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ICAS 2024 CONFERENCE

BOOK OF ABSTRACTS

Travnik 2024

The ICAS Conference was launched in 2013 through a project organized between Interdisciplinary Scientific Values for Education and Research Society (SCIVERS), Wuhan University, China, Huazhong University of Science and Technology of China and the Polytechnic University of Timisoara.

The Faculty of Mechanical Engineering, University of Banja Luka was added to the list as one of the organizers of the ICAS 2017 which was held in Hunedoara, Romania, and it actively participated in its work.

Before the ICAS 2017 Conference took place, the Faculty of Mechanical Engineering in Banja Luka and the Polytechnic University of Timisoara established a Memorandum of Understanding and a special agreement that specified the organization of the Conference. The ICAS 2018 and 2022 Conference will be held in Banja Luka.

Before the ICAS 2024 Conference took place, the University "VITEZ" and the Polytechnic University of Timisoara established a Memorandum of Understanding and a special agreement that specified the organization of the Conference. The ICAS 2024 Conference will be held in Travnik.

The ICAS 2024 Conference and the 14th International Conference of Applied Science will be held in Travnik in 2024 covering a wide range of topics related to applied science, engineering, and technology. The abstracts touch on subjects such as biometrics mechanisms, rarefied gas flow, cavitation erosion, statistical methods in engineering practice, tools coated with DLC, technology for producing angle bars, stress and fatigue life analysis, renewable energy sources, artificial intelligence, computer engineering, information security management, and electric arc detection. The conferences have an international scope, with papers being published in reputable journals. The abstracts provide insights into various research topics, including environmental impacts, mechanical properties of materials, and cutting-edge advancements in different fields.

The document mentions universities from various countries including Serbia, Romania, Slovakia, Poland, Ukraine, Jamaica, Algeria, China, Saudi Arabia, and Bosnia and Herzegovina. These universities are involved in research studies and academic activities across different fields of study.

All members of the Scientific Committee have more than 3 research papers published on the ISI lists, with some having over 20. Each section is chaired by two professors, one from Romania and one from the Faculty of Mechanical or Electrical Engineering, University of Banja Luka.

Having a strong belief that the ICAS conference has already achieved international standards in Romania, we also believe that bringing such a conference to Travnik can contribute to the linking of all the Balkan countries, the EU, and the countries all over the world, in scientific as well as economic and cultural sense.

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KEYNOTE LECTURES

USING STREAMLIT AND BASIC4ANDROID (B4A) TO CREATE THE SAME APPLICATION - STREAMLIT VERSION

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ABSTRACT

This paper deals with the creation of the same unfold sheet metal parts application using the following two languages: Streamlit (<https://streamlit.io/>) and Basic4Android (<https://www.b4x.com/b4a.html>). Specific elements of the two languages are presented in comparison, as well as the conceptual differences resulting from their use in the creation of the application. The application 'Unfold Sheets Part', publicly available on the Internet (<https://unfoldsheetsparts.streamlit.app/>) and on phones with the Android operating system (<https://dorian-nedelcu.streamlit.app/> – 'Programming' section), exemplifies graphically and numerically the unfolding of the following types of surfaces: cylinder intersected by two planes (2 variants), intersection of two cylinders of equal diameter, intersection of three cylinders of equal diameter and cylindrical elbow.

A NEW APPROACH FOR CREATING AND TESTING SAFETY COMPONENTS INTEGRATED INTO A ROBOTIC CELL SIMULATION SCENARIO IN A VIRTUAL REALITY ENVIRONMENT

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ABSTRACT

This research paper focuses on novel approaches for testing and debugging various simulation scenarios within robotic workplaces with the integration of various safety components, mainly in the pre-production phase and design of such workplaces. Nowadays, safety components are an integral part of every robotic workplace. Not only legislation but also workplace safety regulations that every single robotic workplace must be equipped with safety components. These components and the implementation of such a robotic workplace represent a significant financial investment. It is the testing of safety components such as safety barriers, traffic lights, central stop button, laser scanner for robotic systems that are very expensive components that significantly increase the overall price of the robotic workplace. It is the possibility of integrating these safety components within a simulation scenario in the ABB Robot Studio software environment and its direct interaction into the immersive VR environment that gives a very good scope for research and deployment of these safety components for robotic systems in order to eliminate the initial financial costs and save overall time in the design phase of new robotic systems with planned integration of the safety components.

ENHANCING PRODUCTION AND LOGISTICS EFFICIENCY THROUGH DYNAMIC SIMULATION: A CASE STUDY IN TRANSPORT SYSTEM OPTIMIZATION

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ABSTRACT

A dynamic computer simulation verifies how the production and logistics process system will work once it is in place before the actual implementation. This step is important when automating processes but also when looking for bottlenecks in processes that need to be optimized. Simulation can be used to verify the outcome of changes in production, logistics, warehouse, or management processes before they are implemented in the real system. In the digital environment, experiments are conducted with internally deployed systems or processes, such as the impact of process sequencing, orders, random occurrence of equipment failures, their retyping, the impact of logistics on production performance and others. The customer thus avoids potentially high financial and capacity losses caused by additional adjustments of the real system and thus gains confidence in decision-making in the planning phase. The aim of this contribution is to provide a detailed analysis of the transport system in the manufacturing /production and to develop a simulation of a transport system case study. The simulation will be used to verify the proposed innovations in the case study.

DETERMINATION OF ELECTROMAGNETIC FIELD PRODUCED BY BURIED 3-PHASE HIGH VOLTAGE CABLE SYSTEM

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ABSTRACT

To decrease operational losses, 3-phase high voltage electrical system is nowadays frequently positioned in the middle of the consumer's area, applying buried 3-phase cable system. The position of the HV cables in the constructed concrete corridors can be in triangles or in line. Both systems are presented in the paper, together with their electric and magnetic fields. All calculations were performed applying COMSOL Multiphysics program package.

