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NEW TECHNOLOGIES DEVELOPMENT AND APPLICATION
NOVE TEHNOLOGIJE RAZVOJ I PRIMJENA

BOOK OF ABSTRACTS
KNJIGA SAŽETAKA

Editors: Isak Karabegović, Ahmed Kovačević, Sead Pašić, Sadko Mandžuka



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TECHNOLOGY PARK “INTERA” OF MOSTAR

AKADEMIJA NAUKA I UMJETNOSTI BOSNE I HERCEGOVINE
DRUŠTVO ZA ROBOTIKU U BOSNI I HERCEGOVINI
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”NT-2025“

NEW TECHNOLOGIES - DEVELOPMENT AND APPLICATION
NOVE TEHNOLOGIJE - RAZVOJ I PRIMJENA

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NOVE TEHNOLOGIJE, RAZVOJ I PRIMJENA

BOOK OF ABSTRACTS – KNJIGA SAŽETAKA

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TEHNOLOŠKI PARK “INTERA” U MOSTARU

NEW TECHNOLOGIES - DEVELOPMENT AND APPLICATION „NT-2025“

Word of the organiziers

The modern economy is facing numerous challenges that significantly hinder its advancement. A lack of developed research infrastructure, limited resources, and insufficient collaboration between academia and industry have led to weaker innovation development and its difficult commercialization. Many companies lack effective mechanisms for managing knowledge, technologies, and research and development capacities, which ultimately affects their market position, competitiveness, and contribution to regional development.

With the aim of strengthening the links between science, industry, and entrepreneurship, the organizers of this conference are launching a series of professional and free events—seminars, round tables, and expert forums—targeted at small and medium-sized enterprises, as well as all relevant stakeholders in the production and development sectors. These events will introduce participants to contemporary technological practices, opportunities for applying innovations in daily operations, and the importance of intellectual property protection in the development of new products and services.

In an era of rapid market change, time has become a crucial factor in achieving success. The growing demand for personalized products, as opposed to traditional mass production, calls for flexible, swift, and innovative solutions. Therefore, it is essential to promote alternative methods and techniques that enable faster adaptation to market demands and increased efficiency in production processes.

The intention of the organizers is to offer a platform that fosters knowledge and experience exchange, encourages cooperation among professionals, and informs engineers, designers, investors, and other stakeholders about the technical and economic advantages of new technologies. We seek to stimulate the broader application of technological achievements already present in developed countries and make them accessible to the domestic professional community.

We are confident that such scientific gatherings can make a significant contribution to the development of an innovative ecosystem, foster entrepreneurial growth, and facilitate the integration of domestic companies into global development flows. The conference will focus on presenting the latest technological advancements and exploring the possibilities of their implementation in the real sector, with an emphasis on concrete applications across various industrial domains.

Sarajevo, May 10, 2025

Chairman of the Organizing Committee
Prof. Dr. Isak Karabegović

NOVE TEHNOLOGIJE - RAZVOJ I PRIMJENA „NT-2025“

Uvodna riječ organizatora

Savremena ekonomija suočava se s brojnim izazovima koji ograničavaju njegov napredak. Nedostatak razvijene istraživačke infrastrukture, ograničeni resursi i nedovoljna povezanost akademske zajednice s industrijom rezultiraju slabijim razvojem inovacija i njihovom otežanom komercijalizacijom. Mnoge kompanije nemaju adekvatne mehanizme za upravljanje znanjem, tehnologijama i istraživačko-razvojnim potencijalima, što u konačnici utječe na njihovu tržišnu poziciju, konkurentnost i doprinos regionalnom razvoju.

S ciljem jačanja veza između nauke, industrije i poduzetništva, organizatori ove konferencije pokreću niz stručnih i besplatnih događaja – seminara, okruglih stolova i stručnih skupova – namijenjenih malim i srednjim poduzećima, kao i svim relevantnim akterima iz sektora proizvodnje i razvoja. Na tim događanjima sudionicima će biti predstavljene suvremene tehnološke prakse, mogućnosti primjene inovacija u svakodnevnom poslovanju, kao i značaj intelektualnog vlasništva u procesu razvoja novih proizvoda i usluga.

U vremenu u kojem se tržište brzo mijenja, vrijeme kao faktor postaje ključna odrednica uspjeha. Sve izraženija potreba za personaliziranim proizvodima, nasuprot tradicionalnoj masovnoj proizvodnji, zahtijeva fleksibilna, brza i inovativna rješenja. Stoga postaje nužno promovirati alternativne metode i tehnike koje omogućavaju bržu prilagodbu zahtjevima tržišta i veću učinkovitost u proizvodnim procesima.

Namjera organizatora jeste ponuditi platformu koja će omogućiti razmjenu znanja i iskustava, poticati suradnju među stručnjacima, te informirati inženjere, projektante, investitore i druge dionike o tehničkim i ekonomskim prednostima novih tehnologija. Želimo potaknuti širu primjenu tehnoloških dostignuća koja su već prisutna u razvijenim zemljama, te ih učiniti dostupnima domaćoj stručnoj zajednici.

Uvjereni smo da ovakvi naučni skupovi mogu značajno doprinijeti razvoju inovativnog ekosistema, poticati rast poduzetništva i omogućiti integraciju domaćih kompanija u globalne tokove razvoja. Fokus konferencije bit će usmjeren na prezentaciju najnovijih tehnoloških dostignuća i mogućnosti njihove implementacije u realnom sektoru, s naglaskom na konkretne primjene u različitim industrijskim granama.

Sarajevo, 10. maja 2025. godine

Predsjednik Organizacionog Odbora
Prof. dr. Isak Karabegović

PREFACE

Modern industrial production is exposed to many influences and problems that prevent the strengthening of market competitiveness. Let us mention a few of them: materials and raw materials are constantly becoming more expensive, and some even disappear, so a suitable replacement should be found; mass production disappears, and large series manufacturing decreases, while small-scale and medium serial production increases to some extent; new production philosophy demands and prefers highly educated personnel able to successfully implement new technologies; technologies, as well as knowledge, quickly become obsolete, which requires lifelong learning, i. e. constant update of already acquired knowledge; environmental requirements are stronger and higher, which increases companies' costs and funds to invest in equipment (there is a demand for pollution and waste materials reduction, greater work safety, recycling, etc.); market is full of various goods and products of questionable quality from medium developed countries and often with dumping prices; there are ever increasing demands for wage increases, which forces the owners to dislocate their production facilities or move to countries with cheaper labor force; increased education of personnel affects their mobility and increase of fluctuation, as well as greater opportunities in the choice of better jobs, so that they make more use of their intellectual and emotional capabilities, thereby changing the mental structure of employees; customers are increasingly looking for a good design, durability and good price, with a wide range of support and service, not just a product; customers' knowledge is increasing, thus causing the increase in requirements that a product must be flawless in every respect, rather «ideal» (well designed, reliable, stylish, economical, etc.). To successfully solve the abovementioned requirements, there are new technological, production, organizational and other methods and models that ensure the improvement and modernization of production in the preparation phase (modern methods of product design, methods for modeling, simulation and optimization of products and production program, evolutionary methods – methods of artificial intelligence, software and computer hardware), as well as in the realization phase of production (flexibility, innovation, productivity, automation, product quality) we can name it all with a single word "Industry 4.0", which is already present around us, but its concept is not widespread.

The main objectives of the conference are:

- *Transfer of new and high technologies towards the development of scientific research work and implementation in production, in order to achieve technological and economic growth production in companies*
- *Transfer of innovations and practical knowledge and results of our own research, with the aim of strengthening competitiveness of companies.*
- *Promotion of technological and economic feasibility of applying new technologies in companies' industrial production, as well as "Industry 4.0".*
- *Organizing and conducting education to prepare young people for jobs will be in the future, to use technologies that will be, discovered, for competitiveness that will be global.*
- *Performing training courses in new technologies, production and business systems, integrated product development, implementation and maintenance of quality systems, production logistics, acquisition of competitive ability in the market, the application of modern methods in production management, the development of modern and successful production, etc.*
- *Education of the implementation of "Industry 4.0" with the aim of improving many aspects of human life.*

Sarajevo, May 10, 2025 *THE ORGANIZERS*

PREDGOVOR

Suvremena industrijska proizvodnja je izložena mnogim utjecajima i problemima koji ometaju jačanje konkurentnosti na tržištu. Evo samo nekih od njih: materijali i sirovine neprestano poskupljuju, a neki i nestaju, pa im valja naći odgovarajuću zamjenu; masovna proizvodnja nestaje, a velikoserijska se smanjuje, dok raste maloserijska i donekle srednjeserijska proizvodnja; nova proizvodna filozofija uvjetuje, preferira visoko educirane kadrove sposobne da uspješno implementiraju nove tehnologije; tehnologije kao i znanja brzo zastarijevaju, što zahtijeva cjeloživotno učenje, odnosno stalno osvježavanje već stečenih znanja; sve su oštriji i veći ekološki zahtjevi, što poduzećima povećava troškove i sredstva za investiranje u opremu (traži se smanjenje zagađivanja i otpadnih materijala, veća sigurnost u procesu rada, reciklaža otpada i sl.); tržište je sve punije raznovrsnim proizvodima ali i proizvodima upitne kvalitete iz srednje razvijenih zemalja i često s damping cijenama; sve su veći zahtjevi za porastom plaća, što vlasnike prisiljava da svoje proizvodne pogone dislociraju, odnosno presele u zemlje sa jeftinijom radnom snagom; porast obrazovanosti kadrova sve više utječe na njihovu mobilnost i porast fluktuacije, te veće mogućnosti u izboru boljih radnih mjesta, kako bi više koristili svoje intelektualne i emocionalne mogućnosti, čime se mijenja mentalna struktura zaposlenih; kupci sve više traže dobar dizajn, trajnost i povoljnu cijenu proizvoda, uz široki asortiman i servisne usluge, a ne samo proizvod; znanje kupaca sve je veće, zbog čega nastaju i sve veći zahtjevi da proizvod mora biti bez greške u svakom pogledu, bolje rečeno «idealan» (dobro dizajniran, pouzdan, moderan, ekonomičan itd.). Za uspješno rješavanje navedenih zahtjeva postoje nove tehnološke, proizvodne, organizacijske i druge metode i modeli koji osiguravaju unapređenje i modernizaciju proizvodnje u fazi pripreme (moderne metode oblikovanja proizvoda, metode modeliranja, simulacije i optimizacije proizvoda i programa proizvodnje, evolucijske metode-metode umjetne inteligencije, softverske i računalne tehnike), kao i u fazi realizacije proizvodnje (fleksibilnost, inovativnost, proizvodnost, automatizacija, kvaliteta proizvoda),sve to možemo nazvati jednom riječi „Industrija 4.0“, koja je već prisutna oko nas ali njen koncept nije dovoljno rasprostranjen.

***Osnovni ciljevi održavanja konferencije su slijedeći**:*

- *Transfer novih i visokih tehnologija u pravcu razvoja naučnoistraživačkog rada i implementacije u proizvodnji, s ciljem ostvarenja tehnološkog i ekonomskog rasta proizvodnje u kompanijama.*
- *Transfer inovacija i praktičnih znanja i rezultata vlastitih istraživanja, s ciljem jačanja konkurentske sposobnosti kompanija.*
- *Promocija tehnološke i ekonomske opravdanosti primjene novih tehnologija u industrijskoj proizvodnji u kompanijama, kao i“Industrije 4.0“.*
- *Organiziranje i izvođenje edukacija da pripreme mlade ljude za poslove koji ce biti u budućnosti, kako bi koristili tehnologije kojeće biti u budučnosti, za konkurentnost koja će biti globalna..*
- *Izvođenje edukacijskih predavanja iz novih tehnologija, proizvodnih i poslovnih sistema, integriranog razvoja proizvoda, uvođenja i održanja sistema kvalitete, logistike proizvodnje, stjecanja konkurentske sposobnosti na tržištu, primjene modernih metoda u upravljanju proizvodnjom, razvoju moderne i uspješne proizvodnje, itd.*
- *Edukacija o opravdanosti implementaciji „Industrije 4.0“ sa ciljem poboljšanja mnogih aspekata ljudskog života.*

Sarajevo, 10. maj, 2025. godina *ORGANIZATORI*

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„NEW TECHNOLOGIES, DEVELOPMENT AND APPLICATION“

„NOVE TEHNOLOGIJE, RAZVOJ I PRIMJENA“

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"New Technologies, Development and Application“ NT-2025

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ACADEMY OF SCIENCES AND ARTS OF BOSNIA AND HERZEGOVINA

Rodolphe Sepulcher
University of Cambridge
UNITED KINGDOM

Topic: "SPIKING INTELLIGENCE: TOWARDS RECONCILING PHYSICS AND ALGORITHMICS?"

Biography:

Rodolphe Sepulchre is Professor of Engineering at the KU Leuven (Belgium) and at the University of Cambridge (UK). He is a fellow of IFAC (2020), IEEE (2009), and SIAM (2015). He received the IEEE CSS Antonio Ruberti Young Researcher Prize in 2008 and the IEEE CSS George S. Axelby Outstanding Paper Award in2020. He was elected at the Royal Academy of Belgium in 2013. He has been Editor-in- Chief of Systems and Control Lettters (2009-2019) andthe IEEE Control Systems Magazine (2020-2024). He is a recipient of two ERC advanced grants (Switchlets (2015-2021) and SpikyControl (2023-2028)).

Abstract: Spikes and rhythms organize control and communication in the animal world, in contrast to the bits and clocks of digital technology. As continuous-time signals that can be counted, spikes have a mixed nature. This talk will review ongoing efforts to develop a control theory of spiking systems. This talk will review ongoing efforts to develop a control theory of spiking systems via the classical concept of mixed feedback. We discuss the relevance of a theory of mixed feedback systems to address the “AI gap” in the emerging age of event-based technology.

Salim Belouettar
Institute of Sciences and Technology
LUXEMBORG

Topic: "HARNESSING DIGITALISATION AND OPEN INNOVATION FOR CIRCULARITY IN MATERIALS SCIENCE"

Biography:

Dr. Salim Belouettar is a distinguished research scientist renowned for his impactful contributions to mechanics and materials science, particularly through the lenses of digitalisation, open innovation, and circularity. His expertise centers on computational modeling and simulation of composite materials, structures, and processes, which are critical to advancing sustainable practices in aerospace, automotive, and biomedical engineering. Beyond his research endeavors, Dr. Belouettar is a dedicated educator and mentor, having supervised approximately 35 doctoral and postdoctoral researchers. He actively contributes to the scientific community as a member of several professional societies, serving on editorial boards and reviewing for top-tier journals.

Dr. Belouettar's innovative research is transforming the design and engineering of materials and structures, with profound implications for sustainable development. His commitment to integrating digitalisation and open innovation into materials science not only advances knowledge but also ensures a lasting impact on future generations of scientists and engineers committed to circularity in their practices.

Muhammad Masood Rafi
University of Engineering and Technology
PAKISTAN

Topic: "MITIGATING THE CHALLENGES OF LOOSELY CONTROLLED MANUFACTURING PRACTICES IN THE CONSTRUCTION INDUSTRY"

Biography:

Prof. Muhammad Masood Rafi is a Professor and Chairman of the Department of Earthquake Engineering at NED University of Engineering and Technology, Pakistan. He graduated with a PhD from the University of Ulster, UK, in 2007 and completed a post-doctoral fellowship at the University of Aveiro, Portugal, in 2011. With over 30 years of teaching and research experience, Prof. Rafi has made significant contributions to the field of earthquake engineering. He is actively engaged in various projects related to fire and earthquake disaster management, as well as risk reduction. He has completed several research and consultancy projects, collaborating with researchers from around the world. His current research interests include earthquake and tsunami risk reduction, post-earthquake fires, fire resistance of concrete structures,seismic analysis and retrofitting of RC and masonry structures, durability of RC structures, finite element analysis of RC structures, the behaviour of recycled concrete and experimental analysis of RC structures. Prof. Rafi has authored one book, three book chapters and numerous research papers published in journals and conferences. He has supervised several Masters and PhD theses and is frequently invited to deliver professional lectures to students and industry professionals. He has also served as a member of various Technical Program Committees for international conferences.

In addition to his research and teaching, Prof. Rafi is an active contributor to the scientific community. He serves on the editorial boards of prestigious journals and reviews technical papers for academic publications. He is the Editor-in-Chief of the NED University Journal of Research and has been a member of several code development committees. Through his extensive work and collaborations, Prof. Rafi continues to play a pivotal role in advancing knowledge and practices in earthquake engineering, structural fire engineering and disaster management.

Stjepan Lakušić
University of Zagreb
Faculty of Civil Engineering
Zagreb, CROATIA

Topic: "CIRCULAR SOLUTIONS FOR CLEANER, QUIETER CITIES: THE FUTURE OF TRAFFIC POLLUTION BARRIERS"

Biography:

Most of scientific work of Prof. Lakušić is focused on railways, especially researching tram and railway track structures, the dynamic impact of vehicles on the track, noise and vibrations on the tracks, and the elements of attaching the rail to the base. In cooperation with the City of Zagreb, he initiated projects related to environmental protection (impact of traffic noise in urban areas) and projects related to the management and maintenance system of city roads.

He has edited 13 books, one university monograph, one handbook, nine proceedings of international conferences and symposia, and seven proceedings of domestic conferences. Since January 2012, he has been the editor-in-chief of the journal Građevinar (Journal of the Croatian Association of Civil Engineers). He has been a member of the editorial board of three other international journals. Prof. Lakušić initiated several international and domestic scientific, scientific- professional, and professional-scientific events and then actively participated in their organization and implementation. He managed the international scientific project 'Rubberised concrete noise barriers – RUCONBAR'. The project's innovative product, absorbent concrete barriers for noise protection with recycled rubber – RUCONBAR, was awarded several international and domestic awards.

CONTENTS – SADRŽAJ

A SCALABLE ROBOTIC APPROACH FOR SUSTAINABLE VITICULTURE IN DEVELOPING REGIONS

Zandra B. Rivera Chavez[1], Alessia Porcaro[2], Marco C. De Simone[1], Domenico Guida[1]
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Zandra B. Rivera Chavez


Alessia Porcaro


Marco C. De Simone


Domenico Guida

ABSTRACT:
Viticulture in developing regions, particularly in Peru, faces persistent challenges due to climate variability, resource constraints, and limited access to advanced mechanization. Precision agriculture technologies (PATs) have improved sustainability and efficiency in vineyard management; however, their high costs and complex infrastructure requirements prevent small and medium-sized farms (SMFs) from integrating these solutions. This study presents AgriRover, a scalable, autonomous robotic platform designed to overcome these barriers. The system integrates real-time environmental sensing, adaptive navigation, and energy-efficient automation, providing a cost-effective alternative to commercial autonomous viticulture vehicles. By analyzing existing technological solutions, this research highlights the advantages of mobile monitoring over fixed sensor networks and outlines a modular approach to sustainable viticulture. The study demonstrates how AgriRover's design principles address economic and environmental constraints, positioning it as a viable solution for smallholder farmers. Future research will explore AI-enhanced decision-making and renewable energy integration to optimize the system's autonomy and efficiency further.

Keywords: *Precision Viticulture, Autonomous Agricultural Robotics, Sustainable Farming, Smallholder Farming, Viticulture Automation, Environmental Monitoring*

THE EVOLUTION OF PRODUCT QUALITY IN THE AUTOMOTIVE SECTOR: THE INTERDEPENDENCE BETWEEN RAW MATERIAL QUALITY, FINISHED PRODUCTS, AND SUPPLIER PERFORMANCE

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Aurel Mihail Titu


Claudiu-Alexandru Covaci


Adrian Bogorin-Predescu

ABSTRACT:
This paper addresses the essential role of suppliers in the automotive industry, analyzing their impact on the quality of final products and how effective collaborations can improve production processes. The evolution of supplier relationships has gone through significant stages, from vertical integration in the early 20th century to modern outsourcing models and strategic partnerships, exemplified by systems like the Toyota Production System (TPS). In this context, supplier selection and evaluation have become critical, with advanced technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), and Blockchain being utilized for monitoring the quality of raw materials and finished products, offering innovative solutions for continuous process improvement.
Close collaboration with suppliers not only helps maintain a stable and sustainable supply chain but also contributes to enhancing performance and sustainability across the entire automotive industry. These optimization strategies are fundamental for achieving high standards of quality and operational efficiency, essential in a highly globalized and competitive market.

Keywords: *supplier, collaboration, supply chain, quality*

COMPUTER VISION FOR CHESS GAME AUTOMATION

RAČUNARSKI VID ZA AUTOMATIZACIJU IGRE ŠAHA

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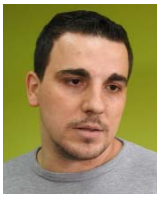
Edin Tabak

ABSTRACT:
In the modern age of computing and technology, computer vision has become a key aspect of numerous innovations and solutions that make everyday life easier. Object recognition in images is one area where computer vision can contribute to significant improvements. Playing chess, one of the oldest and most challenging intellectual games requires concentration and tactical thinking. In computer vision, automating the recognition of chessboards and figures can contribute to developing advanced chess applications, help users analyse games, or even enable a game with a computer based on real-world chess setups. This paper describes how the system for recognising chessboards and figures using computer vision techniques was developed and implemented. Through analysing existing methods, designing a new algorithm, and experimental evaluation, the goal is to create an accurate and efficient system that can recognise chess positions and individual figures based on images.

Keywords: *computer vision, chess, automation, feature recognition*

REZIME:
U modernom dobu računarstva i tehnologije, računarski vid postao je ključni aspekt brojnih inovacija i rješenja koja olakšavaju svakodnevni život. Prepoznavanje objekata na slikama je jedno područje u kojem računarski vid može doprinijeti značajnim poboljšanjima. Igranje šaha, jedne od najstarijih i najizazovnijih intelektualnih igara, zahtijeva koncentraciju i taktičko razmišljanje. U računarskom vidu, automatizacija prepoznavanja šahovskih ploča i figura može doprinijeti razvoju naprednih šahovskih aplikacija, pomoći korisnicima da analiziraju igre, ili čak omogućiti igru s računarom zasnovanu na šahovskim postavkama iz stvarnog svijeta. Ovaj rad opisuje kako je razvijen i implementiran sistem za prepoznavanje šahovskih ploča i figura tehnikama računarskog vida. Kroz analizu postojećih metoda, dizajniranje novog algoritma i eksperimentalnu evaluaciju, cilj je stvoriti tačan i efikasan sistem koji može prepoznati šahovske pozicije i pojedinačne figure na osnovu slika.

