRESENTATION

11 Miloš Maljković
ANALYSIS OF VARIOUS IMPACTS ON ENERGY CONSUMPTION OF ELECTRIC VEHICLES

12 Tatjana Ratknić, Nikola Rakonjac, Ivana Živanović
DEVELOPMENT OF A NATIONAL INDEX OF FOREST FIRE RISK ASSESSMENT

13 Daniel Mijailović
SYNTHESIS AND SUPERCAPACITIVE PERFORMANCES OF ELECTROSPUN CARBON NANOFIBERS DECORATED WITH SPINEL CO_{1.5}MN_{1.5}O₄ NANOCRYSTALS

14 Miloš Vasić, Slobodan Mišanović, Nada Stanojević
MAINTENANCE OF ELECTRIC CITY BUSES – COST BENEFIT ANALYSIS

15 Jelena Svorcan
MULTI-OBJECTIVE CONSTRAINED OPTIMIZATIONS OF VERTICAL-AXIS WIND TURBINE COMPOSITE BLADES BASED ON FINITE ELEMENT ANALYSIS AND PARTICLE SWARM OPTIMIZATION

16 Vladimir Sinđelić, Radovan Bulatović, Milan Bižić, Dragan Petrović
APPLICATION OF WHALE OPTIMIZATION ALGORITHM (WOA) IN OPTIMAL DESIGN OF LEAF SPRINGS OF RAILWAY VEHICLES

17 Nataša Tomić
PRODUCTION OF INTELLIGENT PEDESTRIAN CROSSINGS WITH IMPROVED PHYSICAL AND MECHANICAL PROPERTIES

18 Branka Spasojević, Vlado Čokeša, Đorđe Jović, Ivana Živanović, Filip Jovanović, Zoran Poduška
SELECTION OF POTENTIAL AREAS FOR ESTABLISHING FOREST PLANTATIONS FOR SATISFACTION OF ENERGY NEEDS – THE EXAMPLE OF LAZAREVAC MUNICIPALITY

19 Dragana Vasić Aničijević
ON THE IN SITU IONIC ACTIVATORS FOR ALKALINE HYDROGEN EVOLUTION

- 20 Nenad Šurjanac
USAGE OF UNMANNED AERIAL SYSTEMS FOR COLLECTING FIELD DATA AS A BASIS OF PLANNING AND ORGANIZATION
- 21 Jovana Mandić
THERMODYNAMIC MODELING OF PB/AG - JAROSITE SULFURIZATION FOR VALUABLE METALS RECOVERY
- 22 Aleksandra Joksimović
DEVELOPMENT OF THE ROBOT FOR THE EUROBOT 2019 COMPETITION
- 23 Maja Mandić, Prof. Željko Kamberović, Jelena Uljarević, Nataša Gajić, Jovana Đokić
PRODUCTION OF TECHNOLOGY METALS FROM WASTE ELECTRONICS

17:30-18:00 – CONFERENCE CLOSING

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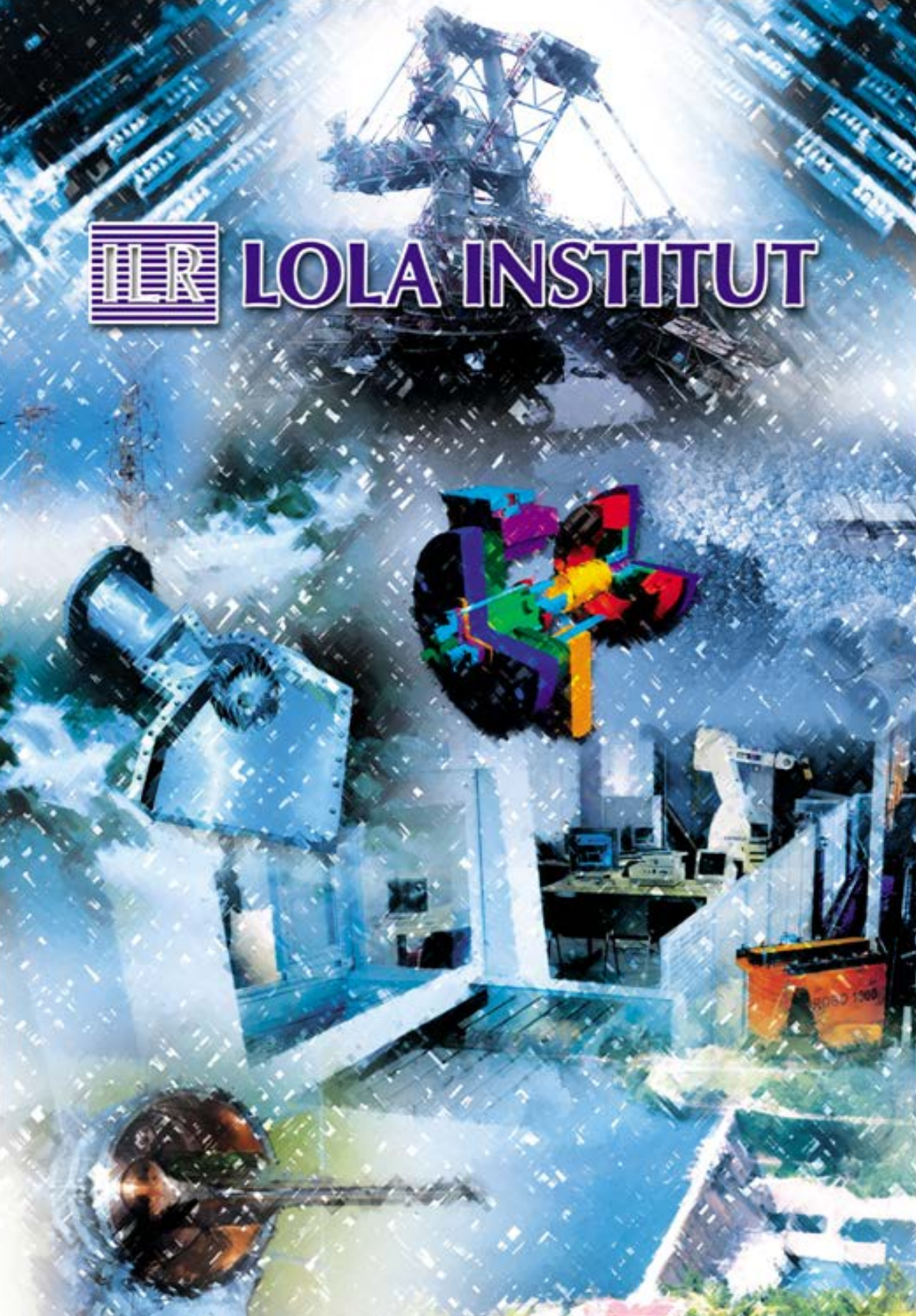
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The background features a collage of abstract shapes and icons. A large green shape on the left contains a microscope and a pipette. A yellow circle in the center has a magnifying glass over a document. An orange shape on the right contains a gear and an arrow. A blue circle at the top has a white arrow pointing up and right. A brain icon is in a light blue cloud at the top right. A dark blue circle at the top left has a white arrow pointing up and left. A white cloud at the bottom left contains a small grey mouse cursor icon. The bottom of the page shows the silhouettes of two people's heads in profile, facing each other, against a teal background.

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