The electric field strength vector magnitude was determined for both single 110 kV cables' geometry and compared with maximal allowed values, defined by appropriate standards. In both cases electric field strength vector magnitude was far below the values defined by international and domestic standards.

The magnetic flux density vector magnitudes were calculated for maximal load, defined by connected power transformers. The magnetic field distribution depends also on the phase arrangement; hence the calculations were carried out for both single cables positions and for all three possible phase arrangements.

Comparing the results of magnetic field calculation, for maximal transmitted power, with the maximum allowed values defined in standards, the calculated values shown to be also far below the allowed values.

Analyzing the electromagnetic field of buried 3-phase HV cable systems, it can be concluded that the system generates field values within recognized guidelines, far below the relevant reference level for safe public exposure.

The results of all electric and magnetic field calculations are presented graphically, as the distributions of the electric field strength vector magnitude and the magnetic flux density vector magnitude.

FUNDAMENTAL SCIENCES

SPATIAL-TEMPORAL PATTERNS OF CHANGES IN PM 2.5 IN ATMOSPHERIC AIR OF IVANO-FRANKIVSK REGION

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ABSTRACT

PM is one of the main atmospheric air pollutants causing serious concern for public health. Spatio-temporal patterns of PM 2,5 change are a current topic in physics atmospheric and environmental sciences. An equally important aspect is the study of the relationship between PM 2,5 concentration and meteorological characteristics. Temperature, humidity, wind and atmospheric pressure can affect the concentration, distribution and transport of PM 2,5. The database for the study included measurements of PM 2,5 concentration, air temperature, atmospheric pressure, and relative humidity every hour, a total of 7,344 for each parameter from the Ecocity public monitoring station in the central part of Ivano-Frankivsk city. There are no significant stationary pollution sources and highways near the observation site. Certain regularities were found in the daily variation of PM 2,5 concentration: sharp increase in concentrations at night with a peak around midnight, decrease during the day (minimum around 17:00). The highest average monthly values of PM 2,5 are in March, the lowest are in July. When analyzing the relationship between PM 2,5 concentrations and air temperature, the regularity is observed both during the day and throughout the year (in cold periods, the concentration of particles is higher, which can be explained by lower air temperatures). Multivariate linear regression was used to find the mathematical relationship between the average monthly values of PM 2,5 concentration, humidity and air temperature. The model is acceptable for estimating and forecasting temporal patterns of the concentration of PM 2,5 particles in the atmospheric air of Ivano-Frankivsk, depending on the average monthly indicators of humidity and atmospheric air temperature.

PEROXIDASE ACTIVITY OF COPPER OXIDE FILM ON GLASS SUBSTRATE

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ABSTRACT

In the present study, copper oxide thin film on the glass slide as a peroxidase nanozyme material were manufactured by bestowing the nanozyme with the beneficial porous architecture with its unparalleled advantages: its surface valence states, high surface-to-volume ratio, and abundant active sites. The copper oxide was fabricated by using thermal synthesis method. The porous structure of copper oxide was investigated by the field emission scanning electron microscopy image and the UV-visible absorbance measurements were taken to examine the peroxidase-mimicking activity. The peroxidase-mimicking activity was examined by observing the catalytic oxidation of chromogenic substrate 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS) in the presence of hydrogen peroxide, which can be visualized by the naked eyes. Copper oxide coating can consist of Cu²⁺ and Cu¹⁺ redox states and oxidize ABTS in the presence of hydrogen peroxide by mimicking peroxidase enzymes. The satisfying nanozyme activity is due in part to the easy access of hydrogen peroxide to the active sites of copper oxide. The porous morphology can lead to the easy channeling of reactants, intermediate and final products. Without intricate functionalization or amalgamation with other materials, the copper oxide nanozyme can be a promising alternative to peroxidase enzymes for hydrogen peroxide measurements in clinical, food industry, and environmental samples.

THE VOLUMES OF STONES STACK CALCULATED BY DIFFERENT METHODS – A CASE STUDY

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ABSTRACT

Paper presents methods for calculating the volume of a stones stack located on an area of mining plant in southern Poland, used by modern engineering programs (the C-Geo program, the WinKalk program, the Geolisp program). The volume of the solid was calculated with the relative error in relation to the initial volume obtained in the Geolisp program (97 064.91 m³) and amounted to 97 207.22 m³ + 0.15% (the C-Geo program) and 97 001.00 m³ – 0.07% (the WinKalk program). The WinKalk program allowed for volume calculation with less than twice the relative error compared to the C-Geo program, however, both programs meet the accuracy requirements specified in the polish law.

THE MOST POPULAR NUTRITIONAL SUPPLEMENTS AMONG ATHLETES – EDUCATIONAL GUIDE FOR BEGINNER FREE TIME ATHLETES

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ABSTRACT

The use of nutritional supplements has really taken off with the development of the fitness industry. It is not only elite athletes who use and try supplements, but nowadays they are also part of the everyday life of people who make hobby and recreational sports. Different nutritional supplements are recommended and offered on the market for different training purposes. One thing is certain: there is no training goal for which manufacturers and distributors cannot recommend a nutritional supplement. In this study, we aim to present, based on literature data, the most used nutritional supplements among athletes. Among other things, we would like to describe the most widely used sports supplements for performance enhancement and muscle recovery, their claimed effects, and recommended methods of consumption.

MEASUREMENT OF AC AND DC MAGNETIC FIELD REDUCTION

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ABSTRACT

The use of nutritional supplements has really taken off with the development of the fitness industry. It is not only elite athletes who use and try supplements, but nowadays they are also part of the everyday life of people who make hobby and recreational sports. Different nutritional supplements are recommended and offered on the market for different training purposes. One thing is certain: there is no training goal for which manufacturers and distributors cannot recommend a nutritional supplement. In this study, we aim to present, based on literature data, the most used nutritional supplements among athletes. Among other things, we would like to describe the most widely used sports supplements for performance enhancement and muscle recovery, their claimed effects, and recommended methods of consumption.