Ključneriječi: *računarski vid, šah, automatizacija, prepoznavanje karakteristika*

EXPERIMENTAL RESEARCH SET-UP FOR THE VALIDATION OF THE ABOVE-KNEE PROSTHESIS WITH SEPARATE KNEE AND ANKLE DRIVES

EKSPERIMENTALNA ISTRAŽIVAČKA POSTAVKA ZA VALIDACIJU NATKOLJENIČNE PROTEZE S ODVOJENIM POGONOM ZA KOLJENO I GLEŽANJ

Zlata Jelačić[1], Remzo Dedić[2]
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Zlata Jelačić


Remzo Dedić

ABSTRACT:
The paper provides a concise overview of the development of a smart upper leg prosthesis. It then details a series of experiments conducted with the patient, including activities such as sitting, standing up from a chair, standing, sitting on a chair, walking, and walking up stairs. The results of these experiments are presented, drawing from both the observations of the research team and the feedback provided by the patient. Finally, the paper offers recommendations for the optimization of the smart upper leg prosthesis.

Keywords: *knee prosthesis, hydraulic drive, sensors*

SAŽETAK:
Rad daje sažeti pregled razvoja pametne natkoljenične proteze. Opisan je niz eksperimenata provedenih s pacijentom, uključujući aktivnosti kao što su sjedenje, ustajanje sa stolice, stajanje, sjedenje na stolici, hodanje i penjanje uz stepenice. Prikazani su rezultati eksperimenata i date preporuke koji se temelje na zapažanjima istraživačkog tima s povratnim informacijama koje je dao pacijent.

Ključne riječi: *natkoljenična proteza, hidraulični aktuatori, senzori*

IMPLEMENTATION OF ROBOT OPTIMIZATION TRAJECTORY IN THE DIE CAST PRODUCTION PROCESS

IMPLEMENTIRANJE OPTIMALIZACIJSKE TRAJEKTORIJE ROBOTA U PROIZVODNOM PROCESU TLAČNOG LIJEVANJA

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Sarajko Baksa


Ines Baksa


Davor Mihalic

ABSTRACT:
In the research work, an automated aluminum die casting process is presented that was realized by accelerating the production cycle through the installation of a dedicated gripper. This enabled computer programming of the optimal trajectory of an industrial robot. It includes an introduction to the die casting method, a technical description of the primary working machines forming the basis of an automated cell, and the model of an industrial robot for manipulating castings manufactured by "ABB" at LTH Alucast Ltd. The automated process was further enhanced by implementing an engraving device by "Borries" for DataMatrix-Code engraving and automated cast deposition. The increased production cycle time was was resolved by the author's optimization of the robot's trajectory and using a dedicated gripper for double manipulation of castings, resulting in a more efficient and faster production cycle.

Keywords:*industrial robot, process automation, die casting, production cycle, optimization*

REZIME:
U istraživačkom radu prikazan je automatizirani postupak lijevanja aluminija koji je realiziran ubrzavanjem proizvodnog ciklusa ugradnjom specijaliziranog hvatača. Time je omogućeno računalno programiranje optimalne putanje industrijskog robota. Uključeno je upoznavanje s metodom lijevanja, tehnički opis glavnih radnih strojeva koji čine osnovu automatizirane ćelije, te model industrijskog robota za manipulaciju odljevaka proizvedenog od strane "ABB-a" u LTH Alucast d.o.o. Automatizirani postupak dodatno je poboljšan implementacijom uređaja za graviranje "Borries" za graviranje DataMatrix-koda i automatsko deponiranje odljevaka. Povećanje vremena proizvodnog ciklusa riješeno je autorskom optimizacijom putanje robota i korištenjem specijaliziranog hvatača za dvostruku manipulaciju odljevaka, što je rezultiralo učinkovitijim i bržim proizvodnim ciklusom.

Ključne riječi: *industrijski robot, automatizacija procesa, tlačno lijevanje, proizvodni ciklus, optimiranje*

INDUSTRY 5.0 WITH AI APPLICATIONS FOR SMART AND SUSTAINABLE PRODUCTION

INDUSTRIJA 5.0 SA PRIMENOM VEŠTAČKE INTELIGENIJE ZA PAMETNU I ODRŽIVU PROIZVODNJU

Mihalj Bakator[1], Dragan Ćoćkalo[1], Stefan Ugrinov[1], Velibor Premčevski[1]
[1]University of Novi Sad, Technical faculty “Mihajlo Pupin” in Zrenjanin, Zrenjanin, Republic of Serbia


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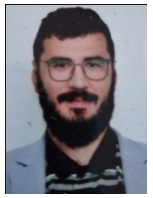
Stefan Ugrinov


Velibor Premčevski

ABSTRACT:
Industry 5.0 introduces a transformative approach to manufacturing by integrating artificial intelligence with human expertise to create smart and sustainable production systems. Industry 4.0 focused on automation and connectivity, this new phase emphasizes on human-AI collaboration, efficiency, and environmental responsibility. AI-driven predictive analytics, digital twins, and collaborative robotics improve operational flexibility, optimize resource utilization, and improve quality control. The success of Industry 5.0 depends on a strategic approach that aligns technological advancements with ethical, economic, and environmental considerations. The main goal of this paper was to develop a theoretical model for smart and sustainable production in enterprises.

Keywords:*Industry 5.0, smart solutions, AI, sustainability, production*

REZIME:
Industrija 5.0 donosi transformativni pristup proizvodnji kroz integraciju veštačke inteligencije sa ljudskom ekspertizom kako bi se stvorili pametni i održivi proizvodni sistemi. Dok je Industrija 4.0 bila usmerena na automatizaciju i povezivost, ova nova faza naglašava saradnju između ljudi i AI, efikasnost i ekološku odgovornost. Prediktivna analitika bazirana na veštačkoj inteligenciji, digitalni blizanci i kolaborativna robotika poboljšavaju operativnu fleksibilnost, optimizuju korišćenje resursa i unapređuju kontrolu kvaliteta. Uspeh Industrije 5.0 zavisi od strateškog pristupa koji usklađuje tehnološki napredak sa etičkim, ekonomskim i ekološkim faktorima. Glavni cilj ovog rada bio je razvoj teorijskog modela za pametnu i održivu proizvodnju u preduzećima.

Ključne riječi:*Industrija 5.0, pametna rešenja, AI, održivost, proizvodnja*

A MODEL FOR TOOL COST MANAGEMENT IN DIGITAL MANUFACTURING

JEDAN MODEL ZA UPRAVLJANJE TROŠKOVIMA ALATA U DIGITALNOJ PROIZVODNJI

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[2]University of Belgrade, Faculty of Mechanical Engineering, Belgrade, Serbia


Jovan Živković


Vojin Vukadinović


Vidosav Majstorović

ABSTRACT:
Big changes are taking place in the industry, caused by the influence of market demands (flexibility and personalization of products), and the development and application of IC technologies in it (digitalization and application of the Industry 4.0 model). That is why today factories are built on new postulates (networked factory entities) with a digital product model that connects business, engineering and production processes, as well as supply chains. This paper deals with an important aspect of digital manufacturing, which is related to tool life cycle cost management (TLMC), in a real factory from the metal industry. It outlines the TLMC concept for this factory, with examples of CAD, CAPP, CAM, ERP and MES models in manufacturing, as well as CPS in manufacturing.

Keywords: *Digital manufacturing, Production Management, ERP, MES, IoT*

REZIME:
U industriji se događaju velike promene proizrokovane uticajma od zahteva tržišta (fleksibilnost i personalizacija proizvoda), i razvoja i primene IC tehnologija u njoj (digitalizacija i primena modela Industrija 4.0). Zato se danas fabrike izgrađuju na novim postulatima (umreženi entiteti fabrike) sa digitalnim modelom proizvoda koji povezuje poslovne, inženjerske i proizvodne procese, kao i lance snadbevanja. Ovajrad se odnosi na važan aspekt digitalne proizvodnje, koji se odnosi na upravljanje troškovima alatima u životnom veku (TLMC), u realnoj fabrici iz metaln industrije. U njemu je izložen koncept TLMC za ovu fabriku, sa primerima CAD, CAPP, CAM, ERP i MES modela u proizvodnji, kao i CPS u proizvodnji.

Ključne riječi: *Tool cost management, digital manufacturing, ERP, MES, tableware*

SHAPE AND MASS ANALYSIS OF FRAGMENTS GENERATED BY NATURAL FRAGMENTATION USING 3D SCANNING TECHNOLOGY

ANALIZA OBLIKA I MASENIH PARAMETARA FRAGMENATA NASTALIH PRIRODNOM FRAGMENTACIJOM UPOTREBOM TEHNOLOGIJE 3D SKENIRANJA

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Faruk Razić


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Sabaheta Kraljušić

ABSTRACT:
This paper investigates the possibility of using 3D scanner in shape and mass properties analysis of the natural fragments and its limitations. After detonation of the six steel cylinders, three heat treated and three non-heat-treated, natural fragments are collected. A total of ten fragments are scanned with Atos Core 200 (GOM, GmbH) 3D scanner, processed in Design X software, exported to a desired format and analyzed in CAD software. Results of the 3D scanning show that it is possible to generate usable model of the irregularly shaped fragment. Comparison of the fragments, scanned and real fragments, does not implicate any significant difference regarding shape and mass. However, it has been found that the process of 3D scanning is time consuming regarding the complexity of the fragment geometry. For the purpose of making scanning process more efficient, special tools are designed and used for fragment positioning in the scanning area of the 3D scanner with the respect to the reference points.

Keywords*: fragments, 3D scanner, post processing, CAD, irregularly shaped*

REZIME:
U ovom radu se istražuje mogućnost korištenja 3D skenera za analizu oblika i masenih parametara fragmenata nastalih prirodnom fragmentacijom. Nakon detonacije šest čeličnih cilindara (tri sirova i tri termički obrađenja), nasumično je prikupljeno 10 fragmenata za potrebe skeniranja. Fragmenti su skenirani na Atos Core 200 (GOM, GmbH) skeneru i obrađeni u Design-x softveru. Rezultati istraživanja pokazuju da je moguće generisati CAD modele nepravilnih oblika fragmenata za koje se upotrebom CAD softvera mogu odrediti maseni parametri. Ograničenja se ogledaju u vremenu skeniranja i dodatnoj softverskoj obradi CAD modela. Kako bi se vrijeme skeniranja skratilo, dizajnirani su specijalni alati za pozicioniranje fragmenata u prostoru u odnosu na referente račke.

Ključne riječi: *fragmenti, 3D skener, dodatna obrada, CAD, nepravilno oblikovan.*

USING A SCALED-DOWN CAR PROTOTYPE TO DEVELOP AND STUDY AN ELECTRONIC DIFFERENTIAL

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Viktor Ivanov


Lubomir Dimitrov


Tetiana Melenchuk


Svitlana Ivanova

ABSTRACT:
The automotive industry's transition to electric vehicles has made it possible to abandon multi-speed gearboxes, and in electric vehicles with motor wheels, there is no need for a gear differential mechanism. Instead of a heavy and complex gear mechanism, an electronic differential is used. Typically, the developed versions of the electronic differential were evaluated using computer modeling. Much less research has been conducted on real vehicles because it requires significant resources. It is relevant to perform road tests on prototype cars. A scaled-down prototype of a car with rear-wheel drive has been developed. An electronic differential has been designed based on the Ackermann-Jeantaud model. The theoretical trajectory was calculated in an iterative manner as a sequential rotation of the electric vehicle around a series of instantaneous centers of velocity. The theoretical trajectory was compared with the traces left by the prototype during a road test. The error in the actual position of the prototype compared to the calculated one does not exceed twelve percent. The performed slalom test showed that the designed electric car moves within the width of the lane, which corresponds to the width of the lane established for urban traffic. The value of the lane width was calculated taking into account the prototype dimensions. The movement of the car in normal mode and with the differential locked was also compared. The designed electronic differential allows for normal car control. Using a scaled-down car prototype allows for testing the electronic differential in road test conditions without spending money on purchasing and re-equipping the car.

Keywords: *electronic differential, scaled-down prototype, Ackermann-Jeantaud model, car slalom test, trajectory of the movement.*

EVALUATION OF THE PROPERTIES OF THE WELDED JOINT OF HIGH-STRENGTH STEEL OF THE PIPE TYPE ACCORDING TO THE NON-DESTRUCTIVE LM-HARDNESS METHOD

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Andrij Dzyubyk


Volodymyr Grudz


Ihor Nazar


Liudmyla Dzyubyk

ABSTRACT:
In the paper, the characteristics of the material damageability of the welded joint of high-strength steel with a ferrite-pearlite weld are considered. The hardness measuring of the welded joint surface and mathematical modeling of the obtained results was carried out according to the LM-hardness method. The macrohardness of the surface layer does not allow to fully evaluate the characteristics of the welded joint material, in contrast to the analysis of the degree of degradation of the material by the scattering of macrohardness according to the LM-hardness method. The nature of the increase in macrohardness in the zone of thermal impact indicates the heterogeneity of the material's properties and the likelihood of its damageability for specific experimental conditions. The tendency to technological damageability of the metal samples decreases with distance from the axis of the weld. At the same time, the LM-hardness method allows us to identify individual areas with a tendency to technological damageability of the base metal outside the thermal impact zone. This indicates the possibility of identifying the dimensions of the zone of thermal deformation effect of the welded joint. The number of indicators of the homogeneity criterion of the material used to assess the degree of its damageability is inversely proportional to the distance to the axis of the weld. It is determined by the operation conditions of the joint or product.

Keywords: *high-strength steel, pipeline steel, main pipelines, strength of welded joints, material damageability, LM-hardness method, welding of high-strength steels*

MODELLING OF GEOMETRIC PROPERTIES OF WEALD BEADS FOR THE WAAM PROCESS

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Kristijan Sket


Mirko Ficko


Timi Karner


Rok Belšak

ABSTRACT:
Wire Arc Additive Manufacturing (WAAM) is an emerging process for the layer-by-layer production of large, complex metal components. An important aspect is that the layer geometry is influenced by the welding parameters. In this study, the influence of welding parameters, in particular robot travel speed and welding current, on the geometrical properties of the weld beads, including height, width and cross-sectional area, is investigated. A full factorial design of experiments matrix was used to collect data from 50 weld lines. Geometric features were extracted from the point cloud data of the weld lines obtained by laser scanning and analysed using machine learning models. The response surface method was used to model and visualise the relationships. The results show that the welding current has a significant influence on the welding geometry, while the travel speed has a smaller influence. The models showed better accuracy for the height and width of the weld ($R^2 \approx 0.87$) but were less accurate for the cross-sectional area ($R^2 \approx 0.85$). Future improvements are indicated, including higher order polynomial terms and additional interaction effects to increase model accuracy.

Keywords: *wire arc additive manufacturing,welding parameters, geometric properties, full factorial experiment, machine learning, response surface methodology*

AXIAL-RADIAL ANALYSIS OF THE INNER RING OF A BALL BEARING IN RELATION TO THE OUTER RING

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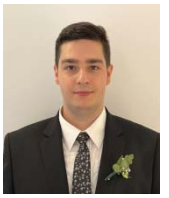
Aurel Mihail Țîțu


Daniel Bâlc


Emanuel Bâlc

ABSTRACT:
Bearings are essential components of a gear mechanism, playing a critical role in enabling the operation of shafts and various moving elements by eliminating friction between them and ensuring smooth motion. The optimization of these components involves a detailed understanding of their mechanical behaviour, and recent studies have revealed that bearings considered functional and within the permissible limits of axial and radial play can exhibit abnormal acoustic behaviour during operation. This observation highlights the need for a more complex analysis than the conventional approach, which focuses separately on axial and radial play. The paper proposes the introduction of an extended analytical concept based on the notion of "running clearance," which combines axial and radial play into a unified model. This approach facilitates a more precise evaluation of the impact of total clearance on bearing performance by accounting for the combined effects of both types of play. The analysis of running clearance holds significant implications for mechanical engineering, offering a fresh perspective for diagnosing acoustic and structural issues in bearings. Through such a methodology, latent defects or abnormal behaviours that are undetectable through conventional inspection methods can be identified. From a technical standpoint, the proposed approach involves the use of advanced measurement and modelling techniques, along with complex experimental analyses, to correlate clearance variations with the acoustic and dynamic behaviour of bearings. Academically, this work opens new research perspectives in the optimized design of bearings and the reduction of noise and vibrations in mechanical systems. The concept of running clearance represents a valuable contribution to the understanding and optimization of bearing performance, with extensive practical applications in both industry and research.

Keywords: *bearings, clearance, optimization, performance, diagnostics*

COMPUTER-AIDED RESEARCH OF LEAD SCREW PROFILE ACCURACY DURING HIGH-PERFORMANCE TURNING

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Oleh Onysko


Volodymyr Kopei


Tetiana Lukan


Bohdan Shuliar

ABSTRACT:
The accuracy of manufacturing lead screws of a trapezoidal profile functionally depends on the accuracy of the thread tool and on the value of its geometric parameter - the rake angle, on which the productivity of the thread turning process largely depends. Analytical dependencies are proposed for predicting the accuracy of the trapezoidal profile of the thread made by a turning tool. A computer program has been developed on their basis, which allows, based on the input standard data on the major diameter and thread pitch, to obtain the calculation of the half-profile angle and its deviations along the flank surface, which, as proven, is a curved line. However, its curvature is critically small and can be neglected. The presented example indicates that when using a cutting tool with a -5° rake angle to turn a lead trapezoidal thread screw with a major diameter of 22 mm and a pitch of 8 mm, the deviation of the half-profile angle reaches 0.18°, which is half the tolerance.

Keywords: *threading, screw,rake angle, deviation, thread profile*

DEVELOPMENT OF A SIMPLIFIED DYNAMIC MODEL OF AN AUTONOMOUS OPEN-WHEEL SINGLE-SEATER VEHICLE

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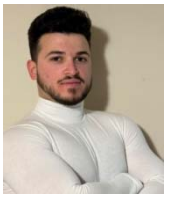
Rosario La Regina


Franesco Sorrentino


Carmine Maria Pappalardo


Domenico Guida

ABSTRACT:
This article presents the results of a study on computer-aided design and dy-namic analysis of a simplified mechanical system, as well as the synthesis of passive mechanical control for a rear suspension system. This system was in-troduced in the new ground effect cars following the 2022 Formula 1 tech-nical regulation changes. The first part of the manuscript outlines the prob-lem of interest, detailing the methodological approach and mathematical framework used in the research. The second part focuses on the numerical experiments conducted to design components that meet the suspension sys-tem requirements. The study demonstrates that an active suspension can be designed using components that passively vary stiffness and damping pa-rameters through specific mechanisms. A simplified mechanical system model was also developed, and dynamic simulations of its nonlinear behav-ior were performed using MATLAB. These simulations allowed for the ex-trapolation of the elastic and damping characteristics. Finally, a functional CAD model of the proposed solution was created in SOLIDWORKS, particu-larly ensuring proper component functionality within the limited available space.

Keywords: *Venturi Effect, F1 Rear Suspension, F1 Tire, Cup Springs, Nonlinear Damper, and Computer-Aided Design*

APPLICATION OF LASER SHOCK PEENING AND ULTRASONIC IMPACT TREATMENT FOR SURFACE FINISHING OF INCONEL 718 ALLOY PRODUCED BY ADVANCED LASER 3D PRINTING PROCESS

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Dmytro Lesyk


Alessandro M. Ralls


Bohdan Mordyuk


Pradeep L. Menezes

ABSTRACT:
Currently, the post-processing of metal/composite products manufactured using 3D printing technologies (direct energy deposition or powder bed fusion methods) has become increasingly important in additive manufacturing chains. The post-processing is the final stage that defines the surface finish and functionality, as well as the physico-mechanical properties of end-products. The application of non-material removal mechanical surface post-treatments (sandblasting (SB) followed by the laser shock peening (LSP) and ultrasonic impact treatment (UIT)) for surface finishing of superalloy 718 fabricated by the laser powder bed fusion (LPBF) 3D printing innovative technology was analyzed in this work. The surface roughness parameters and topography/texture, structure, and microhardness depth profiles in the subsurface layers were studied in the INCONEL 718 parts produced by LPBF and post-processed by SB+LSP and SB+UIT. The transmission electron microscopy of the SB+LSP and SB+UIT-treated samples showed significant grains' refinement in severely deformed top surface layers which resulted in the increase in the hardness from ~3.8 GPa to ~5.5 GPa and ~5.3 GPa, respectively. A surface microrelief was formed with a noticeably reduced roughness (Sa = ~0.14 μm) after SB+UIT.

Keywords: *superalloy 718, laser powder bed fusion 3D technology, surface post-processing, advanced peening, 3D surface profilometry, TEM microscopy*

DYNAMICS AND BIFURCATION OF NONLINEAR SYSTEM WITH TWO PARAMETERS

DINAMIKA I BIFURKACIJA NELINEARNOG SISTEMA SA DVA PARAMETRA

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Kanita Lemes


Vahidin Hadziabdic


Dzanko Hajradinovic


Haris Lulic

ABSTRACT:
In this paper a system of two coupled differential equations with twoparameters is analyzed. Using linear stability analysis, the equilibrium points of the systemand their stability are determined depending on two parameters. For one of the equilibrium points the possibility of a Hopf bifurcation is examined. Applying algorithm for Hopf bifurcation, conditions under which a Hopf bifurcation occurs are derived for this equilibrium point. The nature of the bifurcation—whether supercritical or subcritical—is determined. These results provide insights into the system's qualitative behavior and parameters impact on character and stability of the equilibrium points.

Keywords: *equilibrium points, bifurcation, Hopf bifurcation.*

REZIME:
U ovom radu analiziranje sistem sa dvije spregnute diferencijalne jednačine s dva parametra. Primjenom linearizacije, određuju se fiksne tačke sistema i njihova stabilnost u zavisnosti od dva parametra. Za jednu od fiksnih tačaka ispituje se mogućnost Hopfove bifurkacije. Primjenom algoritma za Hopfovu bifurkaciju, izvedeni su uslovi pod kojima se javlja Hopfova bifurkacija za ovu fiksnu tačku. Određen je tip bifurkacije—da li je superkritična ili subkritična. Ovi rezultati pružaju uvid u kvalitativno ponašanje sistema i uticaj parametara na karakter i stabilnost fiksnih tačaka.