MATERIALS ENGINEERING

POSSIBILITIES OF RECYCLING OF SIDERITIC TAILINGS IN STEEL INDUSTRY

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Abstract

In the context of the circular economy, the production of steel in electric arc furnaces is very well integrated. The promotion of recycling technologies that lead to improved product quality and the expansion of the raw and auxiliary material bay facilitates the closure of the recycling loop. The processing of powdered waste is the set of technological operations through which they are processed for their use under the conditions required by the beneficiaries. The paper presents a technological solution for valuing the sideritic tailings and the ferrous slats in the form of Carbofer by-product, usable in the steel industry when foaming slag in the electric arc furnace. Laboratory tests were carried out at the Faculty of Engineering Hunedoara using sterile sideritic recipes and iron siderurgical sludge.

THE INFLUENCE OF LAYER HEIGHT AND NOZZLE DIAMETER ON THE STRENGTH OF ELEMENTS MANUFACTURED USING FDM TECHNOLOGY

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Abstract

Currently, a wide range of nozzles for producing FDM elements is available on the market. Nozzles can be divided according to the material from which they are made and their diameter. The material from which the nozzle is made mainly affects the range of materials that can be used but has no direct impact on the production time of the elements. The production time and the obtained surface of the elements are mainly influenced by the diameter of the nozzle and the height of the layer used. For machines producing elements in FDM technology using a filament with a diameter of 1.75 mm, commercially available nozzles range from 0.2 to 1 mm. Many guides recommend using a layer height of half the nozzle diameter.

The article presents the results of testing the mechanical properties of elements manufactured using FDM technology and subjected to a monotonic bending test. The specimens differed in the nozzle used for their production and the selected layer height. The test results determine the impact of changing these parameters on the strength and failure mechanism of the specimens.

ANALYSIS OF THE LOAD STRUCTURE IN THE PROCESSING OF ALUMINUM ALLOYS FOR AUTOMOTIVE RIMS

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Abstract

The most used aluminum alloys for manufacturing rims are the deformable alloys 6082 and 6061, as well as the casting alloy AlSi11. The increasing demand for such materials has led to intensified research and development activities in the field of high-strength and high-ductility aluminum alloys. Aluminum alloy rims must meet certain critical safety requirements and adhere to high standards of design, technical conditions, and processing. This paper presents the research conducted and the results obtained regarding the load structure in the processing of 6082 aluminum alloys intended for rim manufacturing. The load consists of aluminum waste and primary aluminum in various proportions depending on the alloying elements added to the metal bath of the waste used in the recipes.

DETERMINING THE AIR RESISTANCE OF AN ELECTRIC CAR

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Abstract

Aerodynamics in vehicles plays a very important role. It not only helps to reduce energy and fuel consumption while driving, but also allows to achieve better results. Aerodynamics also improves cooling of the engine and the vehicle's running gear and braking components. Determining aerodynamic resistance in the context of an electric car is important because it leads to minimizing electricity consumption while maximizing the car's performance.

Analytical and numerical methods are used to determine the aerodynamic resistance of vehicles. Analytical methods are based on solving mathematical equations and theoretical models of air flow around the vehicle. They allow for precise calculations and obtaining accurate results, but remember that they are very complicated and time-consuming. Numerical methods for determining aerodynamic resistance involve performing computer flow simulations based on the finite element method. The use of complex three-dimensional models and a precise division grid also leads to a longer calculation process.

The method of own research was to conduct numerical analyzes of computer fluid dynamics using SOLIDWORKS software. The analyzes were carried out for two selected electric bolide concepts and for a long cylinder reference model to verify the boundary conditions. The scope of the research included carrying out analyzes with the assumed Reynolds number range for the CAD model on a real scale and at a scale of 1:10.

In order to validate the results of the performed numerical analyses, a wind tunnel laboratory station was designed for experimental tests of scale objects.

MICROSTRUCTURE ANALYSE OF NON-METALLIC INCLUSIONS IN CONTINUOUS CASTED STEELS

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Abstract

According to the current quality requirements in the steel production field, high purity of steel composition is required. For this reason, defect detection technology is developing significantly. The paper presents the analysis of 20 charges of continuous casted steel, highlighting the presence of defects by microstructure analyzing of non-metallic inclusions in the semi-finished steel composition. The purpose of using these products is the automotive industry, in the production of hydraulic cylinders. The quality of the steel is directly reflected in the quality of the final product, in the mechanical properties and the duration of the life cycle.

MECHANICAL ENGINEERING

STRESS CONDITIONS ON WALLS OF STEEL AND COMPOSITE SCBA BOTTLE DURING OF FILLING FROM „BANKS OF THE AIR“

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ABSTRACT

Bottles/cylinders of breathing apparatus can be filled with compressors and directly connected to the „banks of the air“. During the filling of the bottle/cylinder of breathing apparatus with high pressure compressors, or with the „banks of the air“, pressure increases over time and the amount of compressed medical air¹ in the bottle/cylinder. The consequence is an increase in the tension in the bottle/cylinder material that is in direct coupling with the specified parameters. The tension intensity and the effect of the increase in pressure in time on the tension of the steel bottle/cylinder can be identified using tensometric tapes.

Dilatation measurements on steel and composite bottles/cylinders of breathing apparatus (SCBA)² in real conditions were performed using tensometric measuring tapes.