Ključne riječi: *fiksne tačke, bifurkacija, Hopfova bifurkacija.*

CALCULATING FRACTIONAL FLOW RESERVE USING NON-INVASIVE TECHNIQUES

IZRAČUNAVANJE FRAKCIJSKE REZERVE PROTOKA KORIŠTENJEM NEINVAZIVNIH TEHNIKA

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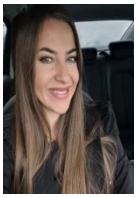
Marija Mojsilović


Milica Tufegdžić


Muzafer Saračević


Nenad Filipović

ABSTRACT:
Determining Fractional Flow Reserve (FFR) often relies on invasive methods, which have practical and cost limitations. This study, conducted on a sample of 15 patients with varying degrees of stenosis in the blood vessel walls, explores computer simulations as a non-invasive alternative. FFR values were measured for the left and right coronary arteries during individual diagnostic cardiac catheterizations. These measured values were compared with those obtained through numerical simulations using specialized software tools and packages for geometrical modeling and blood flow simulation.The study's results are visually presented and analyzed, showing a high degree of agreement between the measured and simulated values. An additional evaluation was performed by analyzing absolute and relative error values for both coronary arteries. The calculated absolute error values ranged from 0.01 to 0.04 for the right coronary arteries and from 0.01 to 0.05 for the left coronary arteries, indicating a strong alignment between the simulated and measured values. Furthermore, relative errors were calculated to further validate the study's findings. ...
Keywords: *coronary arteries, numerical simulation, blood flow simulation, modeling.*

REZIME:
Određivanje frakcijske rezerve protoka (FRP) često se oslanja na invazivne metode, koje imaju praktična i financijska ograničenja. Ova studija, provedena na uzorku od 15 pacijenata s različitim stepenima stenoze u zidovima krvnih sudova, istražuje računalne simulacije kao neinvazivnu alternativu. Vrijednosti FRP-a su izmjerene za lijeve i desne koronarne arterije tokom individualnih dijagnostičkih kateterizacija srca. Ove izmjerene vrijednosti su uspoređene s vrijednostima dobivenim numeričkim simulacijama koristeći specijalizirane softverske alate i pakete za geometrijsko modeliranje i simulaciju protoka krvi. Rezultati studije su vizualno predstavljeni i analizirani, pokazujući visok stupanj podudarnosti između izmjerenih i simuliranih vrijednosti. Provedena je dodatna evaluacija kroz analizuvrijednosti apsolutnih i relativnih grešaka za obje koronarne arterije. Izračunate vrijednosti apsolutnih grešaka su od 0,01 do 0,04 za desne koronarne arterije, od 0,01 do 0,05 za lijeve koronarne arterije, što ukazuje na snažnu podudarnost između simuliranih i izmjerenih vrijednosti. Osim toga, izračunate su relativne greške kako bi se dodatno potvrdili nalazi studije. ...
Ključne riječi: *koronarne arterije, numerička simulacija, simulacija protoka krvi, modeliranje.*

INFLUENCE OF ELASTIC DEFORMATION IN BEARING INNER RINGS ON RUNNING CLEARANCE IN MECHATRONIC SYSTEMS

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Danie Balc


Aurel Mihail Țîțu


Emanuel Balc

ABSTRACT:
Bearings remain some of the most critical components within mechatronic assemblies, playing a vital role in their operation. Through various analyses of their behavior, the importance of the parameter known as "running clearance" has been highlighted, as it directly influences the performance and reliability of bearings. This research direction was detailed in the paper titled "AXIAL-RADIAL ANALYSIS OF THE INNER RING OF A BALL BEARING IN RELATION TO THE OUTER RING," which emphasized the need to understand the impact of running clearance on the entire system. Building upon this investigation, efforts were made to correlate the measured running clearance values with the occurrence or elimination of abnormal noises in the analyzed mechatronic systems. Such noises could indicate accelerated wear or malfunction. During these analyses, a new research niche was identified: the possibility of elastic deformation of the inner bearing ring. This deformation can occur when the inner ring is pressed into a fixture element used for measuring running clearance. The elastic deformation phenomenon directly influences the running clearance values, causing either an increase or a decrease. Consequently, it was concluded that this phenomenon warrants deeper analysis, as it has the potential to affect the design and application of modern mechatronic systems.

Keywords: *mechatronic, bearings, running clearance, deformation, reliability*

RANKING OF SUSTAINABLE ENERGY DEVELOPMENT SOLUTIONS USING MULTI-CRITERIA DECISION MAKING TECHNIQUES

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[1]Hanoi University of Industry, School of Mechanical and Automotive Engineering, Vietnam
[2]Comenius University Bratislava, Faculty of Management, Bratislava, Slovakia


Do Duc Trung


Branislav Dudic


Nguyen Hoai Son


Nguyen Chi Bao

ABSTRACT:
The development of renewable energy is not only a pressing solution to address climate change but also a driving force for sustainable economic growth. Numerous technologies exist for sustainable energy development, each characterized by various criteria, making performance evaluation challenging. This complexity renders the selection of the optimal option a multi-criteria decision-making (MCDM) problem. This paper presents a study on the application of MCDM techniques to select the best option among eight sustainable energy development alternatives: hydropower, geothermal energy, biomass energy, wind energy, solar energy, concentrated solar power, coal-fired power plants, and oil-fired power plants. The Probability method was employed as the MCDM approach in this research. The ranking results of sustainable energy development alternatives using the Probability method were compared with those obtained using other methods, including CURLI, TOPSIS, PIV, and RAM. The results demonstrated that the sustainable energy development alternative identified as the best using the Probability method was consistent with the results of other MCDM methods. Moreover, the Probability method exhibited a high degree of stability in the ranking of alternatives under various weight scenarios. Consequently, geothermal energy was determined as the most suitable sustainable energy development option among the eight alternatives examined.

Keywords: *Sustainable energy development, energy policy, Probability method, MCDM.*

DIGITAL MANUFACTURING IN SERBIA - CASE STUDIES

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Aleksandar Vidojkovic


Sergey Vostrikov


Vidosav Majstorović

ABSTRACT:
Information and communication technologies (ICT) have been present in the industry for more than six decades, and represent the infrastructure for Industry 4.0 . Digitization that is labeled as Industry 4.0 uses different aspects of IC technologies, connected machine (CPS) and parts in the factory (IoT) models, as well as realized the wide application possibilities of BDA (big data) analysis, which are carried out using AI (artificial intelligence) tools. , and especially machine learning (ML). ICT and the other mentioned technologies enable the creation of more flexible and profitable manufacturing processes based on accurate data, which flows through the Internet. Modern factories and the equipment in them are equipped with IoT (Internet of Things), which ensures the online collection of larger and larger amounts of data, so that the wide application of digital technologies is inevitable. That is why we can assert that today's Industry 4.0 model will grow into the Industry 5.0 model based on the model of cognitive manufacturing, which will become the basic model of intelligent manufacturing. Starting from these facts, the paper presents a detailed analysis of today's context of digital manufacturing, as well as its application in selected factories in Serbia, on the Siemens Industry 4.0 model platform.

Keywords: *Digital manufacturing, Industry 4.0, Artificial Intelligence.*

REZIME:
Informacione i komunikacione tehnologije (IKT) su prisutne u industriji više od šest decenija i predstavljaju infrastrukturu za Industriju 4.0. Digitalizacija koja je označena kao Industrija 4.0 koristi različite aspekte IC tehnologija, povezane mašine (CPS) i delove u fabričkim (IoT) modelima, kao i realizuje široke mogućnosti primene BDA (big data) analize, koje se sprovode korišćenjem AI (veštačka inteligencija) alati. , a posebno mašinsko učenje (ML). IKT i ostale pomenute tehnologije omogućavaju kreiranje fleksibilnijih i profitabilnijih proizvodnih procesa zasnovanih na tačnim podacima, koji protiču internetom. Savremene fabrike i oprema u njima opremljeni su IoT-om (Internet of Things), koji obezbeđuje onlajn prikupljanje sve veće količine podataka, tako da je široka primena digitalnih tehnologija neizbežna. Zato možemo tvrditi da će današnji model industrije 4.0 prerasti u model industrije 5.0 zasnovan na modelu kognitivne proizvodnje, koji će postati osnovni model inteligentne proizvodnje. Polazeći od ovih činjenica, u radu je data detaljna analiza današnjeg konteksta digitalne proizvodnje, kao i njene primene u odabranim fabrikama u Srbiji, na platformi modela Siemens Industri 4.0.

Ključne riječi: *Digitalna proizvodnja, Industrija 4.0, Veštačka inteligencija.*

INVESTIGATION OF MATERIAL CHARACTERISTICS FOR ADDITIVE MANUFACTURING

KARAKTERIZACIJA MATERIALA ZA ADITIVNU PROIZVODNJU

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[2]University of Novo mesto, Faculty of Mechanical Engineering, Novo mesto, Novo mesto, Slovenia

Emine Hozdić

Elvis Hozdić

ABSTRACT:
This paper investigates the compressive properties of FDM 3D-printed PLA and PLA+CF materials across varying infill densities (40%, 60%, 80%, 100%) and their exposure to cooling lubricants for 7 and 30 days. Results reveal that PLA+CF exhibits superior compressive strength and stiffness compared to PLA, though with reduced ductility. Prolonged exposure to cooling lubricants negatively affects both materials, with PLA experiencing a more pronounced degradation in mechanical properties than PLA+CF, highlighting the latter's greater chemical resistance. The study addresses a critical gap in the understanding of the effects of real industrial environments, such as cooling lubricants, on the compressive mechanical properties of FDM components. The findings provide valuable insights for optimizing materials and printing parameters to improve the durability and performance of FDM-printed components under challenging operational conditions. Future research directions include exploring additional environmental factors and testing real industrial components.

Keywords: *additive manufacturing, fused deposition modelling (FDM), infill structure, compressive mechanical properties, PLA, PLA+CF*

REZIME:
Ovaj rad istražuje tlačna svojstva FDM 3D-printanih materijala PLA i PLA+CF pri različitim gustoćama ispune (40%, 60%, 80%, 100%) te njihovu izloženost rashladnim lubrikantima u trajanju od 7 i 30 dana. Rezultati pokazuju da PLA+CF ima superiornu tlačnu čvrstoću i krutost u odnosu na PLA, iako uz smanjenu duktilnost. Dugotrajna izloženost rashladnim lubrikantima negativno utječe na oba materijala, pri čemu PLA pokazuje izraženiju degradaciju mehaničkih svojstava u odnosu na PLA+CF, što ukazuje na veću kemijsku otpornost kompozitnog materijala.
Studija se bavi ključnim nedostatkom u razumijevanju utjecaja stvarnih industrijskih okruženja, poput rashladnih lubrikanata, na tlačna mehanička svojstva FDM komponenata. Dobiveni rezultati pružaju vrijedne uvide za optimizaciju materijala i parametara printanja kako bi se poboljšala trajnost i performanse FDM-printanih komponenata u zahtjevnim radnim uvjetima. Budući pravci istraživanja uključuju proučavanje dodatnih okolišnih čimbenika i testiranje stvarnih industrijskih komponenti.

Ključne riječi: *Aditivna proizvodnja, modeliranje taloženjem taline, struktura ispune, mehanička svojstva pri pritisku, PLA, PLA+CF*

PREDICTING ROUGHNESS OF THE 3D PRINTED MODELS USING LINEAR REGRESSION

PREDVIĐANJE HRAPAVOSTI 3D ŠTAMPANIH MODELA KORIŠĆENJEM LINEARNE REGRESIJE

Mijodrag Milošević[1], Mića Đurđev[2], Dejan Lukić[1], Grigor Stambolov[3], Remigiusz Łabudzki[4], and Rafał Świercz[5]
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Mijodrag Milošević


Mića Đurđev


Dejan Lukić


Grigor Stambolov

ABSTRACT:
This study explores the application of linear regression to predict the roughness of the 3D-printed models obtained by FDM technology. Utilizing data from experiments provided freely online, the research analyzes the influence of nine printing parameters on roughness, tensile strength, and elongation. Results show that layer height exhibits the strongest positive correlation with roughness, while bed temperature and fan speed have a negative impact. The linear regression model, developed using Python's Scikit-learn library, demonstrates high predictive accuracy, with an R^2 of 0.922, Mean Absolute Error of 24.01, and Root Mean Squared Error of 27.65. The results provide valuable insights for optimizing 3D printing processes to improve surface quality and reduce production errors, highlighting the role of machine learning in additive manufacturing advancements.

Keywords: *3D printing, roughness, linear regression, machine learning, modelling*

REZIME:
Ova studija istražuje primjenu linearne regresije za predviđanje hrapavosti 3D štampanih modela dobijenih FDM tehnologijom. Koristeći podatke iz eksperimenata koji su slobodno dostupni na internetu, istraživanje analizira utjecaj devet parametara štampanja na hrapavost odštampanih uzoraka. Rezultati pokazuju da visina sloja ima najjaču pozitivnu korelaciju s hrapavošću, dok temperatura podloge i brzina ventilatora negativno utječu. Linearni regresioni model, razvijen korištenjem Python-ove biblioteke Scikit-learn, pokazuje visoku tačnost predviđanja, sa R^2 od 0.922, sa srednjom apsolutnom greškom od 24.01 i srednjom kvadratnom greškom od 27.65. Rezultati pružaju značajne uvide za optimizaciju procesa 3D štampanja s ciljem poboljšanja kvaliteta površine i smanjenja grešaka pri izradi, naglašavajući značaj mašinskog učenja u napretku aditivne proizvodnje.

Ključne riječi: *3D štampa, hrapavost, linearna regresija, mašinsko učenje, modelovanje*

IMPROVING EDM PROCESS QUALITY WITH ADVANCED AUDIT TECHNIQUES

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Aurel Mihail Țițu

Ioan Dănuț Iuonaș

Claudiu Florin Iuonaș

ABSTRACT:
The Electrical Discharge Machining (EDM) process plays a crucial role in machining complex components used in modern industries. This report explores the application of advanced auditing techniques to improve EDM process quality, highlighting how real-time monitoring, risk-based audits, and Continuous Quality Improvement (CQI) audits can optimize process performance. The study outlines the benefits of these methods in reducing defects, enhancing consistency and operational flexibility, and meeting the stringent requirements of the automotive and aerospace industries. Additionally, it examines the challenges associated with implementing these techniques and proposes practical solutions for integrating them into existing quality management systems.

Keywords: *Nonconventional processes, Process audits, Automotive manufacturing, Quality and management assurance, Continuous improvement*

INTELLECTUAL PROPERTY PROTECTION IN MODERN MEDICAL SERVICES: NEUROSURGERY VERSUS FINE MECHANICS

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[2]Lucian Blaga University of Sibiu, Sibiu, România,

Dan Theodor Andronic

Aurel Mihail Titu

ABSTRACT:
The present paper offers a detailed exploration of an advanced field in contemporary medicine, with relevant applications in neurosurgery being correlated with the disciplines of fine mechanics. The authors approached a deep analysis of intellectual property protection's implications in the current scientific and technological progress context in a framework in which advanced knowledge plays a crucial role in optimizing everyday life. The study highlighted the importance of integrating innovation into neurosurgery, a branch of medicine that has benefited significantly from rapid technological development in recent decades. The precision instruments and sophisticated technologies used in brain and spinal surgery are based on advanced principles of fine mechanics. This is a discipline that promotes precision and meticulous control of surgical interventions. At the same time, the essential issue of protecting intellectual property rights has also been emphasized, given the intensity of technological development and the complexity of current innovation. Protecting inventions and discoveries in neurosurgery is a measure to protect innovation and an incentive for continued research and development. The paper brings to the forefront current discussions on the balance between the accessibility of knowledge and the need to protect authors and inventors. The relevance of a robust legal framework that facilitates both intellectual property protection and knowledge dissemination is emphasized, significantly impacting the advancement of medical and engineering sciences. The contribution of this study lies in clarifying the symbiotic relationship between innovation, practical applicability, and legal protection, aspects indispensable to social progress.

Keywords: *Neurosurgery, fine mechanics, intellectual property, framework.*

TOWARDS COGNITIVE CYBER-PHYSICAL PRODUCTION SYSTEMS IN THE AGE OF GENERATIVE ARTIFICIAL INTELLIGENCE

PREMA KOGNITIVNIM KIBERNETSKO-FIZIČKIM PROIZVODNIM SISTEMIMA U DOBI GENERATIVNE UMJETNE INTELIGENCIJE

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Igor Makovec

Elvis Hozdić

ABSTRACT:
This paper explores integrating generative artificial intelligence (GenAI) into cognitive cyber-physical production systems (C-CPPS) to enhance efficiency, decision-making, and autonomy in modern manufacturing. GenAI, a rapidly advancingt echnology, reduces human intervention by automating processes and supporting content generation, presenting significant potential for C-CPPS. This research proposes a comprehensive C-CPPS framework incorporating GenAI at all levels, emphasizingits role in autonomous decision-making while limiting human involvement to supervision. Key integration challenges are identified, with suggestions for future research. The findings advance self-regulating smart manufacturing and support the transition to Industry 5.0.

Keywords: *generative AI, cognitive cyber-physical production systems, Industry 5.0*

REZIME:
Ovaj rad istražuje integraciju generativne umjetne inteligencije (GenAI) u kognitivne kibernetsko-fizičke proizvodne sisteme (C-CPPS) radi povećanja efikasnosti, donošenja odluka i autonomije u modernoj proizvodnji. GenAI automatizira procese i generira sadržaj, smanjujući ljudsku intervenciju i nudeći značajan potencijal za C-CPPS. Predlaže se okvir za C-CPPS s GenAI-jem na svim razinama, s naglaskom na autonomno odlučivanje uz minimalni nadzor ljudi. Identificirani su ključni izazovi i predložena buduća istraživanja. Rezultati doprinose pametnoj proizvodnji i prijelazu na Industriju 5.0

Ključne riječi: *generativna UI, kognitivni kibernetsko-fizički proizvodni sistemi, Industrija 5.0.*

ASPECTS OF PREPARATION AND PLANNING OF BATCH LAUNCH OF DESIGN DOCUMENTATION INTO PRODUCTION FOR TECHNICALLY COMPLEX PRODUCTS

Oleksii Petrenko[1], Anna Nenia[1], Viktor Nenya[1], Viktoriya Antypenko[1]
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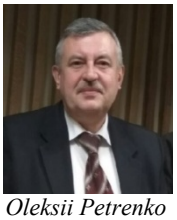
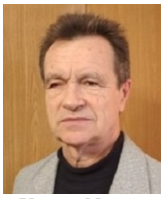

Oleksii Petrenko


Anna Nenia


Victor Nenya


Viktoriia Antypenko

ABSTRACT:
A solution that provides a reduction in the terms of "introduction" of products to the market with an increase in the quality of production planning and the formation of relevant information about the products being produced, which provides for the implementation of a software and information model of the phased (portion) launch of design documentation (CD) in production with a parallel consolidated technological preparation This model of preparation and launch of products into production assumes that production processes for product components begin before the completion of the formation of the entire set of design and technological (TD) documentation for the product, which provides significant savings in time and labor resources.
In this case, a reduction in terms is ensured due to the launch of nodes and units into production as the CD is ready, without waiting for the CD to be ready for the product as a whole. The process of manufacturing products is optimized, as the DSO warehouses, grouped by start-up batches and manufacturing workshops, are transferred to production.

Keywords: *Accelerated production preparation, production planningup, batch launch of design documentation into production*

INFLUENCE OF THE INCLINE ANGLE ON THE SURFACE QUALITY OF 3D PRINTED ELEMENTS

UTJECAJUGLA NAGIBA NA KVALITET POVRŠINE 3D PRINTANIH ELEMENATA

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Erna Berbić


Adis J. Muminović


Enis Muratović


Muamer Delić

ABSTRACT:
Additive manufacturing (AM) are taking an increasingly important place in today's production of finished usable components. In particular, Fused Deposition Modeling (FDM) are most used technology in the field of polymer component manufacturing. One of the characteristics that must be treated with special attention in order for the manufactured element to be usable is the surface quality of manufactured parts. In the case of FDM technology, one of the main parameters that has a significant impact on the quality of the processed surface is the angle of inclination during manufacturing. The inclination of the surface relative to the build plate of the additive manufacturing device is defined by the orientation of the model and the definition of the manufacturing direction. This paper examines the influence of the incline angle on the surface quality of components manufactured from Polylactic Acid (PLA) material using FDM technology.

Keywords: *Surface quality, Fused Deposition Modeling (FDM), Incline angle*

SAŽETAK:
Aditivne tehnologije (AM) zauzimaju sve značajnije mjesto u današnjoj proizvodnji gotovih upotrebljivih komponenata. Posebno se ističu tehnologije taloženja materijala poznatije i kao Fused Desposition Modeling (FDM) u oblasti proizvodnje polimernih komponenata. Jedna od karakteristika izrađenih komada na koju se mora obratiti posebna pažnja da bi izrađeni element bio upotrebljiv je kvalitet obrađene površine. Kod FDM tehnologije, jedan od glavnih parametara koji ima značajan utjecaj na kvalitet obrađene površine je ugao nagiba prilikom izrade. Nagib površine u odnosu na ravan uređaja za aditivnu proizvodnju definiše se preko orijentacije modela i definisanja smjera izrade. U ovom radu ispitan je utjecaj ugla nagiba na kvalitet obrađene površine za komponente proizvedene uz pomoć FDM tehnologije upotrebom PLA materijala.

Ključne riječi: *kvalitet površine, additivna proizvodnja, ugao nagiba*

MOTOR COGNITION AND DECISION THEORY IN SENSORIMOTOR CONTROL

MOTORIČKA KOGNICIJA I TEORIJA ODLUČIVANJA U SENZOMOTORIČKOJ KONTROLI

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[1]*University of Sarajevo, Faculty of Mechanical Engineering, Bosnia and Herzegovina*

Zlata Jelačić

ABSTRACT:
In recent years, optimal control theory has become a leading framework for studying the neural control of movement and motor cognition, contributing to two key research areas: behavioral neuroscience and humanoid robotics. Both fields face common challenges, such as the "degrees of freedom problem" and the fundamental processes of generating, observing, reasoning, and learning "actions." This paper reviews recent research on how the nervous system addresses these estimation and decision-making challenges, highlighting findings that suggest human behavior closely aligns with predictions from Bayesian Decision Theory.

Keywords: *senzorimotor control, optimal control, Bayesian decision theory*

SAŽETAK:
Posljednjih je godina teorija optimalne kontrole postala vodeći okvir za proučavanje neuralne kontrole kretanja i motoričke kognicije, pridonoseći ključnim istraživačkim područjima: biheviorističkoj neuroznanosti i humanoidnoj robotici. Oba polja suočavaju se sa zajedničkim izazovima, kao što su "problem stupnjeva slobode" i temeljni procesi generiranja, promatranja, razmišljanja i učenja. Ovaj rad daje pregled nedavnih istraživanja o tome kako živčani sustav rješava te izazove procjena i donošenja odluka, ističući nalaze koji sugeriraju da je ljudsko ponašanje usko usklađeno s predviđanjima iz Bayesove teorije odlučivanja.

Ključne riječi: *senzorimotoričko upravljanje, optimalno upravljanje, Bayesova teorija odlučivanja*

LEVERAGING LEAN SIX SIGMA (LSS) PRINCIPLES FOR PRODUCT QUALITY IMPROVEMENT IN METALWORKING INDUSTRY: LSS CASE STUDY FROM BOSNIA AND HERZEGOVINA

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Ismar Alagić

ABSTRACT:
The mix of Lean and Six Sigma was created in 2002. for the first time by M. George in his work entitled “Lean Six Sigma (LSS): Combining Six Sigma with Lean Speed”. The LSS means merge of both above mentioned terms are as follows: Lean: represents elimination of waste and to increase process efficiency, and; Six Sigma: reduce deviation from a certain dimension through process stability and achieve process without defects. The most important feature of Six Sigma methodology incorporated into Lean Six Sigma is to try to measure and decrease variations, that is, deviations inside the process, i.e. to do things better, decrease time of cycle, i.e. to do things faster and to increase utilization rate, i.e. to do things cheaper. Lean Six Sigma concept in following four words: teams, process, customers and benefit, explains best meanings of this concept. The interaction among costs in development phase and their influence on the future total product costs is clearly strong. It is so clear that design with 5% influences 70% of total costs, whilst the material which has value of 50% influences just 20% of production costs of the future product. ...
Keywords: *Lean Six Sigma (LSS), waste elimination, process efficiency, increase quality, metalworking, Bosnia and Herzegovina*

REZIME:
Kombinacija Lean i Six Sigma je 2002. godine po prvi put kreirao M. George u svom radu pod nazivom “Lean Six Sigma (LSS): Kombinacija Six Sigma sa Lean Speedom”. LSS znači spajanje oba gore navedena pojma je kako slijedi: Lean: predstavlja eliminaciju otpada i povećanje efikasnosti procesa,i; Six Sigma: smanjiti odstupanje od određene dimenzije kroz stabilnost procesa i postići proces bez defekata. Najvažnija karakteristika Six Sigma metodologije koja je ugrađena u Lean Six Sigma je pokušaj mjerenja i smanjenja varijacija, odnosno odstupanja unutar procesa, odnosno da se stvari rade bolje, smanje vrijeme ciklusa, odnosno da se stvari rade brže i da se poveća iskorištenost. stopu, tj. raditi stvari jeftinije. Lean Six Sigma koncept u sljedeće četiri riječi: timovi, proces, kupci i korist, objašnjava najbolja značenja ovog koncepta. Interakcija između troškova u fazi razvoja i njihov uticaj na buduće ukupne troškove proizvoda je jasno jaka. Tako je jasno da dizajn sa 5% utiče na 70% ukupnih troškova, dok materijal koji ima vrednost od 50% utiče na samo 20% troškova proizvodnje budućeg proizvoda. ...
Ključne riječi: *Lean Six Sigma (LSS), eliminacija otpada, efikasnost procesa, povećanje kvaliteta, obrada metala, Bosna i Hercegovina*

SELECTION OF PROTECTIVE COATING TECHNOLOGY

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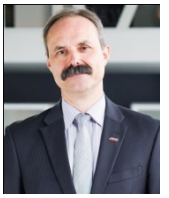
Ihor Shepelenko


Evhen Solovykh


Volodymyr Shumliakivsky


Stanislav Katerynych

ABSTRACT:
The paper compares alternative technologies of discrete-structure coatings with traditional continuous ones by comparing their wear resistance. As the most acceptable technologies of applying hardening coatings of discrete structure the following were considered: vacuum-plasma; ion nitriding; laser heat treatment; electrospark alloying. The wear resistance of coatings was determined under sliding friction conditions. The tests were carried out at fixed temperatures under dry friction and with lubrication with different base materials. The obtained wear resistance of discrete structure coatings and continuous coatings was compared with the basic variant – cementation and hardening. From the comparison of wear resistance of different technological variants the advantage of discrete structure coatings was proved. According to the achievable level of wear resistance of the discrete structure the most obvious advantage has the technology of coating by ion nitriding. It is proved that the wear resistance of discrete coatings does not depend on the base material, which makes it possible to replace expensive high alloys with cheaper structural steels.

Keywords: *protective coatings, wear resistance, discrete structure, surface hardening*

INTELLIGENT CORN MOISTURE PREDICTION FOR CONTINUOUS DRYING SYSTEMS: A GRU TIME-SERIES APPROACH IN THE ERA OF INDUSTRY 4.0

INTELIGENTNO PREDVIĐANJE VLAŽNOSTI KUKURUZA ZA KONTINUIRANE SISTEME SUŠENJA: PRISTUP TEMELJEN NA GRU MODELU VREMENSKIH SERIJA U ERI INDUSTRIJE 4.0

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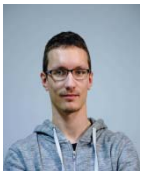

Marko Simonič *Jernej Hernavs* *Lucijano Berus* *David Potočnik*

ABSTRACT:
In the era of Industry 4.0, integrating intelligent systems into agriculture enhances efficiency and sustainability. This study focuses on moisture prediction in continuous corn drying systems using gated recurrent unit (GRU) models, trained on 3826 samples incorporating drying process parameters and weather data (humidity, temperature, precipitation, and solar radiation). The GRU model, optimized through grid search, demonstrated strong predictive accuracy (MSE: 0.17, RMSE: 0.41, MAE: 0.28, MAPE: 2.08), capturing complex temporal relationships influencing moisture dynamics. By combining machine learning, real-time data, and environmental factors, this approach offers a pathway to optimized, sustainable food processing aligned with Industry 4.0 principles.

Keywords:*Corn Drying System, Industry 4.0, Machine Learning, Gated Recurrent Units, Hyperparameter Optimization*

REZIME:
U eri Industrije 4.0 integracija inteligentnih sistema u poljoprivredi poboljšava efikasnost i održivost. Ova studija se fokusira na predviđanje vlažnosti u kontinuiranim sistemima sušenja kukuruza korištenjem modela sa jedinicama upravljanih rekurentnih mreža (GRU), treniranih na 3826 uzoraka koji uključuju procesne parametre i vremenske podatke (vlažnost zraka, temperatura, padavine i solarna radijacija). GRU model, optimiziran metodom pretraživanja mreže (grid search), pokazao je visoku tačnost predikcije (MSE: 0,17, RMSE: 0,41, MAE: 0,28, MAPE: 2,08), uspješno modelirajući složene vremenske odnose koji utiču na dinamiku vlažnosti. Kombinacijom mašinskog učenja, podataka u realnom vremenu i faktora okoline, ovaj pristup nudi put ka optimiziranom i održivom procesu obrade hrane, usklađenom s principima Industrije 4.0.

Ključne riječi: *Sistem za sušenje kukuruza, Industrija 4.0, Mašinsko učenje, Upravljane rekurentne jedinice (GRU), Optimizacija hiperparametara*

MULTI-PARAMETER PREDATOR PREY MODEL

VIŠEPARAMETARSKI MODEL PLIJENA I PREDATORA

Vahidin Hadžiabdić[1], Midhat Mehuljić[1], Jasmin Bektešević[1], Naida Mujić[2] , Sead Peco[3]
[1]University of Sarajevo -Faculty of Mechanical Engineering, Sarajevo, Bosnia and Herzegovina
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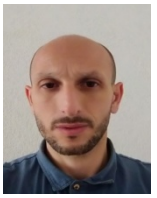
Vahidin Hadžiabdić


Midhat Mehuljić


Jasmin Bektešević


Naida Mujić

ABSTRACT:
The considerations that we want to carry out in this article refer to the examination of the influence of increasing the number of parameters in a system, on the behavior and character of the equilibrium points.We try to connect the influence of individual parameters on the enrichment of different dynamic scenarios that arise in appropriate situations. Does the necessary increase in the number of parameters lead to the appearance of some types of bifurcations?We will illustrate the results and analysis graphically in order to get a better impression of the observed challenge.

Keywords: *stability, sink, dynamics, equilibrium.*

REZIME:
Razmatranja koja želimo provesti u ovom članku odnose se na ispitivanje utjecaja povećanja broja parametara u sistem na ponašanje i karakter točaka ravnoteže (ekvilibrijuma). Pokušavamo povezati utjecaj pojedinih parametara na obogaćivanje različitih dinamičkih scenarija koji se javljaju u odgovarajućim situacijama. Dovodi li nužno povećanje broja parametara do pojave nekih vrsta bifurkacija? Rezultate i analizu ćemo grafički ilustrirati kako bismo stekli što bolji dojam o promatranom izazovu.

Ključne riječi: *stabilnost, sink, dinamika, ekvilibrijum.*

OPTIMIZATION OF CUTTING MODES DURING MACHINING OF DIFFICULT-TO-CUT MATERIALS

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Yaroslav Kusyi


Andrii Kuk


Nataliya Hryniv


Yaroslav Danylo

ABSTRACT:
Evolutionary processes in the manufacturing engineering, associated with sustainable machining and sustainable manufacture of products, require optimizing the structure of technological routes at parts manufacture, choosing rational cutting modes, and increasing productivity while reducing costs and maintaining high product quality of product. Materials with special physical and mechanical properties (corrosion resistance in various environments, heat resistance, and high strength) are widely used in different machines and mechanisms. On the other hand, these materials are difficult-to-cut and require more efforts and skills to assure the regulated quality parameters of products. In this paper the comprehensive research of the influence of cutting modes parameters: feed per spindle revolution S_0, cutting depth t, rotary speed n at turning of the samples made of EI702 steel (36NKhTYu) on the basis of the implementation of a full factor experiment at Lviv Polytechnic National University. Empirical dependencies obtained by mathematical planning of a production experiment allow predicting the values of geometric parameters of products quality in the range of changes in important cutting modes during turning. The developed computer program Roughness Plot Analyzer improves the quality, accuracy, and speed of processing profile graphs during scientific research. Further research in this direction will be extended to a wider range of materials and other methods of parts machining by cutting.

Keywords: *Surface Engineering, Quality, Machining, Manufacture, Difficult-to-Cut Materials, Roughness, Full Factor Experiment*

EVALUATING THE MODEL OF PREVENTIVE MAINTENANCE WITH TIME SHIFTS: A STOCHASTIC PETRI NETS APPROACH

PROCJENA MODELA PREVENTIVNOG ODRŽAVANJA SA VREMENSKIM POMACIMA: PRISTUP STOHASTIČKIH PETRIJEVIH MREŽA

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Ilija Hristoski

ABSTRACT:
In the Industry 4.0 era, preventive maintenance plays a crucial role in ensuring system reliability and minimizing downtime. Among others, the key reasons include integration of smart technologies, increased system complexity, cost reduction, enhanced productivity and efficiency, and regulatory compliance and safety. In this context, this paper evaluates a Deterministic and Stochastic Petri Net (DSPN) model of a generic system experiencing alternating failures and repairs while undergoing preventive maintenance at regular intervals. Unlike traditional models, the proposed approach incorporates time shifts, where each failure and subsequent repair reset the countdown to the next preventive maintenance. The DSPN framework captures the stochastic nature of failures and repairs alongside deterministic scheduling constraints. Performance evaluation focuses on system availability under two scenarios: a low availability system and a high availability system. The results provide insights into how time-shifted preventive maintenance strategies impact long-term system performance. ...
Keywords: *preventive maintenance, Deterministic and Stochastic Petri Nets (DSPNs), modeling and simulation, system availability analysis, TimeNET®*

SAŽETAK:
U eri Industrije 4.0 preventivno održavanje igra ključnu ulogu u osiguravanju pouzdanosti sustava i smanjenju zastoja. Između ostalog, ključni razlozi uključuju integraciju pametnih tehnologija, povećanu složenost sustava, smanjenje troškova, poboljšanu produktivnost i učinkovitost te usklađenost s propisima i sigurnost. U tom kontekstu, ovaj rad procjenjuje model Determinističke i Stohastičke Petrijeve Mreže (DSPN) generičkog sustava koji doživljava naizmjenične kvarove i popravke dok je podvrgnut preventivnom održavanju u redovitim intervalima. Za razliku od tradicionalnih modela, predloženi pristup uključuje vremenske pomake, gdje svaki kvar i naknadni popravak poništavaju i restartuju odbrojavanje do sljedećeg preventivnog održavanja. DSPN okvir bilježi stohastičku prirodu kvarova i popravaka uz deterministička ograničenja rasporeda. Procjena performansi usredotočuje se na dostupnost sustava prema dva scenarija: sustav niske dostupnosti i sustav visoke dostupnosti. Rezultati pružaju uvid u to kako strategije preventivnog održavanja sa vremenskim pomacima utječu na dugoročne performanse sustava. ...
Ključne riječi: *preventivno održavanje, Determinističke i Stohastičke Petrijeve Mreže (DSPN), modeliranje i simulacija, analiza dostupnosti sustava, TimeNET®*

OPTIMIZATION AND INCREASE OF PRODUCTION EFFICIENCY BY USING SERVICE ROBOTS FOR MAINTENANCE, INSPECTION AND LOGISTICS

OPTIMIZACIJA I POVEĆANJE EFIKASNOSTI PROIZVODNJE KORIŠTENJEM SERVISNIH ROBOTA ZA ODRŽAVANJE, INSPEKCIJU I LOGISTIKU

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ABSTRACT:
The introduction of service robots into production processes represents a significant advance in the modernization of industry, especially in the context of Industry 4.0. This paper explores the implementation of service robots for maintenance, inspection and logistics, highlighting their advantages, challenges and future opportunities. The application of these robots enables the automation of key operations, reduction of costs, increased efficiency, and improved safety and quality of work. Service robots for professional services use sophisticated sensors and technologies for movement as well as for detecting and repairing defects in industrial equipment. These robots can operate in difficult and hazardous conditions, reducing risks to workers and increasing work safety. Robotic inspections enable continuous monitoring and assessment of the condition of equipment, which contributes to timely maintenance and prevention of defects. One of the key aspects is the integration of service robots with existing production systems. Through the application of artificial intelligence, IoT technologies and Big Data analytics, robots can provide valuable data to optimize work processes and make informed decisions. ...
Keywords: *Industry 4.0, service robot, maintenance, inspection, logistics.*

SAŽETAK:*Uvođenje servisnih robota u proizvodne procese predstavlja značajan napredak u modernizaciji industrije, naročito u kontekstu Industrije 4.0. Ovaj rad istražuje implementaciju servisnih robota za održavanje, inspekciju i logistiku, naglašavajući njihove prednosti, izazove i buduće mogućnosti. Primjena ovih robota omogućava automatizaciju ključnih operacija, smanjenje troškova, povećanje efikasnosti, te unapređenje sigurnosti i kvalitete rada. Servisni roboti za profesionalne usluge koriste sofisticirane senzore i tehnologije za kretanje kao i za otkrivanje i popravak kvarova na industrijskoj opremi. Ovi roboti mogu raditi u teškim i opasnim uvjetima, smanjujući rizik za radnike i povećavajući sigurnost rada. Robotske inspekcije omogućavaju kontinuirano praćenje i procjenu stanja opreme, što doprinosi pravovremenom održavanju i prevenciji kvarova. Jedan od ključnih aspekata je integracija servisnih robota s postojećim proizvodnim sustavima. Kroz primjenu umjetne inteligencije, IoT tehnologija i Big Data analitike, roboti mogu pružiti vrijedne podatke za optimizaciju radnih procesa i donošenje informiranih odluka. ...*
Ključne riječi: *Industrija 4.0, servisni robot, održavanje, inspekcja, logistika.*

OPTIMAL SELECTION OF DIMENSIONS OF THE HALF DRIVE SHAFT OF THE DRIVE AXLE OF A HEAVY MOTOR VEHICLE IN THE CONCEPTUAL DESIGN PHASE

PRILOG RAZVOJU METODE ZA OPTIMALAN IZBOR PREČNIKA POLUVRATILA POGONSKOG MOSTA TERETNOG MOTORNOG VOZILA U FAZI IZRADE IDEJNOG PROJEKTA

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ABSTRACT:
During the conceptual design phase of heavy motor vehicles, many parameters are not yet known and are therefore adopted based on analogous solutions or relevant recommendations. In light of this, and to simplify the selection process, this paper develops a method for defining the diameter of the half drive shaft of the drive axle from the perspective of minimizing its forced damped torsional vibrations as an elastic system. The procedure is carried out using the method of stochastic parametric optimization. During the post-optimal analysis, the actual torsional stresses in the aforementioned shaft were verified by calculating the constuction safety factor.The method is illustrated with an example of a heavy motor vehicle with a total mass of 18,000 kg, which operates on an uneven road. The analysis determined that the developed method provides acceptable results, as it was compared with the dimensions of half drive shafts in actual vehicles and their construction safety factors.
Keywords: *Half drive shaft, torsional vibrations, optimization*

REZIME:
U fazi izrade idejnog projekta teretnih motornih vozila, mnogi parametri nisu poznati, pa se usvajaju na osnovu analognih rešenja ili odgovarajućih preporuka. Imajući to u vidu, a da bi se proces izbora olakšao, u ovom radu je razvijena metoda za definisanje prečnika poluvratilapogonskog mosta sa aspekta minimizacije njegovih torzionih vibracija, kao elstičnog sistema, primenom metode stohastičke parametarske optimizacije.Tokom postoptimalne analize izvršena je provera stvarnih tangencijalnih napona u pomenutom vratilu. Metoda je ilustrovana na primeru teretnog motornog vozila ukupne mase 18000 kg, koje se ravnomerno kretalo po neravnom putu. Tokom postoptimalne analize izvršena je provera tangencijalnih napona i izračunat stepen sigurnosti pri intenzivnom kočenju posmatranog vozila.
Analizom je utvrdjeno da razvijena metoda daje prihvatljive rezultate, jer su vršena poredjenja sa dimenzijama poluvratila kod stvarno izvedenih vozila.
Ključne reči: *Poluvratilo pogonskog mosta, torzione vibracije, optimizacija, frekventna analiza*

HYDROGEN COMBUSTION IN INTERNAL COMBUSTION ENGINES: CHALLENGES AND OPPORTUNITIES

SAGORIJEVANJE HIDROGENA U MOTORIMA S UNURAŠNJIM SAGORIJEVANJEM: IZAZOVI I PRILIKE

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Ammar Trakić


Jasmin Šehović

ABSTRACT:
The development of hydrogen internal combustion engines (H_2-ICE) has become a key topic in the global transition toward sustainable energy solutions in the transportation sector. This paper provides an overview of the progress in H_2-ICE technology, its potential advantages over conventional internal combustion engines (ICE), and the challenges associated with its application in commercial vehicles. The combustion of hydrogen (H_2) in ICEs offers significant benefits in terms of substantially lower exhaust gas emissions (CO, CO_2, and NO_x) but it also presents practical challenges in engine design as well as in the storage and transportation of H_2 as fuel.While the use of H_2 in fuel cell vehicles is currently more prevalent in the automotive industry due to the minimal emission of pollutants, H_2-ICEs offer certain advantages in terms of efficiency, technological readiness, and lower production costs.

Keywords: *hydrogen (H_2), internal combustion engine (ICE), emissions, efficiency, combustion of hydrogen*

REZIME:
Razvoj motora s unutrašnjim sagorijevanjem na hidrogen (H_2-ICE) je postao ključna tema u globalnoj tranziciji ka održivim energetskim rješenjima u transportnom sektoru. Ovaj rad daje pregled napretka u razvoju tehnologije H_2-ICE, potencijalnih prednosti u odnosu na konvencionalne motore s unutrašnjim sagorijevanjem (ICE) te izazova povezanih s primjenom u komercijalnim vozilima. Sagorijevanje hidrogena (H_2) u motorima s unutrašnjim sagorijevanjem nudi značajne prednosti u smislu znatno smanjenih emisija izduvnih gasova (CO, CO_2 i NO_x), ali također donosi praktične izazove u konstrukciji motora kao i u skladištenju i transportu H_2. Iako je upotreba H_2 u vozilima na gorive ćelije trenutno dominantnija u automobilskoj industriji zbog minimalne emisije zagađujućih materija, H_2-ICE motori nude određene prednosti u smislu efikasnosti, tehnološke spremnosti i nižih troškova proizvodnje.

Ključne riječi: *hidrogen (H_2), motor sa unutrašnjim sagorijevanjem (ICE), emisije, efikasnost, sagorijevanje hidrogena*

A SPIRAL TORSION SPRING AS A POWER SOURCE FOR A KINETIC SOUVENIR BOX

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Alma Žiga

ABSTRACT:
This paper presents a cylindrical box-shaped souvenir with dimensions of Ø80x30mm, fabricated using polylactic acid (PLA) material on a 3D printer. The box employs an iris mechanism, where the petals function as a lid. Rotating the upper ring causes the petals to open, revealing the interior. A flat spiral torsion spring, housed within the box, provides the potential energy required for closure. The paper will compare the analytically calculated bending stress in the spring, derived from existing literature, with the stress obtained through finite element analysis (FEA).

Keywords: *flat spiral torsion spring, PLA material, bending stress, box souvenir, iris mechanism*

SAŽETAK:
U radu je opisan suvenir-kutija, cilindričnog oblika dimenzija Ø80x30mm, napravljena od PLA materijala na 3D printeru. Kutija ima iris mehanizam čije latice formiraju poklopac. Okretanje gornjeg prstena dovodi do rotiranja latica a time i do otvaranja kutije i otkrivanja unutrašnjosti. Ravna, spiralna, torziona opruga, smještena u kutiji, daje energiju potrebnu za zatvaranje latica. Rad poredi napon savijanja u spirali, dobiven analitički na osnovu raspoložive literature, sa naponom koji je dobiven numerički, koristeći metodu konačnih elemenata (FEA).

Ključne riječi: *ravna, spiralna, torziona opruga, PLA material, napon savijanja, iris mehanizam*

USE OF WOOD-PLASTIC COMPOSITES OBTAINED BY 3D PRINTING : A REVIEW

UPOTREBA DRVNO-PLASTIČNIH KOMPOZITA DOBIJENIH 3D PRINTANJEM: PREGLED

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ABSTRACT:
This research analyzes the properties and uses of wood-plastic composites (WPCs) fabricated via 3D printing technology. Diverse techniques for creating are explored, highlighting the impact of various wood and plastic combinations on their physical, mechanical, thermal and hygromorphic characteristics. WPCs are materials that integrate the natural and mechanical properties of wood with the resilience and adaptability of plastics. The prospective uses are explored, emphasizing their present and future functions in both consumer and industrial settings. WPCs are sustainabile since they enable the utilization of recycled materials, providing environmental advantages, but some challenges in processing and performance of 3D printed WPCs exist, along with need for research and development focused on enhancing material qualities and broadening application potential. The review explores methods of combining wood fibers, wood fluor and continous fibers with polymers.