OVERVIEW ON THE ENVIRONMENTAL IMPACT OF USED ENGINE OIL

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ABSTRACT

The environmental impact of used engine oil encompasses multifaceted repercussions on soil, water, and air quality, constituting a significant concern in contemporary environmental discourse. This article provides a comprehensive overview of the harmful effects deriving from the improper disposal and leakage of used engine oil. Soil contamination arises from the introduction of toxic compounds such as heavy metals, polycyclic aromatic hydrocarbons (PAHs), and other hazardous substances, disrupting microbial communities, soil structure, and nutrient cycles. Concurrently, water bodies face contamination through runoff and direct discharge, leading to aquatic ecosystem disruption, bioaccumulation in aquatic organisms, and potential harm to human health. Furthermore, volatilization and incomplete combustion of used engine oil contribute to air pollution, releasing harmful gases and particulate matter, exacerbating respiratory ailments and contributing to global climate change. Mitigation strategies, including proper recycling, disposal protocols, and adoption of cleaner technologies, are imperative to alleviate the environmental burden posed by used engine oil. By synthesizing current research findings and highlighting the interconnectedness of soil, water, and air pollution, this article underscores the urgency for holistic approaches in addressing the environmental impact of used engine oil, emphasizing the imperative of sustainable practices to safeguard ecosystems and public health.

TESTS AND ANALYSIS OF THE RESULTS OF THE MECHANICAL PROPERTIES OF VARIOUS ALUMINUM ALLOYS

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ABSTRACT

It is essential to know the mechanical properties of a material used in a structure to determine its purpose and lifespan. These properties largely depend on the material's creation process and chemical composition. The verification of mechanical properties is done by performing standard test methods. These tests confirm if the material's characteristic properties stated in certificates and other documents from the supplier are accurate. This paper explains the procedure of experimental testing of different aluminum alloys through tensile tests using standard test tubes made of three types of alloys - EN AW 5083, EN AW 6082 and EN AW 7075. The test results are shown diagrammatically as the elongation-stress dependence, and the values of the fundamental mechanical properties were read. The methodology of experiments according to the standards for this type of test was covered, and finally, the analysis and comparison of the results obtained were performed depending on the type of material.

SYNTHESIS OF BIOMETRICS MECHANISMS: MOREY EEL PHARYNGEAL JAWS

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ABSTRACT

This paper shows the synthesis and analysis of a mechanism that mimics the motion of a Moray eel opening and closing both of its pairs of jaws. When the outer jaws open, the inner – pharyngeal jaws are pulled forward and open, ready to grasp possible prey items and pull them back into the throat. The eel does this with several muscles and tendons, which change their length during the motion. The mechanism proposed in this paper consists only of rigid bodies, and mimics the same motion, with one degree of freedom.

The first section (Introduction) describes in more detail the jaws of the Moray eel and presents some of the available literature in the field of biologically inspired mechanisms. It also discusses the constraints and limitations of converting this specific biological construct into a rigid body mechanical system. The second section contains the synthesis, with the first subsection showing mechanism type and structural synthesis and the second subsection the dimensional synthesis, based on the constraints mentioned in the first section. The third section shows the kinematic analysis of the mechanism, as well as the results obtained by way of a simulation done using some of the software. The final section summarizes the synthesis and analysis process, and discusses possible practical applications of the kinds of mechanisms, as well as possibilities for future work.

RAREFIED GAS FLOW IN CONVERGENT AND DIVERGENT MICROTUBE

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ABSTRACT

An axisymmetric stationary isothermal flow of a rarefied gas through convergent and divergent microtubes of circular cross-section was considered. The gas flow is compressible, subsonic and occurs at moderately high values of the Reynolds number. The flow is caused by the pressure difference between the inlet and outlet of the microtube. As flow through micropipes is considered, rarefaction is included. Low rarefied gas flows are examined, which implies low values of the Knudsen number - slip gas flows. In this flow regime boundary conditions of gas slip on the wall for the velocity field are applied. To reduce the dimensional system of equations (continuity, Navier-Stokes, equation of state of an ideal gas) to a form suitable for solving, it is necessary to introduce appropriate reference quantities, reference dimensionless numbers and assumptions based on the flow model. Also using a perturbation approach, velocity components and pressure are expressed in the form of a perturbation series. The first term in the perturbation series represents the continuum, while the second term represents the influence of slip and inertia. It is shown that rarefaction decreases the pressure along the microtubes, regardless of their geometry. The highest ratio of inlet and outlet pressure is required for divergent microtubes, and the smallest ratio is required for convergent microtubes. It is revealed that the presence of inertia increases the pressure along the microtubes, for all considered geometries.

CAVITATION EROSION INFLUENCE ON FATIGUE LIFE OF A HIGH STRENGTH STRUCTURAL STEEL

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ABSTRACT

Cavitation erosion is a severe phenomenon of hydrodynamic equipment, determining their removal from use due to the continuous damage of the materials from which they are made. Intensive research is carried out to characterize the cavitation erosion phenomenon and to determine the cavitation erosion strength of materials. This research highlighted that the material damage through cavitation is characterized by fracture mechanisms specific to low-cycle fatigue. Few studies are reported on the combined action of cavitation erosion and mechanical loads. For this reason, the paper presents a study on the influence of cavitation erosion on the fatigue behavior of a structural high-strength steel. Fatigue tests were performed on two sets of samples, eroded by cavitation and non-eroded. The results highlighted a different influence of cavitation erosion on fatigue life of the material, depending on the magnitude of the variable stress.

COMPARASION OF SELECTED STATISTICAL METHODS AND THEIR USE IN SPECIFIC CASE OF ENGINEERING PRACTICE

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ABSTRACT

The aim of the paper is to present research findings regarding the comparison of two methods that have been applied to the same research problem. In this case, we are talking about measured data in the case of softwood biomass densification. The main goal of the study is to define a model describing the given process, using both selected methods, and to compare its quality. Likewise, to compare the conditions of application of these methods, their limiting criteria, advantages, and disadvantages in practice. In the mentioned case, it was about the parameters of the uniaxial process of biomass pressing, which have a significant influence on the resulting quality of the biofuels, which in this case is represented by a measurable quantity, the density of the biofuels. These parameters are compacting pressure, pressing temperature, moisture content and particle size of the raw material. The experimental results of the research were obtained in laboratory conditions by means of an experimental press. The performed analysis was used to estimate effects, test hypotheses about the significance of the model and effects, and the predictive ability of the obtained model. It was the predictive ability of the model that was the criterion for comparing the quality of the given models. This is represented by the coefficient of determination R^2 , as the ratio of the sum of squares (SSM) explained by the model and the total sum of squares (SST), and thus expresses the degree of agreement of the observed values with the model. The presented experimental research knowledge should demonstrate the importance of knowledge about statistical methods and individual methodologies and can be useful as such in processing diverse measured data of different nature.:

CONSIDERATIONS REGARDING THE USE OF TOOLS COATED WITH DLC IN THE PROCESSING OF ALUMINUM ALLOYS USED IN THE AERONAUTICAL INDUSTRY

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ABSTRACT

The paper is intended to be a short presentation of the history of cutting tools coated with DLC diamond coating used in the machining of aluminum alloys used in the aeronautical industry. The authors present some theoretical considerations regarding the types of DLC coatings, the manufacturing methods, the performance of these types of cutting tools and their specific applications. Also, the evolution of DLC coatings, the advantages, and disadvantages of using tools coated with DLC in the processing of aluminum and other metallic materials are presented. Other industries where DLC diamond coatings are used are also synthesized.

DEVELOPMENT OF A TECHNOLOGY FOR PRODUCING AN ANGLE BAR WITH VARIABLE THICKNESS USING RESISTANCE WELDING AND ROLL FORMING

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ABSTRACT

Various technologies for producing materials and structural parts with variable thickness are known. These technologies consist of several processes, including rolling, stamping, mechanical processing and welding. The sequence and type of processes used to obtain a structural element with variable thickness is related to the specific structural element as well as the type of production. For example, for a specific structural element, the technology for single-unit production will look different from that for mass production. The aim of this work was to develop a technology for mass production of an angle bar with variable thickness using resistance welding and roll forming. The paper presents the selection of resistance welding parameters leading to the production of a tape of variable thickness. A numerical analysis of the influence of the profiling tool radius on selected parameters of the variable thickness angle profiling process was also performed. As a result of the tests, a diagram of a prototype line to produce an angle bar with variable thickness was proposed.

The research results were obtained as part of the project titled "Opracowanie technologii wytwarzania szaf metalowych z materiałów o zmiennej grubości" implemented by Metalkas S.A. based on contract number POIR.01.01.01-00-0713/18. The project is co-financed by the Europejski Fundusz Rozwoju Regionalnego, w ramach Działania 1.1 Projekty B+R przedsiębiorstw. Poddziałanie 1.1.1 Badania przemysłowe i prace rozwojowe realizowane przez przedsiębiorstwa Programu Operacyjnego Inteligentny Rozwój 2014-2020.

ANALYSIS OF STRESSES AND FATIGUE LIFE OF THE BOLTS OF THE BRIQUETTING PRESS'S WORKING SYSTEM

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ABSTRACT

The working systems of the briquetting press machine are subject to loads that vary over time resulting from the briquetting process. The main components of these working systems have a specified fatigue life and after working a certain number of hours, they are destroyed and to continue using the briquetting press machine, these parts must be replaced with new ones. For example, when it comes to the fatigue life of the compacting sleeve, briquetting press manufacturers most often specify the minimum durability of 2,000 hours in the technical documentation of the machine. However, these are not the only elements that are subject to fatigue damage. For example, the bolts that fasten the hydraulic cylinder closing the compacting sleeve to increase the density of the produced briquettes play a very important role. This paper presents a hybrid method of calculating bolts used in an example operating system of a briquetting press machine. The calculations include, among others, determining the forces in the bolts using standard formulas, as well as mapping the shape of the existing briquetting press's working system in the CAD program and carrying out FEM calculations to determine the stresses, among others, in the bolts. Considering the calculated stress ranges and the "Eurocode 3: Design of steel structures - Part 1-9: Fatigue" standard, the fatigue life of the bolts was determined. The use of the calculation procedure presented in this paper will enable future designers to select bolts for a specific fatigue life.

INFLUENCE OF MECHANICAL CHARACTERISTICS OF MATERIALS OF THREADED CONNECTIONS OF OIL AND GAS DOWNHOLE EQUIPMENT ON THEIR FATIGUE LIFE

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ABSTRACT

Threaded connections of downhole oil and gas equipment such as tool joints of drill pipes and sucker rod connections operate under difficult conditions of significant cyclic loading and a corrosive environment. This often leads to material fatigue and parts failure. Therefore, the design of such threaded connections requires accurate methods for calculating fatigue life. Using an improved finite element analysis technique in Abaqus/CAE and fe-safe, which considers maximum plastic deformation in the first steps of the simulation, the influence of the mechanical characteristics of the materials of these threaded connections on their fatigue life was investigated. Increasing the ductility of the coupling (box) material while maintaining the same nipple (pin) material can lead to equalization of loads along the thread and increased fatigue life. An additional increase in fatigue life can be achieved by optimal plastic pre-deformation of the connection under a high axial external load. The results prove that the fatigue life of these threaded connections can be significantly improved without optimizing their geometric parameters.