Keywords:*wood-plastic composites, additive manufacturing, 3D printing, biocomposites*

REZIME:
Ovo istraživanje analizira svojstva i upotrebu drvno-plastičnih kompozita (WPC) proizvedenih tehnologijom 3D printanje. Istražuju se različite tehnike stvaranja, naglašavajući utjecaj različitih kombinacija drva i plastike na njihove fizičke, mehaničke, toplinske i higromorfne karakteristike. WPC su materijali koji integriraju prirodna i mehanička svojstva drveta sa elastičnošću i prilagodljivošću plastike. Istražuju se potencijalne upotrebe, naglašavajući njihove sadašnje i buduće funkcije u potrošačkim i industrijskim okruženjima. WPC-ovi su održivi jer omogućavaju korištenje recikliranih materijala, pružajući ekološke prednosti, ali postoje neki izazovi u obradi i performansama 3D printanih WPC-ova, zajedno s potrebom za istraživanjem i razvojem usmjerenim na poboljšanje kvaliteta materijala i širenje potencijala primjene. Pregled istražuje metode kombinovanja drvenih vlakana, drvnog brašna i neprekidnih vlakana sa polimerima.

Ključne riječi: *drvo-plastični kompoziti, aditivna proizvodnja, 3D printanje, biokompoziti*

DIMENSIONAL COMPENSATION FOR LOOSE FIT ASSEMBLIES IN FDM 3D PRINTING OF PLA CYLINDRICAL PARTS

KOMPENZACIJA DIMENZIJA ZA SKLOPOVE SA LABAVIM NALIJEGANJEM KOD 3D PRINTANJA CILINDRIČNIH DIJELOVA OD PLA

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Ernad Bešlagić


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ABSTRACT:
This study examines dimensional deviations in polylactic acid (PLA) 3D printed parts with cylindrical features and explores compensations to ensure loose fits in cylinder-hole assemblies. In the first phase, samples with cylindrical features, including solid protrusions and holes (3.5–30 mm), were fabricated and measured to analyse deviations from designed dimensions. In the second phase, these findings were used to adjust dimensions, and new cylinder-hole pairs were printed to achieve the desired loose fit. Printing parameters such as layer height and infill density were varied to assess their impact on dimensional accuracy. Results confirmed that applied compensations successfully achieved loose fits, offering practical guidelines for designing PLA parts for assembly applications.

Keywords:*polylactic acid (PLA), FDM 3D printing, dimensional accuracy, cylindrical features, loose fit assemblies, dimensional compensations*

REZIME:
Ovo istraživanje istražujedimenzionalna odstupanja kod 3D printanih dijelova od polilaktične kiseline (PLA) sa cilindričnim geometrijama i kompenzacije dimenzija u svrhu osiguranja labavog nalijeganja u sklopovima cilindar-otvor. U prvoj fazi, uzorci sa cilindričnim geometrijama, uključujući nastavke i otvore (3,5-30 mm), su izrađeni i izmjereni kako bi se analizirala odstupanja od konstruktivnih dimenzija. U drugoj fazi, ovi rezultati su iskorišteni za prilagođavanje dimenzija, i novi parovi cilindar-otvor su printani kako bi se postiglo željeno labavo nalijeganje. Parametri printanja, kao što su visina sloja i gustoća ispune, su varirani kako bi se procijenio njihov uticaj na dimenzionalnutačnost. Rezultati su potvrdili da su primijenjene kompenzacije uspješno ostvarile labavo nalijeganje, pružajući praktične savjete za konstruiranje PLA dijelova u sklopovima.

Ključne riječi: *polilaktična kiselina (PLA), 3D printanje FDM tehnologijom, dimenzionalnatačnost, cilindrične geometrije, sklopovi sa labavim nalijeganjem, dimenzionalne kompenzacije*

ANALYSIS OF THE APPLICABILITY OF ADDITIVE TECHNOLOGY FROM THE ASPECT OF USED MATERIALS

ANALIZA PRIMJENJIVOSTI ADITIVNE TEHNOLOGIJE SA ASPEKTA KORIŠTENIH MATERIJALA

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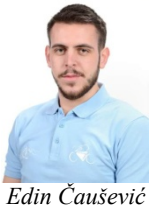
Edin Čaušević


Adi Pandžić


Edina Karabegović

ABSTRACT:
The development of technologies used for product manufacturing is constantly growing. The use of conventional technologies lasted for many years, constantly seeking optimal solutions for product manufacturing. The market's demand for manufacturing complex products, products made from hard-to-machine materials, or the need for rapid production of products, has led to the development of new manufacturing technologies, automation of production processes and the implementation of intelligent manufacturing systems, among others. With unconventional and additive technologies in industrial manufacturing, many benefits have been found over conventional manufacturing methods. The development of additive technologies has made it possible to achieve significant savings in material and energy for shaping products, reduced prototype production time and development time for new products. In this paper, an analysis of the applicability of additive technologies is presented from the aspect of the materials used for manufacturing 3D-printed notched elements. The notched element was previously made using CNC machining.
Keywords: *additive technologies, 3D printing, PLA, carbon, metal powder*

REZIME:
Razvoj tehnologija za izradu proizvoda je u stalnom porastu. Primjena konvencionalnih tehnologija je trajala dugi niz godina uz konstantno traženje optimalnih rješenja za izradu proizvoda. Potreba tržišta za izradom proizvoda složenog oblika, proizvoda od teško obradivih materijala ili izradu proizvoda u što kraćem vremenu, dovela je do razvoja novih tehnologija izrade proizvoda, automatizacije proizvodnje, primjene inteligentnih proizvodnih sistema i sl. Primjenom nekonvencionalnih i aditivnih tehnologija u industrijskoj proizvodnji ostvarile su se mnoge prednosti u odnosu na klasičan način izrade proizvoda. Razvoj aditivnih tehnologija omogućio je značajnu uštedu u materijalu i energiji za oblikovanje proizvoda, kraćem vremenu izrade prototipa i razvoja novog proizvoda. U ovom radu izvršena je analiza primjenjivosti aditivnih tehnologija sa aspekta korištenih materijala za izradu radnog komada 3D printanjem. Komad je prethodno urađen CNC obradom rezanja.
Ključne riječi: *aditivne tehnologije, 3D printanje, PLA materijal, karbon, metalni prah.*

DETERMINING DIMENSIONAL DEVIATIONS IN SPHERES FORMED BY EXPLOSIVE FORMING

ODREĐIVANJE DIMENZIONALNIH DEVIJACIJA KOD KUGLI DOBIVENIH OBRADOM EKSPLOZIJOM

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ABSTRACT:
Explosive forming as a high-velocity forming technology relies on the relative displacement of each point deformed by the shock wave. Explosives are used for shaping metal or other workpieces, particularly suitable for large-sized objects and complex geometries. 3D scanning can be highly useful for analyzing and measuring the dimensions of the initial geometry of a workpiece, and after explosive forming, scanning is used to review the final geometry. By comparing CAD models (before and after forming), deviations arising from the forming process are determined. This paper presents the determination of deviations in a metallic sphere made of St12 material with a sheet thickness of 1 mm. A comparison was also made with a metallic sphere of the same material but a sheet thickness of 1.5 mm, leading to specific conclusions.

Keywords:*explosive forming, deformations, deviations, 3D scan*

REZIME:
Obrada metala eksplozijom kao visokobrzinska tehnologija oblikovanja zasniva se na relativnom pomaku svake točke koju deformira udarni val. Kod obrade eksplozijom koriste se eksplozivna sredstva za oblikovanje metalnih ili drugih radnih predmeta, a posebno je pogodna za oblikovanje radnih predmeta velikih dimenzija i složene geometrije. 3D skeniranje može biti jako korisno za analizu i mjerenje dimenzija početne geometrije radnog predmeta a nakon oblikovanje eksplozijom skeniranje se koristi za pregled konačne geometrije, te usporedbom CAD modela (prije i poslije oblikovanja) određuju se devijacije nastale nakon oblikovanja. U radu je prikazano određivanje devijacije kod metalne kugle materijala St12 i debljine lima 1 mm. Također, izvršena je i usporedba devijacija kod metalne kugle od istog materijala ali debljine lima 1,5 mm te su doneseni zaključci.

Ključne riječi: *obrada eksplozijom, deformacije, devijacije, 3D skeniranje*

LOGISTIC REGRESSION ANALYSIS OF ENTREPRENEURIAL INTENTIONS AND MINDSET DIMENSIONS OF STUDENTS FROM BOSNIA AND HERZEGOVINA AND EUROPEAN UNION

LOGISTIČKA REGRESIJSKA ANALIZA PREDUZETNIČKIH NAMJERA I DIMENZIJA NAČINA RAZMIŠLJANJA STUDENATA IZ BOSNE I HERCEGOVINA I EVROPSKE UNIJE

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Faris Ferizbegovic


Mugdim Pasic

ABSTRACT:
The aim of this research was to develop machine learning logistic regression model to classify students from BIH and EU based on their entrepreneurial intentions, entrepreneurial mindset dimensions, resources and demographic and academic characteristics. Logistic regression coefficients were used to analyze the impact of variables on model output. The results showed that the increase in variable values of Entrepreneurial intention, Confidence, Action-oriented, as well as being in the Master study cycle increase the odds ratio that the student is from BIH, while increase in variable values of Peculiarity, Innopreneurship, Innovation-oriented, Experience, Risk acceptance, Need to achieve, Persistence, Resources, Age, as well as being male and being in the Bachelor study cycle decrease the odds ratio that the student is from BIH, increasing the probability that the student is from the EU.

Keywords: *machine learning, logistic regression, entrepreneurship, entrepreneurial intention,entrepreneurial mindset dimensions.*

REZIME:
Cilj ovog istraživanja je bio da se razvije model logističke regresije mašinskog učenja za klasifikaciju studenata iz BiH i EU na osnovu njihovih preduzetničkih namjera, dimenzija preduzetničkog načina razmišljanja, resursa i demografskih i akademskih karakteristika. Koeficijenti logističke regresije korišteni su za analizu uticaja varijabli na izlaz modela. Rezultati su pokazali da povećanje vrijednosti varijabliPreduzetnička namjera, Samopouzdanje, Orijentiranost na akciju kao i da je student upisan naMagistarski ciklusstudija povećavajuomjer šansi da je student iz BiH, dok povećanje vrijednosti varijabliPosebnost, Inovativno preduzetništvo, Orijentiranost na inovaciju, Iskustvo, Prihvatanje rizika, Potreba za postignućem, Upornost, Resursi, Godine, kao i da je student muškog spola i da je upisan naBachelorciklus studija smanjuju omjer šansi da je student iz BiH, što povećava vjerovatnoću da je student iz EU.

Ključne riječi: *mašinsko učenje, logistička regresija, preduzetništvo, preduzetnička namjera, dimenzije preduzetničkog načina razmišljanja.*

COMPARATIVE ANALYSIS OF DISTRICT HEATING TECHNOLOGIES: A CASE STUDY ON COGENERATION AND HEAT PUMPS

KOMPARATIVNA ANALIZA TEHNOLOGIJA DALJINSKOG GRIJANJA: STUDIJA SLUČAJA O KOGENERACIJI I TOPLOTNIM PUMPAMA

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Nejra Biber


Nijaz Delalic


Azrudin Husika

ABSTRACT:
This paper presents comparative analysis of two different heat sources for the existing district heating system in Sarajevo. Analyzed alternatives include:(i) cogeneration in the Kakanj thermal power plant combined with the construction of a hot water pipeline, and (ii) the integration of water-to-water heat pumps. The paper analyzes the required primary energy and the cost of heat energy at the entry point to the district heating system starting from the base load of 300 MWth. The results showed that the primary energy consumption is lower in the case of heat pumps compared to the case of Kakanj thermal power plant. Further, the cost of heat at the entry point to the district heating system is also lower for heat pumps. This research gives insights into the technical and economic aspects of the analyzed technologies and underlines the role of heat pumps as a promising alternative for district heating systems in the decarbonization process.

Keywords: *district heating, cogeneration, heat pumps.*

REZIME:
Ovaj rad predstavlja komparativnu analizu dva različita izvora toplote za postojeći sistem daljinskog grijanja u Sarajevu. Analizirane alternative uključuju:(i) kogeneraciju u termoelektrani Kakanj uz izgradnju vrelovoda i (ii) integraciju toplotnih pumpi tipa voda-voda.Rad analizira potrošnju primarne energije i trošak za toplotnu energiju na ulaznoj tački sistema daljinskog grijanja, polazeći od osnovnog opterećenja od 300 MWth. Rezultati su pokazali da je potrošnja primarne energije niža u slučaju isporuke toplote pomoću toplotnih pumpi u poređenju sa onom iz termoelektrane Kakanj. Nadalje, trošak za toplotnu energiju na ulaznoj tački sistema daljinskog grijanja također je niži za toplotne pumpe. Ovo istraživanje pruža uvid u tehničke i ekonomske aspekte analiziranih tehnologija i naglašava ulogu toplotnih pumpi kao obećavajuće alternative za sisteme daljinskog grijanja u procesu dekarbonizacije.

Ključne riječi: *daljisnko grijanje, kogeneracija, toplotne pumpe*

EVALUATION OF THE CAPABILITY OF A DIGITAL MICROMETER USING MSA ANALYSIS FOR MONITORING THE QUALITY OF PARTS MANUFACTURING

PROCJENA SPOSOBNOSTI DIGITALNOG MIKROMETRA UPOTREBOM MSA ANALIZE ZA PRAĆENJE KVALITETA PROIZVODNJE DIJELOVA

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Adis Durakovic

ABSTRACT:
In this work, an evaluation of the ability of a digital micrometer as a measuring system was made using MSA analysis (repeatability, reproducibility, GRR), for monitoring the quality of manufacturing parts according to AIAG requirements. It very often happens that during the parts manufacturing process, after the parts manufacturing process has been approved, the parts manufacturing process itself is optimized, which can sometimes have a negative impact on the quality of the manufactured parts. In this paper, even after the optimization of the process, the assessment of the ability of the micrometer as a measuring system was examined and the influence of the optimization of the process on the quality of the manufactured parts was analyzed.

Keywords: *MSA , quality, repability, reproducibility, measurements, analysis*

SAŽETAK:
U radu je urađena procjena sposobnosti digitalnog mikrometra kao mjernog sistema upotrebom MSA analize (ponovljivost,obnovljivost, GRR), za praćenje kvaliteta izrade dijelova prema zahtjevima AIAG. Vrlo često se dešava da u toku procesa izrade dijelova nakon što je odobren process izrade dijelova dolazi do optimizacije samog procesa izrade dijelova što nekad može imati negativan utjcaj na kvalietet izrađenih dijelova. U ovom radu je i nakon optimizacije procesa ispitana procjena sposobnosti mikrometra kao mjernog sistema i analiziran je utjecaj optimizacije procesa na kvalitet izrađenih dijelova.

Ključne riječi: *MSA, kvalitet, ponovljivst, obnovljivost, mjerenje, analiza*

EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF DEFORMATION SPEED AND DEFORMATION RATE ON THE FORCE OF MULTI-STAGE DRAWING

EKSPERIMENTALNO ISTRAŽIVANJE UTICAJA BRZINE DEFORMISANJA I BRZINE DEFORMACIJE NA SILU VIŠESTEPENOG IZVLAČENJA

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Mirna Nožić

ABSTRACT:
Deformation speed and deformation rate affect the value of deformation force in deformation processing processes. The paper presents the results of the experimental determination of the deformation force and the deformation rate during the drawing of cylindrical workpieces on a four-stage tool. Experimental research was carried out in laboratory and production conditions, at different deformation speed.

Keywords: *deformation rate, deformation speed, drawing force, logarithmic degree of deformation, deep drawing with reduced wall thickness*

REZIME:
Brzina deformisanja i brzina deformacije utiču na vrijednost deformacione sile u procesima obrade deformisanjem. U radu su dati rezultati eksperimentalnog određivanja deformacione sile i brzine deformacije pri izvlačenju cilindričnih radnih predmeta na četverostepenom alatu. Eksperimentalna istraživanja su provedena u laboratorijskim i proizvodnim uslovima, pri različitim brzinama deformisanja.

Ključne riječi*: brzina deformacije, brzina deformisanja, sila izvlačenja, logaritamski stepen deformacije, duboko izvlačenje sa redukcijom debljine zida*

METALLOGRAPHIC PROPERTIES OF BEARING STEEL

METALOGRAFSKA SVOJSTVA ČELIKA ZA LEŽAJ

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Belma Fakić


Adisa Burić


Edib Horoz

ABSTRACT:
Bearing steel is a steel used for the production of balls, rollers and rings for bearings. The essential properties of steel are uniform hardness and wear resistance. Uniformity of chemical composition significantly affects the achievement of uniform microstructure across the cross-section of the piece. The presence of non-metallic inclusions in steel significantly reduces the service life of bearing steel. This paper presents an overview of metallographic tests of 100Cr6 bearing steel.

Keywords: *bearing steel, heat treatment, microstructure, non-metallic inclusion, carbide, grain size*

SAŽETAK:
Čelik za ležajeve je čelik koji se koristi za proizvodnju kuglica, valjaka i prstenova za ležajeve. Osnovna svojstva čelika su ujednačena tvrdoća i otpornost na habanje. Ujednačenost hemijskog sastava značajno utiče na postizanje ujednačene mikrostrukture na poprečnom presjeku komada. Prisutnost nemetalnih uključaka u čeliku značajno smanjuje vijek trajanja čelika za ležajeve. Ovaj rad daje pregled metalografskih ispitivanja čelika za ležajeve 100Cr6.

Ključne riječi: *čelik za ležajeve, termički tretman, mikrostruktura, nemetalni uključci, karbidi, veličina zrna*

MARTENSITIC TRANSFORMATION IN SEMIAUSTENITIC STAINLESS STEEL 17-7PH WITH MODIFIED CHEMICAL COMPOSITION

MARTENZITNA TRANSFORMACIJA POLUAUSTENITNOG NEHRĐAJUĆEG ČELIKA 17-7PH MODIFIKOVANOG HEMIJSKOG SASTAVA

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Belma Fakić


Diana Ćubela

ABSTRACT:
Steel 17-7PH is austenitic-martensitic steel with high strength, hardness, resistance to creep and corrosion. It is designed for use in aerospace components, but can also be used for other applications which require high strength and corrosion resistance, as well as for the leaf spring to operate at temperatures up to 316°C. The type of steel is determined by the starting martensite transformation, Ms, and the end of martensitic transformation, Mf. This paper presents the experimental determination of the temperature of martensitic transformation as well as the application of the JMatPro application.

Keywords: *semiaustenitic steel, martensite, heat treatment, temperature transformation*

SAŽETAK:
Čelik 17-7PH je austenitno-martenzitni čelik visoke čvrstoće, tvrdoće, otpornosti na puzanje i koroziju. Dizajniran je za upotrebu u vazduhoplovnim komponentama, ali se može koristiti i za druge primjene koje zahtijevaju visoku čvrstoću i otpornost na koroziju, kao i za rad lisnatih opruga na temperaturama do 316°C. Vrsta čelika određena je početnom martenzitnom transformacijom, Ms, i krajem martenzitne transformacije, Mf. U radu je prikazano eksperimentalno određivanje temperature početka martenzitne transformacije kao i primjena JMatPro aplikacije.

Ključne riječi: *poluaustenitni čelik, martenzit, termički tretman, temperatura transformacije*

COMPARATIVE ANALYSIS OF HYDRAULIC MACHINERY VIBRATION EVALUATION STANDARDS

KOMPARATIVNA ANALIZA STANDARDA ZA EVALUACIJU STANJA HIDRAULIČKIH MAŠINA

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Emir Nezirić


Safet Isić


Damir Špago


Merima Ćupina

ABSTRACT:
Standardization is an inevitable part of technological processes. One of the processes that has been standardized is the evaluation of hydraulic machinery vibrations, which is a key component of machinery reliability assessment. The aim of this paper is to conduct a comparative analysis of the ISO 20816-5 standard and its predecessors, ISO 10816-5 and ISO 7919-5. The main parts and items were grouped into three divisions and compared across the standards. A subjective assessment of the ease and impact on reliability of the new standard's procedures for these parts and items was conducted. It was concluded that the new standard has significantly simplified and provided a more detailed description of measurement procedures, as well as clearly outlined steps for the reliable evaluation of machinery condition based on vibration measurements and other mechanical parameters.

Keywords: *vibration measurement, vibration evaluation standards, hydraulic machinery.*

REZIME:
Standardizacija je neizbježan dio inžinjerskih procesa. Jedan od procesa koji je standardizovan je evaluacija vibracija hidrauličkih mašina, koja je ključna komponenta u procjeni pouzdanosti mašina. Cilj ovog rada je da se provede komparativna analiza ISO 20816-5 standarda i njegovih predhodniga, ISO 10816-5 i ISO 7919-5. Glavne stavke standarda su podijeljene u tri grupe i upoređene između standarda. Subjektivna procjena jednostavnosti primjene i uticaja na pouzdanost je izvršena nad dijelovima standarda. Zaključeno je novi standard značajno jednostanviji od svojih prethodnika i da daje više opisa procedura mjerenja, kao i jasno istaknute korake za procjenu pouzdanosti mašina zasnovane na mjerenju vibracija i drugih mehaničkih parametara.

Ključne riječi: *mjerenje vibracija, standardi za evaluaciju vibracija, hidrauličke mašine.*

PRODUCTIVITY OF WOOD EXTRACTION BY CABLE YARDER “MOUNTY 4000”

EFEKTI RADA NA PRIVLAČENJU DRVETA ŠUMSKOM ŽIČAROM “MOUNTY 4000”

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Jusuf Musić


Velid Halilović


Emin Sirćo


Jelena Knežević

ABSTRACT:
Wood extraction by cable yarders represents transport with the load partially or completely lifted from the soil, where the interaction soil-machine is minimal or completely eliminated. The productivity and cost of wood extraction by cable yarder “Mounty 4000” depending on the most important influence factors were analyzed in this research. The productivity was determined by work and time study. The share of productive work time was 79.7%, and allowance time 20.3%. Work productivity decreased by yarding distance increasing, from 82.05 to 31.39 m^3/WD. Direct unit costs increased with yarding distance increasing, from 24.49 to 64.03 BAM/m^3. Time study analysis and time of cable yarder assembly and disassembly pointed to the excellent training of the workers and the very good work organization. The results of performed work and time study are similar to the results of other researches for similar work conditions.