DESIGN AND STRENGTH ANALYSIS OF THE MAIN FRAME OF AN INNOVATIVE GRAIN DRYER WITH DEFORMATION GAUGE MEASUREMENT OF THE MASS OF THE DRIED MATERIAL

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ABSTRACT

Seeds of crops such as rapeseed, corn, and sunflowers require postharvest drying for proper storage. Inadequate seed moisture leads to the development of bacteria and fungi. Inadequate humidity increases the content of harmful fusarium microtoxins. The average moisture content of corn during harvest is up to 35%, in the case of rapeseed, 12%, and in the case of wheat - 18%, while the recommended moisture content for grain storage is 14% for corn, 6% for rapeseed, and 14% for wheat. There are mobile and stationary dryers available on the market that can be used as flow or batch dryers. The aim of the work is to develop an innovative concept of a dryer with strain gauge measurement of the mass of dried material and to analyze the strength of its main frame. The dryers available on the market do not have scales that could control weight loss. The project included the analysis of commercialized and available solutions on the market, the development of a 3D CAD model of the entire dryer with a hopper of 8 m³, and an analysis of the strength of the dryer's main frame using the finite element method. The 3D model and FEM strength analysis were made in SolidWorks. The developed dryer has a good chance of commercialization.

ELECTRICAL ENGINEERING

DESIGN OF EFFICIENT 2.45 GHZ SINGLE-BAND RECTENNA SYSTEM FOR ISM APPLICATIONS

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ABSTRACT

This work proposes a simple rectenna system operating at 2.45 GHz ISM bands, using the 50Ω antenna impedance followed by matching impedance and a voltage rectifier circuit. An L-section impedance matching circuit has been designed. Depend on RF capacitor and inductor, it was placed between the antenna and the rectifier circuit to reduce the mismatch loss and to ensure maximum power transfer to enhance the rectifier efficiency. Then the rectifier circuit is constructed using voltage doubler configuration with Schottky diode SMS7630-005LF. The proposed design has been simulated and optimized in an advanced design system (ADS) software. It has been seen in the results that: the proposed system is performing very well at 2.45 GHz. The proposed rectenna is having a maximum efficiency up to 60% at 2.45 GHz with an input power of 0 dBm. Furthermore, with variations in the load resistance across a wide range of values from 5 to 10 k Ω with low input power equal to 0 dBm, the rectenna maintains an efficient power conversion. The output voltage value at 0 dBm is nearly 1.5 V with an optimum load $RL = 5\text{ K}\Omega$. The implemented system can be used efficiently for the RF energy harvesting applications.

A WIDEBAND AND HIGH ISOLATION GYSEL POWER DIVIDER FOR WIRELESS COMMUNICATION

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ABSTRACT

The paper presents recent advancements in the design and implementation of reconfigurable antennas, focusing on their potential to enhance performance metrics such as bandwidth, gain, and radiation pattern agility. Reconfigurable antennas can cover different wireless standards that operate over a wide frequency range, it is capable of dynamically altering their frequency, polarization, and radiation properties in a controlled and reversible manner. They modify their geometry and behavior to maximize the antenna performance in response to changes in their surrounding conditions. To implement a dynamical response, they employ different mechanisms such as PIN diodes, varactors, radio-frequency microelectromechanical systems (RF-MEMS).

Reconfigurable antennas offer attractive potential solutions to solve the problem of the need to use multiple antennas for different applications, such as Bluetooth, Wi-Fi, WiMAX, WLAN, etc. In this paper, a novel frequency reconfigurable, the antenna design using p-i-n diode is proposed. The antenna switches at two different frequencies between 2.4 GHz and 5.2GHz. The design includes a PIN diode in the feeder by adjusting the status of the switches state either on or off mode in simultaneously, the resonance frequencies can be varied, thus achieving frequency reconfigurable. The antenna (41×44×1.6 mm³) is designed on FR4 substrate with permittivity of 4.4 and tangential loss of 0.02. The investigation and the simulation of the PIN diode model is constructed on CST Simulation tools. The resulting antenna is suitable for applications wireless local-area network (WLAN) technologies.

ANALYSIS OF THE OPERATION OF A PHOTOVOLTAIC HYBRID SYSTEM, ELECTRIC GRID, DIESEL-GENERATOR GROUP

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ABSTRACT

Recently, there has been a significant surge in the utilization of renewable sources for generating electricity. This growth has been so rapid that it can be described as almost exponential. As a result, numerous individuals and organizations, both natural and legal, have become prosumers in this field. When a specific energy source is linked to the power grid and interconnected with another energy source, the hybrid system's behavior deviates from the individual behavior of each system connected to the network. The paper analyzes a case study consisting of three photovoltaic systems of different powers and with different equipment characteristics (two of them), connected to the grid and a diesel-generator group. An examination is conducted on the electricity generation and usage of the complete photovoltaic system throughout a span of one year. Subsequently, the impact of the hybrid system on the network during notable fluctuations in load is assessed. The analysis shows that over the period of one year, the photovoltaic system provided 32.31% of the industrial user's energy consumption. Considering the energy injected into the grid, the energy generated by the photovoltaic system accounts for 42.21% of the user's total energy usage. Upon reviewing the data, it was established that the photovoltaic system linked to the grid fails to meet the necessary quality standards concerning fluctuations in supply voltage.

DATA ANALYSIS AND FUZZY LOGIC MODELLING REGARDING ELECTRICITY AVAILABILITY OF PHOTOVOLTAIC PANELS

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ABSTRACT

On the whole of the paperwork, we have approached the directions that can be found in its title and in which the authors propose to treat the theory necessary for the experimental data and then the analysis of the data resulting from the measurements regarding the electromagnetic quantities found in the production part of the photovoltaic panels in a selected park as a case study. On the other hand, an analysis proposal is presented regarding the results obtained with the use of fuzzy logic. A model was created to assess the availability of electricity with simulation using the Tool Box module from the MATLAB software. The work is therefore divided into the theoretical part, which includes two chapters, and the practical and computational part, with several other dedicated chapters. The conclusions of the research are expressed at the end together with the bibliographic list of the synthesis studied to be able to elaborate the paper, as usual.