Keywords: *wood extraction, cable yarder, productivity, cost calculation.*

REZIME:
Privlačenje drveta žičarama predstavlja njegov transport pri čemu je teret djelimično ili potpuno odignut od tla, te je interakcija tlo-stroj minimalna ili potpuno eliminirana. U radu je analizirana produktivost i troškovi privlačenja drveta žičarom “Mounty 4000” u zavisnosti od važnijih utjecajnih faktora. Efekti rada su utvrđeni primjenom studija rada i vremena. Udio operativnog vremena iznosio je 79,7%, a dodatnog vremena 20,3%. Produktivnost rada opadala je sa povećanjem distance, od 82,05 do 31,39 m^3/RD. Neposredni jedinični troškovi rada rasli su sa povećanjem distance, od 24,49 do 64,03 KM/m^3. Analiza strukture radnog vremena, kao i vremena montaže i demontaže žičare ukazala je na odličnu obučenost radnika i vrlo dobru organizaciju rada. Dobiveni rezultati o utrošku vremena i produktivnosti rada su slični rezultatima drugih autora, u sličnim uvjetima rada.

Ključne riječi: *privlačenje drveta, šumska žičara, efekti rada, kalkulacija troškova rada.*

DETECTION OF DRY TREES USING NDVI IMAGES TAKEN BY A DRONE

DETEKCIJA SUHIH STABALA POMOĆU NDVI SNIMAKA DOBIJENIH KORIŠTEJNEM DRONA

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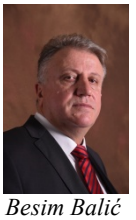
Admir Avdagić


Ahmet Lojo


Besim Balić


Ismet Fazlić

ABSTRACT:
Forests are critical terrestrial ecosystems that provide extensive economic, ecological, and environmental benefits. However, they are increasingly threatened by both biotic and abiotic disturbances. Among biotic factors, insect infestations are a leading cause of damage, posing significant challenges to coniferous forests in the Northern Hemisphere. Remote sensing technologies offer a promising solution for detecting forest disturbances caused by pests. This study evaluates the effectiveness of the Normalized Difference Vegetation Index (NDVI) in identifying dead trees affected by pest infestations. Using data collected from a Mavic 3M unmanned aerial vehicle equipped with a multispectral camera, NDVI imagery was generated and classified into vegetation presence levels. The classification successfully delineated areas containing dead trees, demonstrating the potential of NDVI-based remote sensing for forest health monitoring.

Keywords: *Remote sensing, NDVI, forest classification, pest damage, dead trees*

REZIME:
Šume su vrlo važni kopneni eko sistemi sa značajnim ekonomskim, ekološkim i ekološkim prednostima, ali su ugroženi biotičkim i abiotičkim poremećajima. Kukci su glavni uzročnik biotičkih poremećaja sa štetnim učincima na crnogorične šume sjeverne hemisfere. Tehnologije daljinskog očitavanja mogu biti učinkovit alat za otkrivanje poremećaja šuma uzrokovanih različitim štetočinama. U ovom smo radu analizirali potencijal normaliziranog vegetacijskog indeksa razlike (NDVI) u detekciji suhih stabala napadnutih od različitih štetnika. NDVI je stvoren korištenjem bespilotne letjelice Mavic 3M sa multispektralnom kamerom. NDVI slika je klasificirana u klase na temelju razine prisutnosti vegetacije. Kao rezultat klasifikacije dobivena je klasa čija ljestvica uključuje osušena stabla.

Ključne riječi*: Daljinska detekcija, NDVI, klasifikacija, suha stabla*

EFFICIENCY OF HEATS PUMP SYSTEM IN THE EUROPEAN UNION

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Branislav Dudić


Alexandra Mittelman


Branko Štrbac


Borislav Savković

ABSTRACT:
The surrounding environment contains abundant energy that can be harnessed for our benefit, a challenge addressed by heat pumps—one of the most prominent systems for extracting environmental energy. Heat pumps represent an alternative, modern, energy-efficient, and environmentally friendly source of thermal energy. Simply put, they are economical and ecological devices for heating and cooling water, leveraging renewable energy sources. The European Union offers favourable and practical conditions for using heat pumps as alternative energy sources. In the most developed European countries such as France and Germany, it is now common for new residential buildings to be equipped with heat pump systems.

Keywords: *heat pump, investment, economy measures, heat demand, energy demand.*

SMED IN PRACTICE – CASE STUDY OF FAST TOOL CHANGES APPLICATION THROUGH LEAN SIX SIGMA PROJECT

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Ismar Alagić

ABSTRACT:
In this paper, it will point out the application of Single Minute Exchange of Die (SMED) as Lean Six Sigma (LSS) tool in order to provide fast tool changes. This article is the result of several years of dedicated work in the field Lean Six Sigma project implemented in working conditions of manufacturing-oriented companies. A special attention is given to the research of a unique and understandable concept of continuous progress - Kaizen.
This article provides proposal a set of approaches that are the basis for the development and application of the SMED as tool for Lean Six Sigma approach.

Keywords: *Single Minute Exchange of Die (SMED), Lean Six Sigma (LSS), Setup-time, manufacturing application, Kaizen improvement.*

REZIME:
U ovom radu će se ukazati na primjenu Single Minute Exchange of Die (SMED) kao Lean Six Sigma (LSS) alata kako bi se omogućile brze izmjene alata. Ovaj članak je rezultat višegodišnjeg predanog rada na polju Lean Six Sigma projekta implementiranog u radnim uslovima proizvodno orijentisanih kompanija. Posebna pažnja posvećena je istraživanju jedinstvenog i razumljivog koncepta kontinuiranog napretka - Kaizen.
Ovaj članak daje prijedlog skupa pristupa koji su osnova za razvoj i primjenu SMED-a kao alata za Lean Six Sigma pristup.

Ključne riječi: *Jednominutna razmjena matrice (SMED), Lean Six Sigma (LSS), Setup-time, proizvodna aplikacija, Kaizen poboljšanje*

DEFINITION OF THE FUNCTIONAL REQUIREMENTS FOR THE DESIGN OF AN AUTONOMOUS LIGHT-WEIGHT PEDAL ASSISTED URBAN VEHICLE

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Rosario La Regina


Teresa Adinolfi


Carmine Maria Pappalardo


Domenico Guida

ABSTRACT:
This paper aims to define the functional requirements for designing a light urban pedal-assisted vehicle, a key step in shaping the future of sustainable urban mobility. In the current context of increased environmental awareness, light pedal-assisted vehicles (Pedelec) represent an evolution in the transport sector, reducing dependence on fossil fuels and CO2 emissions. The work analyses the current legislation at the European and national levels. It exam-ines the state of the art of two and four-wheel pedal-assisted vehicles, com-paring the different available technologies. In particular, the main compo-nents of pedal-assisted bicycles have been analyzed, and then a step forward in terms of safety and comfort has been made with an overview of existing models of pedal-assisted quadricycles. The conclusion of the present work underscores the potential impact of these innovative solutions on the future of sustainable urban mobility, offering hope for a greener future. Additional-ly, this study underlines the need for further technological and infrastructural developments to support greater adoption of pedal-assisted vehicles, espe-cially in densely populated and congested urban areas.

Keywords: *Pedelec, Electric-assisted vehicles, Quadricycle.*

PROBABILITY OF CUTTING TOOL FAILURE IN INTERMITTEN MACHINING

VEROVATNOĆA OTKAZA REZNOG ALATA U OBRADI SA PREKIDAMA

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[3]National Technical University «Kharkiv Polytechnic Institute», Kharkiv, Ukraine


Artem Naidenko


Serhii Riabchenko


Oleg Golovatenko


Kateryna Kamchatna-Stepanova

ABSTRACT:
The assessment of the probability of tool failure is based on determining the statistical characteristics of the strength of the tool material - the mathematical expectation of the yield strength and its standard deviation, as well as the maximum principal stress of the tool in the contact zone. The probability of failure of PcBN based tools during impact oblique cutting with a radius cutting edge was calculated. It was established that the presence of an impulse load during impact processing of hardened steels significantly increases the probability of brittle failure of tools.

Keywords: *probability of fracture, intermittent machining, cutting tool, hardened steel.*

REZIME:
Procena verovatnoće kvara alata zasniva se na određivanju statističkih karakteristika čvrstoće materijala alata – matematičkog očekivanja granice tečenja i njene standardne devijacije, kao i maksimalnog glavnog napona alata u zoni kontakta. Izračunata je verovatnoća kvara alata na bazi PcBN tokom udarnog kosog sečenja sa poluprečnikom reznom ivicom. Utvrđeno je da prisustvo impulsnog opterećenja pri udarnoj obradi kaljenih čelika značajno povećava verovatnoću krtog loma alata.

Ključne riječi: *verovatnoća loma, povremena obrada, rezni alat, kaljeni čelik.*

PREDICTION DATA ANALYSIS OF MEASURING INSTRUMENTS BEHAVIOUR FOR RELIABLE USE IN LEGAL METROLOGY

ANALIZA PODATAKA I PREDVIĐANJE PONAŠANJA MJERNIH INSTRUMENATA ZASNOVANO NA MAŠINSKOM UČENJU ZA POUZDANU UPOTREBU U ZAKONSKOM MJERITELJSTVU

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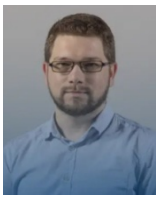
Haris Memić


Almira Softić


Haris Lulić


Jasmin Kevrić

ABSTRACT:
Legal metrology focuses on consumer protection from unreliable, inaccurate, and imprecise measurements. Measuring instruments subject to legal control must comply with the requirements of metrological normative acts. Reliable measurement results are used for economic transactions and in industry. Our objective in this paper was to predict instrument behaviour and failures through the analysis of measuring instruments database history. Data analysis using Machine learning tools for prediction of instrument behaviour (specific type of non-automatic weighing instrument) was made. The data set covers all measurement ranges inrelation to theirpermissibleerrors. Usedanalysisprovidesinsight into the reliability of the instruments' measurement results for all users, but also for state authorities responsible for end consumers protection and supervision of the measurement system in the country.

Keywords: *dataanalysis, verification, legalmetrology, consumerprotection, machinelearning*

REZIME:
Zakonsko mjeriteljstvo usmjereno je na zaštitu potrošača od nepouzdanih, netačnih i nepreciznih mjerenja. Mjerila koja podliježu zakonskom nadzoru moraju ispunjavati zahtjeve mjeriteljskih normativnih akata. Pouzdani rezultati mjerenja koriste se za ekonomske transakcije iu industriji. Naš cilj u ovom radu bio je predvidjeti ponašanje i neusklađenosti instrumenata kroz analizu istorije baze podataka mjernih instrumenata. Napravljena je analiza podataka korištenjem alata za mašinsko učenje za predviđanje ponašanja instrumenta (određeni tip neautomatske vage). Skup podataka pokriva sve mjerne opsege u odnosu na njihove dozvoljene greške. Korištena analiza daje uvid u pouzdanost mjernih rezultata instrumenata za sve korisnike, ali i za državna tijela zadužena za zaštitu krajnjih potrošača i nadzor mjernog sistema u zemlji.

Ključne riječi: *analiza podataka, verifikacija, zakonsko mjeriteljstvo, zaštita potrošača, mašinsko učenje*

MANAGING PARTNERS, DATA AND COMPLIANCE THROUGHOUT THE LIFECYCLE ON THE BASIS OF A PACKAGING LINE

UPRAVLJANJE PARTNERIMA, PODACIMA I ZASNOVANO NA PRAVILIMA KROZ ŽIVOTNI CIKLUS NA PRIMJERU SUSTAVA ZA PAKIRANJE

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Alexandra Saliger


Viktorio Mališa

ABSTRACT:
The aim of Industry 4.0 is the comprehensive networking of machines and devices and the creation of digital twins based on the collected data. The Asset Administration Shell (AAS) provides a standard for the organisation and management of data throughout the lifecycle of an asset, and this article examines the changes in relationships, partners, data flows and compliance during the product lifecycle and the associated challenges. A case study of a packaging line with multiple networked machines is used to demonstrate how the models of a production line are constructed to assess security throughout the lifecycle. Using sub-models of the asset administration shell, safety data from different components of a machine or system can be collected and analysed.

Keywords:*industry 4.0,life cycle machine, modeling, packaging machine*

SAŽETAK:
Cilj Industrije 4.0 je sveobuhvatno umrežavanje strojeva i uređaja te stvaranje digitalnih blizanaca na temelju prikupljenih podataka. Asset Administration Shell (AAS) pruža standard za organizaciju i upravljanje podacima tijekom životnog ciklusa strojeva i procesa (assets), a ovaj članak ispituje promjene u odnosima, partnerima, protoku podataka i usklađenosti tijekom životnog ciklusa proizvoda i povezane izazove. Studija na primjeru sustava za pakiranje s više umreženih strojeva koristi se za demonstraciju izrade modela proizvodne linije s ciljem procjene sigurnosti tijekom životnog ciklusa. Pomoću podmodela ljuske za upravljanje assets mogu se prikupljati i analizirati sigurnosni podaci iz različitih komponenti stroja i cijelog sustava.

Ključne riječi: *industrija 4.0, životni ciklusa stroja, modeliranje, sustav za pakiranje*

MODELLING THE STRESS STATE OF THE CAMSHAFT CAM OF A CAR ENGINE

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Artem Krasota


Ihor Shepelenko


Mykhailo Krasota


Oleksandr Lizunkov

ABSTRACT:
In this paper, the expediency of applying antifriction coatings to the working surface of camshaft cams is substantiated by means of finite element modelling. Building an adequate model required reproducing the operating conditions of the camshaft and the gas distribution mechanism as a whole. Thus, the peculiarities of the camshaft operation were taken into account, taking into account the forces acting in the gas distribution mechanism at the moment of valve opening, i.e. when the camshaft cam hits the pusher. It is shown that as a result of the interaction between the surface of the pusher and the cam of the camshaft, a friction force arises, which is directed tangentially to the cam profile surface in the direction opposite to the rotation of the camshaft.
The simulation was performed for two camshaft designs: a cam with an antifriction coating and a basic steel cam. As a result of the modelling, a field of stresses and displacements on the cam surface of the camshaft was obtained.
The qualitative and quantitative analysis of stress and displacement diagrams suggests that a camshaft with cams treated with a finishing antifriction non-abrasive treatment experiences lower power stresses than cams without antifriction coating, and therefore will be subject to less wear. Studies have shown the effectiveness of applying antifriction coatings to the working surface of the camshaft cams of an internal combustion engine.

Keywords: *camshaft cam, antifriction coatings, stress state, modelling, wear*

VIBRATION PATTERN ANALYSIS OF A 3-DOF STRUCTURE UNDER DAMAGE SCENARIOS

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Leidy E. Pamplona Berón


Domenico Gentiluomo


Marco C. De Simone


Domenico Guida

ABSTRACT:
Structural Health Monitoring (SHM) is essential for assessing and preserving the integrity of engineering structures. This study explores the variations in the vibration response of a 3-Degree-of-Freedom (3-DoF) structure under different damage scenarios using Power Spectral Density (PSD) and Continuous Wavelet Transform (CWT). The dataset comprises five vibration scenarios, including ambient reference (undamaged) and half-cut beam (HCB) configurations. PSD analysis identifies the HCB 2aD configuration as exhibiting the most significant deviation from the ambient reference, while CWT highlights the dominant energy contribution of sensor S1 in the undamaged condition.

Keywords: *continuous wavelet transform, damage, natural frequencies, power spectral density, vibration*

ANALYSIS OF ERROR FORMATION IN SELECTIVE LASER SINTERING BASED ON STATISTICAL MODELING

ANALIZA FORMIRANJA GREŠKE U SELEKTIVNOM LASERSKOM SINTEROVANJU BAZOVANO NA STATISTIČKOM MODELU

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Yaroslav Garashchenko


Vladimir Fedorovich


Yevgeniy Ostroverkh


Predrag Dašić

ABSTRACT:
The article presents a comprehensive study of the Selective Laser Sintering (SLS) process aimed at improving the accuracy of product manufacturing. A structural and probabilistic model of the resulting shape formation error has been developed, considering various factors affecting manufacturing accuracy: triangulation errors, shrinkage compensation, laser beam settings, and discreteness due to powder material. The study was conducted on additive machines using statistical modeling.

Keywords: *selective laser sintering, forming errors, achievable forming accuracy, triangulation model.*

REZIME:
U članku je predstavljena sveobuhvatna studija procesa selektivnog laserskog sinterovanja (SLS) u cilju poboljšanja tačnosti proizvodnje proizvoda. Razvijen je strukturni i probabilistički model nastale greške formiranja oblika, uzimajući u obzir različite faktore koji utiču na tačnost proizvodnje: greške triangulacije, kompenzaciju skupljanja, podešavanja laserskog zraka i diskretnost zbog materijala praha. Studija je sprovedena na aditivnim mašinama korišćenjem statističkog modeliranja.

Ključne riječi: *selektivno lasersko sinterovanje, greške formiranja, dostižna tačnost oblikovanja, triangulacioni model.*

CELLULAR AUTOMATA METHOD FOR MODELING HEAT AND MASS TRANSFER IN HETEROGENEOUS MEDIA WITH BARRIERS

METODAĆELIJSKOG AUTOMATA ZA MODELIRANJE TRANSFERA TOPLOTE I MASE U HETEROGENIM MEDIJIMA SA BARIJERAMA

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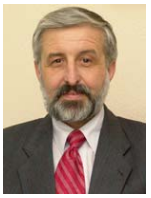
Tetiana Lysenko


Volodymyr Tonkonogyi


Liubov Bovnegra


Oleksandr Rudyi

ABSTRACT:
The method of cellular automata for modeling heat and mass transfer in heterogeneous media with barriers is considered. It is shown that shell molds consisting of various components with heterogeneous physical and chemical properties are heterogeneous media. Mass transfer processes in the system“casting - mold” significantly affect the quality of the received casting, especially in molds of complex design. To model the influence of heat and mass transfer processes on the surface quality of castings, two-layer molds with a working layer of sand-resin mixture and a support layer of materials with different gas content, gas permeability and heat storage capacity were selected. A three-dimensional model of Stochastic Excitable Cellular Automata (SECA) was used to study the specifics of the process of heat front propagation in shell-type molds containing barriers.

Keywords: *heterogeneous media, heat transfer, mass transfer, modeling, barriers.*

REZIME:
Razmatran je metod ćelijskih automata za modelovanje prenosa toplote i mase u heterogenim sredinama sa barijerama. Pokazano je da su kalupi za školjke koji se sastoje od različitih komponenti sa heterogenim fizičkim i hemijskim svojstvima heterogeni mediji. Procesi prenosa mase u sistemu „livanje – kalup“ značajno utiču na kvalitet dobijenog odlivaka, posebno kod kalupa složenog dizajna. Za modelovanje uticaja procesa prenosa toplote i mase na kvalitet površine odlivaka, izabrani su dvoslojni kalupi sa radnim slojem mešavine peska i smole i nosećim slojem od materijala različitog sadržaja gasa, propustljivosti gasa i kapaciteta skladištenja toplote. Trodimenzionalni model stohastičkih ekscitabilnih ćelijskih automata (SECA) korišćen je za proučavanje specifičnosti procesa širenja toplotnog fronta u kalupima tipa školjke koji sadrže barijere.

Ključne riječi: *heterogeni mediji, prenos toplote, prenos mase, modeliranje, barijere.*

MODELING AN AUTONOMOUS FORMULA SAE RACING CAR USING SIMSCAPE MULTIBODY

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Rosario La Regina

Rosario Pio Russo

Carmine Maria Pappalardo

Domenico Guida

ABSTRACT:
Accurate control of driving dynamics is crucial in developing high-performance autonomous vehicles, such as those used in Formula SAE Driverless competitions. In this study, a Proportional-Derivative (PD) controller is designed to adjust the trajectory of a Formula SAE self-driving vehicle. The PD control is chosen for its simplicity and reliability in providing a good compromise between responsiveness and system stability. The algorithm is designed to act on the steering box pinion, correcting trajectory errors through a feedback and feedforward approach. The results show the effectiveness of PD control in keeping the vehicle on track accurately, paving the way for further development with more advanced control strategies for improving dynamic performance.

Keywords: *Autonomous vehicle, nonlinear control, FSAE, race car, Simscape Multibody*

INFLUENCE OF MAIN FACTORS ON THE FORMATION OF LIQUID FUELS RESISTANT TO STRATIFICATION

UTICAJ GLAVNIH FAKTORA NA FORMIRANJE TEČNIH GORIVA OTPORNIH NA STRATIFIKACIJU

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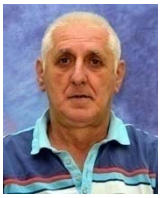
Roman Klimov


Predrag Dašić


Raul Turmanidze

ABSTRACT:
The formation of dispersed systems is associated with the adsorption of surfactants at the interface, which determines the stability of the phases. The study of the kinetics of this process, as well as possible technological influences on it, is important for the development of emulsification technology. A water-fuel emulsion allows you to significantly increase the efficiency of hydrocarbon fuels and significantly reduce the emission of harmful substances into the environment.The work investigates the influence of various factors on the process of crushing the dispersed phase of an emulsion during its boiling. Determining the optimal values of these parameters will allow rational use of energy in preparing liquid fuels.

Keywords: *fuel, factor, fragmentation, temperature, water, pressure.*

REZIME:
Formiranje dispergovanih sistema povezano je sa adsorpcijom površinski aktivnih materija na interfejsu, što određuje stabilnost faza. Proučavanje kinetike ovog procesa, kao i mogućih tehnoloških uticaja na njega, značajno je za razvoj tehnologije emulgovanja. Emulzija vode i goriva vam omogućava da značajno povećate efikasnost ugljovodoničnih goriva i značajno smanjite emisiju štetnih materija u životnu sredinu. U radu se istražuje uticaj različitih faktora na proces usitnjavanja dispergovane faze emulzije tokom njenog ključanja. Određivanje optimalnih vrednosti ovih parametara omogućiće racionalno korišćenje energije u pripremi tečnih goriva.

Ključne riječi: *gorivo, faktor, fragmentacija, temperatura, voda, pritisak.*

SWING-UP AND STABILIZATION CONTROL OF A CART-PENDULUM SYSTEM USING NMPC, LQR, AND REINFORCEMENT LEARNING

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ABSTRACT:
The control of the cart-pendulum system is a challenging problem due to its nonlinear and unstable dynamics. This study evaluates three control strategies: Nonlinear Model Predictive Control (NMPC) + Linear Quadratic Regulator (LQR), Reinforcement Learning (RL), and a hybrid RL+LQR approach. Their performance is assessed regarding swing-up time, stabilization, and robustness. Results demonstrate that each control strategy presents distinct advantages and limitations, emphasizing the importance of selecting an appropriate approach based on application requirements. Furthermore, tuning the parameters of RL plays a crucial role in enhancing the efficiency and adaptability of these methods.

Keywords: *cart-pendulum, linear control, non-linear control, reinforcement learning, stabilization, swing-up*

ENHANCING OF PROCESS CAPABILITY IN THE METALWORKING INDUSTRY THROUGH LEAN SIX SIGMA IMPLEMENTATION: EVIDENCE FROM BOSNIA AND HERZEGOVINA

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Ismar Alagić

ABSTRACT:
This article is dealing with one aspect of broader research of project approach in application of Lean Six Sigma (LSS), which is possible to use in different areas of business and industry as well. Practical experiences tell us that Lean Six Sigma methodology is not possible to be implemented without complete support of the top management, but more important, without qualified Lean Six Sigma personnel. This is one of the criticisms of Lean Six Sigma methodology, too much time and money are necessary for Lean Six Sigma experts, and these activities can take them away from their primary activities in the company. However, companies from this survey which successfully implemented Lean Six Sigma methodology specify that it is possible to do it with minimum costs. Roles of the staff implementing Lean Six Sigma methodology as: "Yellow Belt", "Green Belt", "Black Belt" and "Master Black Belt" are explained in this article. In this survey, we were aiming to increase a level of technical know-how and managerial skills within organisation with the main focus on management staff in company from domestic metalworking sector.
…
Keywords: *Lean Six Sigma (LSS), process capability, DMAIC (Define, Measure, Analyse, Improve, Control) tools, metalworking, Bosnia and Herzegovina.*

REZIME:
Ovaj članak se bavi jednim aspektom šireg istraživanja projektnog pristupa u primjeni Lean Six Sigma (LSS) koji je moguće koristiti iu različitim oblastima poslovanja i industrije. Praktična iskustva govore da metodologiju Lean Six Sigma nije moguće implementirati bez potpune podrške najvišeg menadžmenta, ali još važnije, bez kvalifikovanog Lean Six Sigma osoblja. Ovo je jedna od kritika Lean Six Sigma metodologije, previše vremena i novca je potrebno Lean Six Sigma stručnjacima, a te aktivnosti ih mogu odvojiti od primarnih aktivnosti u kompaniji. Međutim, kompanije iz ovog istraživanja koje su uspješno implementirale Lean Six Sigma metodologiju navode da je to moguće učiniti uz minimalne troškove. U ovom članku su objašnjene uloge osoblja koje implementira Lean Six Sigma metodologiju kao: „Žuti pojas“, „Zeleni pojas“, „Crni pojas“ i „Master crni pojas“. U ovom istrazivanju smo imali za cilj da povećamo nivo tehničkog znanja i menadžerskih vještina unutar organizacije sa glavnim fokusom na rukovodeće osoblje u kompaniji iz domaćeg metaloprerađivačkog sektora.
…
Ključne riječi: *Lean Six Sigma (LSS), sposobnost procesa, DMAIC (definiranje, mjerenje, analiza, poboljšanje, kontrola) alati, obrada metala, Bosna i Hercegovina.*

THE APPLICATION OF DISRUPTIVE TECHNOLOGIES IN THE AVIATION INDUSTRY

PRIMENA DISRUPTIVNIH TEHNOLOGIJA U VAZDUHOPLOVNOJ INDUSTRIJI

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Žaklina Teofilović


Isak Karabegović

ABSTRACT:
Disruptive technologies in the aviation industry enhance operational efficiency and reduce costs while establishing new standards in data analytics and autonomous systems. However, implementing these technologies poses challenges related to process optimization, integration of new technologies with existing systems, regulatory compliance, and cybersecurity. This paper provides an overview of the application of disruptive technologies in the aviation sector, focusing on their benefits and the challenges associated with their implementation. Additionally, since these technologies require highly skilled professionals, the paper highlights the significance of upskilling, reskilling, and strategically managing employees to align with market demands in the aviation industry. This is especially relevant in the ongoing digital transformation and the rising adoption of disruptive technologies.

Keywords: *disruptive techologies, benefits, challenges, people skills*

REZIME:
Disruptivne tehnologije u vazduhoplovnoj industriji poboljšavaju operativnu efikasnost i smanjuju troškove istovremeno uspostavljajući nove standarde u analitici podataka i autonomnim sistemima. Međutim, implementacija ovih tehnologija donosi i izazove vezane za optimizaciju procesa, integraciju novih tehnologija sa postojećim sistemima, usklađenost sa propisima i sajber bezbednost. Ovaj rad daje pregled primene disruptivnih tehnologija u sektoru vazduhoplovstva, fokusirajući se na njihove prednosti i izazove povezane sa njihovom primenom. Pored toga, pošto ove tehnologije zahtevaju visokokvalifikovane profesionalce, ovaj rad naglašava značaj usavršavanja, prekvalifikacije i strateškog upravljanja zaposlenima kako bi se kompetencije uskladile sa zahtevima tržišta avio industrije. Ovo je posebno značajno za tekuću digitalnu transformaciju koju karakteriše sve više usvajanje disruptivnih tehnologija.

Ključne riječi: *disruptivne tehnologije, koristi, izazovi, veštine zaposlenih*

THE EXPERIMENTAL RESEARCH THE FORCES GENERATED IN THE ROPES OF A PORTAL CRANE ”SOKOL” WHEN SCOOPING BULK CARGO IN A PORT

EKSPERIMENTALNO ISTRAŽIVANJE SNAGE NASTALE U UŽADIMA PORTALNE DIZALICE ”SOKOL” PRILIKOM PREUZIMANJA RASUTOG TERETA U LUCI

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Viktor Strelbitskyi


Anatolii Konoplov


Liubov Bovnegra


Raul Turmanidze

ABSTRACT:
Portal grab cranes play a crucial role in port facilities for managing dry bulk cargo. This article examines the findings from experimental investigations into the dynamic loads experienced by the lifting mechanism of “Sokol” clamshell portal cranes, which are used extensively for the transfer of bulk materials at the seaport. To assess the dynamic forces, the electrotensometric technique was employed. Utilizing the gathered experimental results, the probabilistic characteristics regarding the distribution of operational dynamic loads within the grab ropes were deduced. The analysis of this information indicated that during the overloading of weights between 12 to 17 tons, the dynamic force coefficients in the trailing ropes fluctuated between 1.2 and 2.3.

Keywords: *portal crane, rope, rope force, investigation, grab, statistical modeling.*

REZIME:
Portal grab kranovi igraju ključnu ulogu u lučkim objektima za upravljanje suvim rasutim teretom. Ovaj članak ispituje nalaze iz eksperimentalnih istraživanja dinamičkih opterećenja koje doživljava mehanizam za podizanje" Sokol " portalnih kranova na preklop, koji se intenzivno koriste za prenos rasutih materijala na morskoj luci. Za procjenu dinamičkih sila korištena je elektrotenzometrijska tehnika. Koristeći prikupljene eksperimentalne rezultate, izvedene su vjerojatne karakteristike u pogledu raspodjele operativnih dinamičkih opterećenja unutar užadi za hvatanje. Analiza ovih podataka pokazala je da su tokom preopterećenja težina između 12 i 17 tona dinamički koeficijenti sile u vučnim užadima varirali između 1,2 i 2,3.

Keywords: *portal crane, uže, konopac sila, istraga, grab, statističko modeliranje.*

DESIGN OPTIMIZATION OF HEATERS

OPTIMIZACIJA DIZAJNA GRIJAČA

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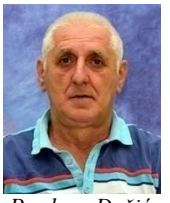
Predrag Dašić

ABSTRACT:
There is a need for compressed air in most industrial enterprises to drive many types of pneumatic equipment, such as pneumatic machines, pneumatic tools, pneumatic hammers, etc. One of the ways to reduce the consumption of compressed air by consumers is to increase its temperature when it is supplied to them. In an ideal case, the specific volume of air consumed changes in direct proportion to the change in its temperature. The developed technique can be used when considering finding the optimal design of heat exchange equipment using ribbed heating surfaces.

Keywords: *heaters, optimization, tubes, ribbed surfaces, factor.*

REZIME:
U većini industrijskih preduzeća postoji potreba za komprimovanim vazduhom za pogon mnogih vrsta pneumatske opreme, kao što su pneumatske mašine, pneumatski alati, pneumatski čekići itd. Jedan od načina da se smanji potrošnja komprimovanog vazduha kod potrošača je povećanje njegove temperature kada im se on isporučuje. U idealnom slučaju, specifična zapremina potrošenog vazduha se menja u direktnoj proporciji sa promenom njegove temperature. Razvijena tehnika se može koristiti kada se razmatra pronalaženje optimalnog dizajna opreme za razmenu toplote pomoću rebrastih grejnih površina.

Ključne riječi: *grejači, optimizacija, cevi, rebraste površine, faktor.*

PRELIMINARY DESIGN OF THE THRUST SUPPORT SYSTEM OF AN AUTONOMOUS FLYING CAR

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Carlos Pérez Carrera


Ömer Ekim Genel


Carmine Maria Pappalardo


Domenico Guida

ABSTRACT:
The advent of Urban Air Mobility (UAM) is set to transform urban transportation, with the development of flying cars at the van guard of this transformation. This study presents the design and static analysis of a structural arm that supports the propulsion system of a fly ing car. The arm is constructed using Aluminum 7075-T6 and features a hollow tubular design that balances strength and weight with the spe cific requirements of Vertical Take-Off and Landing (VTOL) vehicles in mind. A Finite Element Analysis (FEA) was conducted to evaluate the arm's performance under static loading conditions. The study fo cused on stress distribution, deformation patterns, and compliance with safety factors. The results demonstrate that the maximum Von Mises stress remains within the allowable limits, ensuring structural integrity under specified loads. This study verifies that the preliminary sizing of the structural arm meets the necessary safety standards, thereby estab lishing a foundation for the future integration of flying cars into urban environments. While this research demonstrates a robust computational framework for assessing the arm's structural behavior, future work in volving experimental validation is essential to validate these findings and enhance the design's reliability. This research contributes to advancing f lying car technology, which aligns with the goal of achieving efficient and reliable UAM solutions.

Keywords: *Urban Air Mobility, Flying Car, Structural Arm Design, Finite Element Analysis*

MODELING THE PROCESS OF EXTERNAL CYLINDRICAL GRINDING WITH THE CONSIDERATION OF THE RESTORATION OF THE PARAMETERS OF THE TECHNOLOGICAL SYSTEM

MODELIRANJE PROCESA SPOLJNOG CILINDRIČNOG BRUŠENJA UZ RAZMATRANJE RESTAURACIJE PARAMETARA TEHNOLOŠKOG SISTEMA

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Ruslan Dzhemalyadinov


Eshreb Dzhemilov


Predrag Dašić

ABSTRACT:
The article deals with the development of a mathematical model of the external cylindrical grinding process taking into account the restoration of the system parameters. The possibility of stabilizing the quality of finished products at the operations of external cylindrical grinding due to the stabilization of quality parameters based on monitoring the parameters of the technological system is considered. An unambiguous connection has been established between the output signal y(t) and the numerical sequence of the set quantization period T.The mathematical description of the process of digital signal processing was based on their representation as a function of discrete time.

Keywords: *cylindrical grinding, mathematical model, diagnostics.*

REZIME:
Članak se bavi razvojem matematičkog modela procesa eksternog cilindričnog mlevenja uzimajući u obzir obnavljanje parametara sistema. Razmatrana je mogućnost stabilizacije kvaliteta gotovih proizvoda na operacijama spoljašnjeg cilindričnog mlevenja usled stabilizacije parametara kvaliteta na osnovu praćenja parametara tehnološkog sistema. Uspostavljena je nedvosmislena veza između izlaznog signala i(t) i numeričkog niza zadatog perioda kvantovanja T.Matematički opis procesa digitalne obrade signala zasnivao se na njihovom predstavljanju u funkciji diskretnog vremena.

Ključne riječi:*cilindrično brušenje, matematički model, dijagnostika.*

ANALYSIS AND PREDICTION OF WATER-WATER HEAT PUMP OPERATING PARAMETERS USING ARTIFICIAL NEURAL NETWORKS

ANALIZA I PREDIKCIJA PARAMETARA RADA TOPLOTNE PUMPE VODA-VODA UPOTREBOM UMJETNIH NEURONSKIH MREŽA

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ABSTRACT:
Water-to-water heat pumps are a key technology for efficient heating, but their performance depends heavily on precise control of operational parameters like flow and return water temperatures. In this study, neural networks were used to predict these temperatures during heating mode operation. Real-world data was collected over a month, with measurements taken every minute, including flow water temperature, return water temperature, and outdoor air temperature. The neural network effectively captured the complex relationships between these variables, delivering highly accurate predictions. By using this approach, it can be seen how machine learning can help optimize heat pump performance, making them more energy-efficient and reliable. This work demonstrates the potential for smarter, data-driven heat pump control strategies that can benefit both energy savings and sustainability.

Keywords: *Heat pumps, Neural networks, Energy efficiency.*

REZIME:
Toplotne pumpe tipa voda-voda predstavljaju ključnu tehnologiju za efikasno grijanje, ali njihov učinak u velikoj mjeri zavisi od precizne kontrole radnih parametara poput temperatura polazne i povratne vode. U ovom istraživanju korištene su neuronske mreže za predviđanje ovih temperatura tokom rada u režimu grijanja. Podaci iz stvarnog okruženja prikupljani su tokom jednog mjeseca, s mjerenjima koja su vršena svake minute, uključujući temperaturu polazne vode, temperaturu povratne vode i temperaturu vanjskog zraka. Neuronska mreža je uspješno savladala složene odnose između ovih varijabli, pružajući vrlo tačne predikcije. Korištenjem ovog pristupa pokazano je kako mašinsko učenje može pomoći u optimizaciji rada toplotnih pumpi, čineći ih energetski efikasnijim i pouzdanijim. Ovaj rad ističe potencijal pametnih, podacima vođenih strategija kontrole toplotnih pumpi, koje doprinose i uštedi energije i održivosti.

Ključne riječi: *Toplotne pumpe, neuronske mreže, energteska efikasnost.*

INCREASING THE EFFICIENCY OF GAS TURBINES BY USING PART OF THE EXHAUST GASES

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Ali I. Shehata


M. Mito

ABSTRACT:

Energy is the primary force behind life; it is inconceivable to imagine life without it. Therefore, attaining sustainability in the energy sector is a requirement for every other field and industry. Sustainability in all its forms—economic, social, and environmental—must therefore be incorporated. With some thought and work, energy sustainability has permeated every industry. The development of fossil fuel-based energy generation sources is one of the most critical pillars in the energy industry, given the pursuit of this objective. This study aims to Explain the importance of increasing the efficiency of gas turbine stations by using part of the exhaust gas and how to apply this to raising the efficiency of the gas turbine station by using a reheated and a heat exchanger before the combustion chamber and using the combined cycle, and comparing them in terms of efficiency, in terms of operating cost, in terms of life span, Invasive through methodology combines description, application, and analysis methodologies using simulation technology. The results indicated that the heat exchanger re-reheating method increased the efficiency of the turbine station at a rate ranging from 5 to 15%, the cost of increasing the efficiency was 28%, and the life expectancy of the station was 23 years. In comparison, the combined cycle method cost 35% and increased the efficiency by a rate ranging from 6% to 18% of the turbine station. The expected lifespan is 22 years

Keywords: *sustainability, gas turbines, power plants, exhaust, combined cycle, efficiency*

APPLICATION OF SOLAR ENERGY FOR DOMESTIC HOT WATER HEATING IN A SINGLE-FAMILY HOUSE

PRIMJENA SOLARNE ENERGIJE ZA ZAGRIJAVANJE POTROŠNE TOPLE VODE U PORODIČNOJ KUĆI

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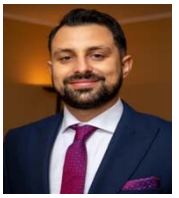
Rejhana Blažević



Damir Ljuhar

ABSTRACT:
The majority of single-family houses in Bosnia and Herzegovina (B&H) consume a significant amount of electricity for domestic hot water (DHW) production.This paper examines the use of solar energy for DHW preparation in households, estimating heat energy needs, solar contribution, system losses, and installation costs using the EN 15316-4-3 standard. The analysis revealed that solar energy covers approximately 58% of the heat demand for DHW. The investment payback period for a solar water heating system was estimated at 15 years. However, this long payback period is influenced by Bosnia and Herzegovina's currently low electricity prices. With the planned introduction of CO□ taxes, electricity from fossil fuels, which are the dominant energy source in B&H, is expected to become less competitive, potentially increasing electricity prices. These changes could improve the economic viability of solar DHW systems.

Keywords: *solar thermal system, domestic hot water, single-family house, CO_2 emission*

REZIME:
Većina porodičnih kuća u Bosni i Hercegovini (BiH) koristi značajnu količinu električne energije za proizvodnju potrošne tople vode (PTV). Ovaj rad istražuje upotrebu solarne energije za pripremu PTV-a u domaćinstvima, procjenjujući potrebnu toplotnu energiju, solarni doprinos, gubitke u sistemu i troškove instalacije koristeći EN 15316-4-3standard.Rezultati analize pokazuju da solarna energija može pokriti približno 58% potreba za toplotnom energijom za zagrijavanje PTV-a.Period povrata investicije za solarni sistem za grijanje vode procijenjen je na 15 godina. Međutim, ovaj relativno dugi period otplate rezultat je trenutno niskih cijena električne energije u BiH.Planiranim uvođenjem poreza na emisiju CO□, očekuje se da će električna energija iz fosilnih goriva, koja su dominantni energent u BiH, postati manje konkurentna, što bi potencijalno moglo povećati cijene električne energije. Ove promjene bi mogle poboljšati ekonomsku održivost solarnih sistema za grijanje PTV-a.

Ključne riječi: *solarni toplotni sistem, potrošna topla voda, porodišna kuća, emisija CO_2*

EXPERIMENTAL ANALYSIS OF A SOLAR MODULE'S CHARACTERISTIC PERFORMANCE IN AL-BAYDA CITY, LIBYA

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ABSTRACT:
This research represents an experimental analysis of a monocrystallin solar panel from unknown maufacturer, which is one of those units sold in the local market. Since the methods by which solar panels and modules are specified locally lack analysis in different climatic conditions, and since some photovoltic panels' manufacturers and providers do not include catalogs with more data on their panels, this research focused on analyzing a solar panel by collecting its parameters characteristics such as voltage and current under inclination angles of 0, 45, 60, 90 degrees at the beginning of July, in the city of Al-Bayda. The experimental analysis process is accomplished by using a laboratory data acquisition/control unit to collect the parameters that are used to evaluate the unit's output using engineering equation solver (EES). The relationships between these parameters are then plotted using Excel. Hence, it is found that this solar panel's actual efficiency reached 10.02% at the weather conditions at Al-Bayda, compared to an actual efficiency of 14.63% at standard conditions, and maximum actual power of 21.19 watts compared to an actual standard power of 50 watts.

Keywords: *Efficiency; Engineering Equation Solver; Monocrystalline; Photovoltaic; Solar cells; Solar modules; Solar panels*

REPAIR OF SUPPORTS OF THE ABOVEGROUND PART OF THE MAIN PIPELINE

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Andrij Dzyubyk


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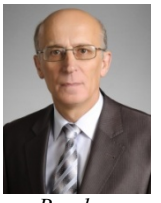
Bogdan Kindrats'kyi

ABSTRACT:
The paper considers the problem of lifting the above-ground part of a main pipeline above the supports for repair work. To solve this problem, a mathematical model is used that takes into account operational loads, structural features of the pipeline, as well as the possibility of elastic and rigid movement of the supports. The model describes the peculiarities of the above-ground part, where the pipeline is free to rest on individual supports. At the same time, the part is exposed to mechanical loads, elastic deformations, and external factors, which causes the necessity of periodic repair of the supports. The above-ground part of the main pipeline is inextricably linked to its underground part and rests on soil with elasticity deformations. This combination causes additional displacements of the pipeline, which can significantly affect its strength. The paper analyzes the change in bending-moment stresses when the pipeline is lifted above the supports. It is shown that lifting the pipeline can lead to critical compressive stresses that exceed the permissible value, increasing the risk of plastic deformations, defects such as cracks, corrugations in pipes, etc. To prevent damage and to ensure the necessary displacements, a method of synchronized lifting of the pipeline over several neighboring supports is proposed. The necessary calculations were performed on the example of a three-support overhead crossing. The reactions of the supports and the acting loads in the aboveground part of the pipeline were calculated. It is established that the lifting of only one support does not provide the required strength, since this leads to an exceeding of permissible compressive stresses. The optimal value of the central support lifting for the considered aboveground part of the main pipeline is determined, which allows compensating for the displacement during the repair of the outer supports as well as ensuring the reliability of the system.

Keywords: *main pipeline, above-ground part of the pipeline, repair of pipeline supports, pipeline lifting, pipeline strength, bending stresses in the pipeline, three-support overhead crossing*

WIND VELOCITY ANALYSIS IN THE TREBEVIĆ AREA: SEASONAL VARIATIONS AND TRENDS

ANALIZA BRZINE VJETRANA PODRUČJU TREBEVIĆA: SEZONSKE VARIJACIJE I TRENDOVI

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ABSTRACT:
The largest percentage of electricity in Bosnia and Herzegovina (B&H) is generated by burning fossil fuels, primarily coal, in thermal power plants. This paper investigates the potential of utilizing wind energy for electricity generation in the Trebević area. Wind velocity data, obtained from the Federal Hydrometeorological Institute, were analyzed for the Trebević area at an altitude of 1151 m. Using logarithmic and power laws, wind velocity values measured at a height of 15 m were extrapolated to a turbine tower height of 100 m. The calculations indicate that the average wind speed at 15 m is 3,93 m/s, while at 100 m it is approximately 6,7 m/s. The average annual wind power densities at heights of 15 m and 100 m are 92 W/m² and 452 W/m², respectively, demonstrating significant wind energy potential in the Trebević area.