APPLICATION OF RENEWABLE ENERGY SOURCES IN TRAFFIC - BUS STATION AS A GREEN ENERGY ISLAND

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ABSTRACT

The use of renewable energy sources in urban areas is becoming more common. Our design solution offers the possibility of supplying energy to fully electric buses at adapted stops, especially at the final stations (turning points). Adjusting the roof of the station enables the use of solar energy and wind energy with the possible expansion of the application of the road structure to increase energy capacities (protective fence as a linear energy block and sound protection of the settlement from traffic as an energy island). In addition to the good fit of the wind generator and the photovoltaic panel, their mutual harmony increases the overall efficiency of the entire system. The convenience of the turnpike is due to the longer stay of buses compared to other stops, so there is enough time to recharge the batteries, and at the same time, there is less influence of neighboring buildings on the station installations on the periphery, so the use of renewable energy sources is better.

THE USE OF GEOTHERMAL WATERS IN THE ENERGY, RESIDENTIAL AND AGRICULTURAL FIELDS

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ABSTRACT

The purpose of this work is to focus on the following applications: district heating systems based on geothermal water, greenhouses and fish farming heating, geothermal aqua-parks, and renewable power generation by conversion of geothermal energy. Such a project is based on two drilling wells (Doublet) and a primary circuit of geothermal water. Geothermal water is the most popular nutritional supplement among athletes – educational guide for beginner free time athletes.

transporter of earth energy. The thermal water is pumped from the production well in a heat exchanger and afterwards, the water is pumped back in the geothermal aquifer, through a reinjection well placed at a specific distance. The energy of the primary circuit is transferred through the heat exchanger to a secondary circuit, being then used for heating purposes, or other cascade applications, as greenhouse heating or aquaculture facilities, electrical power generation, etc. We evaluate the thermal potential of one geothermal project in the western Romania. This value is calculated by considering one Doublet, having a depth of around 4,200m, a flow of 80-85l/s (around 83kg/s), and thermal water temperature of at least 225°C. By having this potential, we can realize: a project for an extensive greenhouse facility, geothermal district heating system, the warm water supply, and a geothermal project with cascade applications.

COMPUTER ENGINEERING

USE OF TECHNOLOGY AND ARTIFICIAL INTELLIGENCE IN MANAGEMENT: ARE WE PREPARING STUDENTS FOR THE FUTURE?

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ABSTRACT

Artificial Intelligence has changed the way we manage and market our businesses. This presentation will highlight various examples of management where AI has disrupted what we learn in traditional business courses. The examples given will be from various sectors and will help you rethink your concepts of what AI can do by sensitizing you with what AI is already doing. Online available data was collected on how businesses in various sectors are incorporating AI to improve their functions and what are the challenges they are facing. From this information, a way forward was developed for the students to prepare a “future proof” career in business management. A major finding is that the universities need to improve the way they are preparing their students for the future of commerce. The presentation will also help you rethink your career path considering emerging trends in business management. This study is a generalized study and gives an overall state of affairs instead of giving a detailed AI adoption in a particular country. This presentation will help undergraduate students in rethinking their strategy as they prepare for a career in business management. This presentation will share some business ideas to inspire your entrepreneurial thinking.

USING STREAMLIT AND BASIC4ANDROID (B4A) TO CREATE THE SAME APPLICATION - B4A VERSION

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ABSTRACT

The paper describes “Unfold Sheets Parts” application designed to unfold the sheet metal parts (the unfolding of the following types of surfaces: cylinder intersected by two planes - 2 variants, intersection of two/ three cylinders of equal diameter and cylindrical elbow) designed with two programming languages: Streamlit [1] and B4A [2]. The Streamlit version of application use Python & Matplotlib to generate the unfolded geometry and to plot the numerical & graphical results; the application is publicly available on the Internet [3], does not contain any viruses and not store data to any external server. The B4A version of application is available to download for smartphones as “Unfold Sheets Parts.apk” in the “Programming” section of reference [4]; this application does not share data over the internet, the code runs entirely on the user's smartphone, does not contain any viruses and not store data to any external server. Specific elements of the two languages are presented in comparison, as well as the conceptual differences resulting from their use in the creation of the application.

APPLICATION OF ARTIFICIAL INTELLIGENCE (AI) FOR THE CONTROL OF THE COVID-19 PANDEMIC: CURRENT STATUS AND FUTURE PROSPECTS

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ABSTRACT

The COVID-19 pandemic has not only caused dramatic changes in people's daily lives, but also spurred the development of innovative technological solutions based on autonomous artificial intelligence (AI) with the aim of curbing the spread of the virus and easing the burden on healthcare systems. This review explores how AI systems have been adapted and applied to combat pandemics, particularly in the context of infection control and health systems support.

Artificial intelligence has proven to be crucial in the analysis and interpretation of the abundance of data on infection and the spread of viruses, providing significant insights into the dynamics of the pandemic. Through risk assessment and identification of key factors of spread, AI technologies have contributed to a better understanding of diseases and information on public health.

In addition, innovations in robotic technology and autonomous systems have proven essential in supporting healthcare workers and reducing exposure to the risk of infection. Through process automation, these systems enabled more efficient management of resources, faster diagnosis and treatment, and minimization of contact between healthcare workers and patients.

In addition, smart wearables have become a key part of pandemic monitoring and control strategies. Integrating sensors and AI analysis, these devices enable vital signs monitoring, symptom detection, and provide behavioral and location information, contributing to better epidemiological assessment and public health strategies.

Overall, the application of artificial intelligence, robotic technologies and wearable devices represents a key step in the fight against the COVID-19 pandemic, while highlighting the importance of technological progress in modern healthcare.

EMBEDDED GPU ACCELERATION OF OBJECT DETECTORS USING NVIDIA CUDA

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ABSTRACT

Real-time object detection in images and videos remains a challenge due to the high computational demands placed on traditional CPUs. This paper investigates the use of embedded GPUs to accelerate two prevalent object detection methods: Histogram of Oriented Gradients (HOG) and Haar Cascade Classifiers. We leverage the CUDA programming model and the OpenCV library to implement these methods on the Jetson Nano, a compact embedded system equipped with a Tegra K1 system-on-chip (SoC) featuring a quad-core ARM processor and a Kepler-integrated GPU. Our experimental evaluation demonstrates significant performance improvements. The GPU implementation achieves a 4x speedup for the HOG method and a 2x speedup for the Haar Cascade Classifier compared to their CPU counterparts, paving the way for real-time object detection applications on resource-constrained embedded platforms.

ARTIFICIAL INTELLIGENCE IS LIKE AN ENGINE OF THE FUTURE DEVELOPMENT OF HIGHER EDUCATION

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ABSTRACT

Artificial intelligence serves as a driving force for future growth in basic and higher education. AI refers to computer systems that can do complex tasks formerly handled only by humans, such as reasoning, decision-making, and problem solving. Today, the phrase "artificial intelligence" (AI) encompasses a broad spectrum of technologies that underpin several services and products we use daily, ranging from chatbots that offer real-time customer care to programs that recommend TV series. Artificial intelligence (AI) has sparked growing interest and research in a variety of disciplines, including higher education. This study paper investigates the impact of AI on higher education by focusing on teaching and learning, assessment, ethics, required skills, and future employment opportunities.

AI has the power to completely change education by automating administrative tasks, providing immediate feedback, and customizing instruction to each student's needs. Additionally, technology can assist with evaluation and grading, freeing up teachers to focus on developing curricula and providing high-quality instruction. With the promise of greater accuracy, efficiency, and convenience, artificial intelligence (AI) has made inroads into several sectors, including healthcare, banking, transportation, and entertainment. The emergence of intelligent robots driven by artificial intelligence has been nothing short of revolutionary in a time of rapid technological advancement.

Many of the goals set forward to improve teaching and learning are not being reached today. Teachers are looking for scalable, safe, and effective ways to fulfill these concerns with the help of technology. Like everyone else, educators make use of AI-powered services in their daily lives. Examples include automated travel planning on their phones, voice assistants in their homes, and tools that can write essays, fix grammar, and complete sentences. Consequently, educators perceive prospects to leverage AI-driven functionalities such as speech recognition to augment the assistance offered to students with impairments, multilingual learners, and other individuals who may gain from enhanced flexibility and customization in digital learning resources.

MODEL OF MEASURABLE ASPECTS OF INFORMATION SECURITY MANAGEMENT WITHIN THE FRAMEWORK OF HIGH OF EDUCATION

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ABSTRACT

Within higher education, there are increasing demands to ensure the security and protection of information resources. Applying the ISO 27001 standard and an Information Security Management System (ISMS) helps assess the risk of security attacks and threats. Business institutions and universities have different organizational commitments to information security, and because of this, different levels of ISMS development and functioning are achieved. Therefore, there is a need to create a model for assessing the current state of information security of any business institution. In the creation of the model, the recommendations of the management framework for managing IT processes - COBIT were taken into account.

The components that indicate the degree of quantifiable characteristics of ISMS management have been identified. Research on the degree of development of the suggested model was conducted at several colleges using fuzzy logic applied to the defined elements. The results are displayed in order of the proposed assessment model's lowest and highest evaluations of the state of information security. The model can also be used to evaluate how well a few other parameters in the areas of ecological, workplace health and safety, and the economy are performing.

ELECTRIC ARC DETECTION AT PANTOGRAPH-CATENARY SYSTEM FAILURE USING THE LABVIEW IMAGE PROCESSING TECHNIQUE

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ABSTRACT

Electric energy is transmitted to a continuously moving electric locomotive through the interaction of pantograph-catenary wires. However, poor interaction between these two variable elements affects the quality of the power supply and damages the contact elements. Detecting these electric discharges may be difficult using conventional methods that measure the current flow value on a high-voltage line of 25 kV. The PCS (pantograph catenary system) can be monitored by a video camera that permanently acquires images of the PCS in specific contact areas detecting electric discharges by extracting the optical characteristics of the arc. In this application, we used a video processing technique in LabVIEW to count the number of pixels that have the arc characteristic and detect the electric discharge caused by malfunction of the PCS as missing droppers, extreme wind conditions, presence of ice on the contact wire, etc automatically noticing the train operator by the presence of arc and malfunction of the locomotive power supply.

QUALITY MODELS AND WEB APPLICATION VALIDATION METHODS

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ABSTRACT

When it comes to evaluating the quality of web applications, there are various models and validation methods that can be applied such as ISO 25010 quality model, McCall's model, usability quality model ISO 9241-11, and others. The user survey method enables a comprehensive analysis and review of web pages that will be the subject of analysis and research, and the results will provide a better picture of the quality of the web pages in question and will identify potential areas for improving user experience and design. The focus of the work will be on the research and analysis of the quality of several websites of educational institutions in Central Bosnia that are used and are still in use. Research on the quality of websites of educational institutions refers to the aspect of usability and performance through a designed survey questionnaire and analysis of the results at the end of the research. The research was conducted during 2022, in which parents, teaching and IT staff of educational institutions participated. Website performance was measured using the software tool Pingdom. The usability of the website is evaluated through survey questions, which are finally analyzed and presented in the paper. The methodology used in the work is an anonymous questionnaire, a software tool for performance measurement, statistical methods and a scientific method of analysis and synthesis. The paper used a small sample of forty randomly selected respondents, but presented a methodology and quality model that can be applied to a larger sample as well. The work and results of the research show the analysis and quality model of the selected web pages based on the research of the given data set. The above results can serve as input information to web developers and web page designers when improving the user experience and design of this type of project.



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