Keywords: *wind energy,wind velocity, seasonal variations, wind power density*

REZIME:
Najveći procenat električne energije u Bosni i Hercegovini (BiH) proizvodi se sagorijevanjem fosilnih goriva, prvenstveno uglja, u termoelektranama. Ovaj rad istražuje potencijal korištenja energije vjetra za proizvodnju električne energije na području Trebevića. Podaci o brzini vjetra, dobijeni od Federalnog hidrometeorološkog zavoda, analizirani su za područje Trebevića na nadmorskoj visini od 1151 m. Koristeći logaritamski i eksponencijalni zakon, vrijednosti brzine vjetra izmjerene na visini od 15 m ekstrapolirane su na visinu tornja turbine od 100 m. Proračuni pokazuju da prosječna brzina vjetra na visini 15 m od tla iznosi 3,93 m/s, dok je na visini 100 m od tla oko 6,7 m/s. Prosječne godišnje gustinesnage vjetra na visinama od 15 m i 100 m iznose 92 W/m² i 452 W/m², respektivno, što ukazuje na značajan potencijal energije vjetra na području Trebevića.

Ključne riječi: *energija vjetra, brzina vjetra, sezonske varijacije, gustina snage vjetra*

ASSESSMENT OF THE ELECTRIC VEHICLES ENERGY REGENERATION POTENTIAL UNDER VARIOUS DRIVING CYCLES

PROCJENA POTENCIJALA REGENERACIJE ENERGIJE KOD ELEKTRIČNIH VOZILA ZA RAZLIČITE CIKLUSE VOŽNJE

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Jasmin Šehović


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Emir Jašarević

ABSTRACT:
Reducing overall energy consumption of motor vehicles is achieved in various ways, one of which is increasing the energy efficiency of the propulsion systems. Electric and hybrid vehicleshave the ability to regenerate energy during vehicle motion, which depends on the vehicle's propulsion system, but also on the vehicle's driving modes. Energy required for vehicle motion, as well as the potential for energy regeneration, for different driving cycles, are investigated in this paper. Calculation is made for one B-segment electric passenger car. The vehicle driving is analysed according to the standardized WLTC test driving cycle and one measured driving cycle in Sarajevo. The calculation was performed using Matlab/Simulink and AVL Cruise simulation software. The influence of different vehicle driving cycles on energy consumption, as well as the potential for energy regeneration, is pointed out.

Keywords: *electric vehicle, energy consumption, energy regeneration, driving cycle*

REZIME:
Smanjenje ukupne energetske potrošnje motornih vozila se postiže na različite načine, od kojih je jedan povećanje energetske efikasnosti pogonskih sistema. Električna i hibridna vozilaimaju mogućnost regeneracije energije pri kretanju vozila, koja zavisi od pogonskog sistema vozila, ali i od režima kretanja vozila. U radu je izvršen proračun energije potrebne za kretanje vozila, kao i potencijala za regeneraciju energije, pri različitim ciklusima vožnje, za jedno električno putničko vozilo. Analizirano je kretanje vozila prema standardizovanom WLTC ispitnom ciklusu vožnje i jednom ciklusu vožnje karakterističnim za Sarajevo. Proračun je izvršen korištenjem Matlab/Simulink, te AVL Cruise programa za simulaciju. Ukazano je na uticaj različitih režima kretanja vozila na potrošnju energije, kao i na potencijal za regeneraciju energije.

Ključne riječi: *električna vozila, potrošnja energije,regeneracija energije, ciklusi vožnje*

USE OF DIGITAL SOLUTIONS IN MODERN ENGINEERING: A CASE STUDY ON WATER FLOW THROUGH A TURBINE SPIRAL CASING

KORIŠTENJE DIGITALNIH RJEŠENJA U MODERNOM INŽINJERSTVU: STUDIJA SLUČAJA TOKA VODE KROZ SPIRALNO KUĆIŠTETURBINE

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Muris Torlak


Safet Isić

ABSTRACT:
We present a procedure to evaluate the flow rate through a water turbine using computer models in order to reduce costs of laboratory testings.CADmodel of the spiral casingof a Francis turbine is created using the point cloud obtained by its 3D scanningin real scale. The flow fieldsare computed for a range of assumed water flow rates using a computational fluid dynamics (CFD) software. Pressure is obtainedat the monitoring locations adopted in accordance with the Winter-Kennedy method. The relation betweenthe spatial pressure differences and the correspondingflow rates is established. The procedure can be used to support monitoring and estimation of water flow rates througha turbine using Winter-Kennedy methodand pressure measured in operating conditions.

Keywords: *hydroturbines, water flow-rate measurement, Winter-Kennedy method, computational fluid dynamics (CFD)*

REZIME:
Predstavljena jeprocedura za procjenu protoka vode kroz hidroturbinu korištenjem kompjuterskih modela u cilju smanjenja troškova laboratorijskih ispitivanja. CAD modelspiralnog kućišta Francisove turbine kreiran je korištenjem oblaka tačaka dobijenog 3D skeniranjem istog u stvarnojrazmjeri. Strujna polja se računaju za pretpostavljeni interval protoka vode pomoću softvera za računsku dinamiku fluida (CFD). Dobija se pritisak na monitoring-lokacijama usvojenimprema Winter-Kennedy metodi. Uspostavljena je relacija između prostornih razlika pritiska i odgovarajućih vrijednosti protoka. Procedura se može koristiti kao podrška praćenju i procjeni protoka vode kroz turbinu korištenjem Winter-Kennedy metode ivrijednosti pritiska izmjerenih u radnim uslovima.

Ključne riječi: *hidroturbine, mjerenje protoka vode, Winter-Kennedy metoda, računska dinamika fluida (CFD)*

POLLUTANT EMISSION DURING PULVERIZED COAL CO-FIRING WITH WODDY BIOMASS AND RDF

EMISIJA DIMNIH PLINOVA PRI KOSAGORIJEVANJU LIGNITA, DRVNE BIOMASE I RDF GORIVA U LETU

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Kenan Kadic

ABSTRACT:
Decarbonization, waste management and energy sustainability are still very high on the list of economic and social priorities and challenges in the European Union that need to be fully addressed in the near future. In this context, in addition to the long-standing regular use of waste wood biomass as fuel in industrial and energy combustion plants, there is still a growing level of simultaneous use of other alternative fuels, e.g. such as fuel obtained by selection and mechanical processing of municipal and industrial waste. The problem of collection and, in particular, safe and efficient permanent disposal of waste is also recognizable in Bosnia and Herzegovina. In this regard, research into the basic characteristics of combustion of various solid fuel mixtures has been carried out in laboratory conditions. Specifically, this paper presents the emission values of key polluting and undesirable components in flue gases during the co-firing of lignite, waste wood biomass, the fast-growing energy crop Miscanthus and RDF fuel.

Keywords:*reactor, coal, biomass, RDF, combustion, emissions*

REZIME:
Dekarbonizacija, upravljanje otpadom i energetska održivost su u Evropskoj Uniji i dalje vrlo visoko na listi privrednih i društvenih prioriteta i izazova koje treba u potpunosti riješiti u dogledno vrijeme. U tom kontekstu, pored već dužeg vremena izražene redovite primjene otpadne drvne biomase kao goriva u industrijskim i energetskim ložištima, i dalje je rastući nivo istovremene primjene drugih alternativnih goriva, npr. poput goriva koje de dobija selekcijom i mehaničkom obradom komunalnog i industrijskog otpada. Problem prikupljanja te naročito sigurnog i efikasnog trajnog zbrinjavanja otpada je prepoznatljiv i u Bosni i Hercegovini. U vezi s tim su u laboratorijskim uslovima izvršena istraživanja osnovnih karakteristika sagorijevanja različitih mješavina čvrstih goriva. Konkretno, u ovom radu su predstavljene vrijednosti emisije ključnih zagađujućih i nepoželjnih komponenti u dimnim plinovima prikosagorijevanju lignita, otpadne drvne biomase, brzorastućeg energetskog usjeva Miscanthus i RDF goriva.

Ključne riječi:*reaktor, ugalj, biomasa, RDF, sagorijevanje, emisija*

OXYGEN-ENRICHED COMBUSTION STUDY OF WODDY BIOMASS

SAGORIJEVANJE DRVNE BIOMASE U ATMOSFERI OBOGAĆENOG KISEONIKA

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Kenan Kadić

Nihad Hodžić

ABSTRACT:
Oxy-fuel combustion (OFC) is one of the promising technologies for the future of combustion, particularly in efforts to mitigate global warming and reduce CO_2 emissions. These technologies involve oxygen-enriched combustion (OEC) and flue gas recirculation. This study focuses on oxygen-enriched combustion without flue gas recirculation. In addition to the altered combustion atmosphere, the use of waste woody biomass as fuel contributes to the potential for achieving negative carbon emissions. The emphasis is on analyzing changes of emission for key flue gas components in OEC compared to conventional air combustion. OEC as part of the OFC, is particularly interesting from the perspective of CO_2 emission reduction in the context of applying Carbon Capture and Storage (Bio-CCS) or Utilization (CCU) technologies. The experimental research was conducted in a pulverized-fuel combustion lab-scale furnace at a constant combustion process temperature of 950 °C. The research results demonstrate the significant impact of the altered combustion atmosphere on the emission of pollutants.
Keywords: *biomass, Bio-CCS, OFC, OEC, CO_2 emission.*

SAŽETAK:
Oxy-fuel sagorijevanje je obećavajuća tehnologija za budućnost sagorijevanja, posebno sa aspekta globalne borbe protiv zagrijavanja Zemlje, odnosno smanjenja emisije CO2. Ove tehnologije podrazumijevaju sagorijevanje sa obogaćenim kiseonikom i recirkulacijom dimnih plinova, a u ovom radu je akcenat na tehnologiju sagorijevanja sa obogaćenim kiseonikom bez recirkulacije dimnih plinova. Osim spomenute promjene atmosfere sagorijevanja, dodatni doprinos se ogleda u vrsti goriva, otpadna drvna biomasa, što sveukupno može rezultirati emisiju CO2 negativnu. Naglasak je na analizi promjene emisije osnovnih komponenti dimnih plinova pri sagorijevanju biomase u struji obogaćenoj kiseonikom u odnosu na konvencionalno sagorijevanje sa vazduhom. Ova tehnologija sagorijevanja kao dio oxy-fuel tehnologija sagorijevanja je posebno interesantna sa aspekta promjene CO2 emisije u funkciji primjene Bio-CC(S)U. Eksperimentalno istraživanje je rađeno na pulverised-fuel combustion lab-scale furnace sa konstantnom temperaturom sagorijevanja od 950 °C. Rezultati istraživanja pokazuju značajan uticaj promjene atmosfere sagorijevanja na emisiju polutanata.
Ključne riječi: *biomasa, Bio-CCS, OFC, OEC, CO_2 emisija.*

FORECASTING NATURAL GAS CONSUMPTION IN SARAJEVO CANTON DURING HEATING SEASON

PREDVIĐANJE POTROŠNJE PRIRODNOG GASA U KANTONU SARAJEVO TOKOM SEZONE GRIJANJA

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Mirza Pasic


Adnan Dugum


Sarah Kolja


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ABSTRACT:
In this research a multiple linear regression model is developed to predict natural gas consumption in Sarajevo Canton using meteorological parameters and air pollutants as variables. Data on natural gas consumption were collected from the only local natural gas distributor company Sarajevo gas, and meteorological data were collected from the Federal Hydro meteorological Institute of Bosnia and Herzegovina. The findings of this research show that temperature, atmospheric pressure, and relative humidity significantly influence gas consumption, explaining 91,50% of its variability. Higher values of these meteorological parameters correspond to lower gas consumption. The most important variable in the model is temperature. This research provides important insights for managing natural gas consumption in Sarajevo Canton during complete heating season as a whole in response to changing weather conditions.

Keywords: *natural gas consumption, regression, meteorological parameters, air pollution*

REZIME:
U ovom istraživanju razvijen je model višestruke linearne regresije za predviđanje potrošnje prirodnog gasa u Kantonu Sarajevo koristeći meteorološke parametre i polutanata zraka kao varijable. Podaci o potrošnji prirodnog gasa prikupljeni su od jedinog lokalnog distributera prirodnog gasa Sarajevogasa, a meteorološki podaci od Federalnog hidrometeorološkog zavoda Bosne i Hercegovine. Nalazi ovog istraživanja pokazuju da temperatura, atmosferski pritisak i relativna vlažnost značajno utiču na potrošnju gasa, objašnjavajući 91,50% njegove varijabilnosti. Veće vrijednosti ovih meteoroloških parametara odgovaraju manjoj potrošnji plina. Najvažnija varijabla u modelu je temperatura. Ovo istraživanje pruža važne uvide u upravljanje potrošnjom prirodnog gasa u Kantonu Sarajevo tokom cijele sezone grijanja u cjelini kao odgovor na promjenjive vremenske prilike.

Ključne riječi: *potrošnja prirodnog gasa, regresija, meteorološki parametri, zagađenost zraka*

FINANCIAL VIABILITY AND ENERGY EFFICIENCY OF RESIDENTIAL SOLAR POWER SYSTEMS: A CASE STUDY FROM SERBIA

FINANSIJSKA ISPLATIVOST I ENERGETSKA EFIKASNOST REZIDENCIJALNIH SOLARNIH SISTEMA: STUDIJA SLUČAJA IZ SRBIJE

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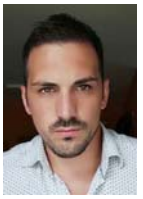
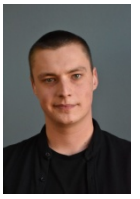
Luka Đorđević


Borivoj Novaković


Dalibor Šeljmeši


Dejan Landup

ABSTRACT:
Solar energy is becoming an increasingly popular option for households looking to reduce electricity costs. This study examines the impact of a residential solar power system installed in a household in Vojvodina, Serbia. The system has a capacity of 11 kW and operates without battery storage, feeding excess energy into the grid. The analysis is based on actual electricity consumption, production data from the inverter, and electricity bills for 2024. The results show that the solar system led to a major reduction in electricity expenses. The household used a total of 17,816 kWh during the year, with 13,451 kWh produced by the solar panels. Out of this, 3,232 kWh was used directly, while the rest was sent to the grid. Without the solar system, the total electricity cost would have been around 1,954 euros. With the system in place, the household paid only 751 euros, leading to significant savings. These findings suggest that installing solar panels can be a good long-term investment, helping households lower their electricity costs while also contributing to a more stable and sustainable energy supply. ...
Keywords: *solar energy, household electricity, cost reduction, on-grid system, Serbia*

REZIME:
Solarna energija postaje sve popularnija opcija za domaćinstva koja žele smanjiti troškove električne energije. Ova studija ispituje uticaj rezidencijalnog solarnog sistema instaliranog u domaćinstvu u Vojvodini, Srbija. Sistem ima kapacitet od 11 kW i funkcioniše bez baterijskog skladištenja, pri čemu se višak proizvedene energije isporučuje u mrežu. Analiza se zasniva na stvarnim podacima o potrošnji električne energije, proizvodnji elektrane i računima za struju u 2024. godini. Rezultati pokazuju da je solarni sistem doveo do značajnog smanjenja troškova električne energije. Domaćinstvo je tokom godine potrošilo ukupno 17.816 kWh, od čega je 13.451 kWh proizvedeno solarnim panelima. Od toga, 3.232 kWh je iskorišteno direktno, dok je ostatak predat u mrežu. Bez solarnog sistema, ukupni trošak električne energije iznosio bi oko 1.954 eura. Sa instaliranim sistemom, domaćinstvo je platilo samo 751 euro, što je rezultiralo značajnim uštedama. Ovi rezultati ukazuju na to da instalacija solarnih panela može biti dobra dugoročna investicija, pomažući domaćinstvima da smanje troškove električne energije i istovremeno doprinesu stabilnijem i održivijem energetskom sistemu. ...
Ključne riječi: *solarna energija, električna energija u domaćinstvu, smanjenje troškova, on-grid sistem, Srbija*

NEW TECHNOLOGIES AND MIGRATION: THE CASE OF THE ALBANIAN MINORITY IN SERBIA

NOVE TEHNOLOGIJE I MIGRACIJE: SLUČAJ ALBANSKE MANJINE U SRBIJI

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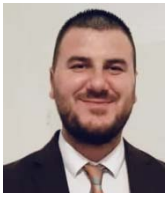
Agon Islami


Elvir Šahić


Maida Cico


Mirha Bičo Ćar

ABSTRACT:
Migration and technological changes of the Fourth Industrial Revolution are processes that significantly shape modern society and are mutually supportive. Innovations in the field ICT have an intensive impact on the migration process, starting from decision-making about migration, through the impact on travel and maintaining ties with communities of origin, to the integration of migrants into new environments and connections in transnational networks. On the other hand, migrants contribute to the transfer of technical and technological improvements from the country of destination to the country of origin. This paper analyzes these phenomena through a case study of the Albanian minority in Serbia. The authors address the challenges and opportunities that new technologies create for minority communities and migrants as a specific social group, the impact of new technologies on migration processes, and provide insight into the specificities of all the aforementioned processes and effects in addressing migration challenges and the complex technological changes within the Albanian minority in Serbia.

Keywords: *migration, new technologies, minority groups, Preševo Valley*

REZIME:
Migracije i tehnološke promjene četvrte industrijske revolucije predstavljaju procese koji bitno determinišu savremeno društvo i međusobno se podržavaju. Inovacije u oblasti IKT, intenzivno utiču na migracioni proces počev od odlučivanja o migraciji, preko uticaja na putovanje i koji održavanje veze sa zajednicama porekla, pa do integracije migranata u nove sredine i poveziranja u transnacionalne mreže. Sa druge strane, migranti doprinose transferu tehničko-tehnoloških unaprjeđenja iz zemlje odredišta u zemlju porijekla. Ovaj rad analizira ove fenomene, kroz studiju slučaja albanske manjine u Srbiji. Autori se bave identifikovanjem izazova i mogućnosti koje nove tehnologije stvaraju manjinskim zajednicama i migrantima kao specifičnoj društvenoj skupini; uticajem novih tehnologije na migracione procese te daje uvid u specifičnosti svih naprijed navedenih procesa i efekata pri suočavanju sa migracionim izazovima i kompleksom tehnoloških promjena kod albanske manjine u Srbiji.

Ključne riječi: *migracije, nove tehnologije, manjinske skupine, Preševska dolina*

COMPUTER-AIDED ANTICANCER POTENTIAL OF SEMISYNTHETIC NATURAL ANALOGUES TOWARDS EPIDERMAL GROWTH FACTOR RECEPTOR

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Ozlem Aydin


Idris Arslan

ABSTRACT:
Natural products are a great group of secondary metabolites produced by living organisms to optimize nature. Natural sources such as terrestrial higher plants, fungi, bacteria, and marine organisms synthesize the metabolites to adapt the their microenvironments. To date, many FDA approved drugs have been discovered for therapeutic use from natural sources, including taxol (paclitaxel), vincristine/vinblastine (anticancer), fingolimod (multiple sclerosis), cyclosporine and doxorubicin (immunosuppressant). Nowadays, naturally occurring compounds are a great reservoir for drug discovery and design.
In the presentstudy, we have focused on potential modulatory activities of triterpenoid-based natural products and their derivatives by Click Chemistry towards epidermal growth factor receptor (EGFR) protein through computed-aided screening. Our findings revealed that azole derivatives of betulinic acid and ursolic acid showed significantly binding affinity on EGFR protein by molecular docking.

Keywords: *EGFR, cancer, molecular docking, 1MOX,*

DYRK1A PROTEINS: KEY REGULATORS IN NEURODEVELOPMENT AND CELLULAR PROCESSES

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Ece Uğur

Idris Arslan

ABSTRACT:
Protein kinases are enzymes that play a critical role in regulating various cellular processes by adding phosphate groups to specific amino acids in proteins. Dual-specificity tyrosine phosphorylation refers to a specific type of kinase activity where the enzyme can phosphorylate a protein on both tyrosine and serine/threonine residues. DYRK1A (dual-specificity tyrosine phosphorylation-regulated kinase 1A) is a member of the DYRK family of proteins, characterized by their involvement in cellular signaling pathways, regulation of cell cycle, and processes related to neurodevelopment.DYRK1A is a multifaceted kinase that plays critical roles in both cancer metastasis and neuronal function. Its regulatory effects on cell migration, apoptosis, and synaptic plasticity present opportunities for targeted therapies in HCC and neurological disorders. Further research into the molecular mechanisms underlying DYRK1A's actions in these contexts will be essential for the development of specific interventions aimed at mitigating its pathological effects in cancer and neurodegeneration.

Keywords: *DYRK1A, protein kinase, neurodevelopment, Leucettinib-21*

DEEP REINFORCEMENT LEARNING FOR ADAPTIVE OBJECT SORTING IN COLLABORATIVE ROBOTICS

DUBOKO UČENJE SA PODRŠKOM ZA ADAPTIVNO SORTIRANJE OBJEKATA U KOLABORATIVNOJ ROBOTICI

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Haris Subašić


Lejla Banjanović-Mehmedović


Selma Subašić


Isak Karabegović

ABSTRACT:
This paper explores the application of Deep Reinforcement Learning (DRL) in human-robot collaborative sorting tasks, emphasizing the robot's adaptability. DRL enables robots to adjust to dynamic environments, including human presence and unknown objects. Using RGB and depth images processed by DenseNet, the robot recognizes and manipulates objects.
The proposed approach estimates grasping positions without prior object knowledge, enhancing adaptability in unstructured environments. A Deep Q-Network (DQN) simulation in CoppeliaSim evaluates execution speed, accuracy, and system robustness, demonstrating improved sorting efficiency and safety in human-robot collaboration.

Keywords: *Deep Reinforcement Learning, Adaptive Sorting, Collaborative Robotics.*

REZIME:
Ovaj rad istražuje primjenu dubokog učenja s podrškom (DRL) u zadacima sortiranja u okviru kolaboracije ljudi i robota, s naglaskom na prilagodljivost robota. DRL omogućava robotima prilagođavanje dinamičnim okruženjima, uključujući prisustvo ljudi i nepoznate objekte. Korištenjem RGB i dubinskih slika obrađenih putem DenseNet mreže, robot prepoznaje i manipuliše objektima. Predloženi pristup omogućava procjenu pozicija hvatanja bez prethodnog poznavanja objekata, poboljšavajući prilagodljivost u nestrukturiranim okruženjima. Simulacija algoritma Deep Q-Network (DQN) u CoppeliaSim okruženju procjenjuje brzinu izvršenja, tačnost i robusnost sistema, pokazujući poboljšanu efikasnost sortiranja i sigurnost u kolaboraciji ljudi i robota.

Ključne riječi: *duboko učenje s podrškom, adaptivno sortiranje, kolaborativna robotika.*

EFFICIENT ROUTE BALANCING IN LOGISTICS: A SOLUTION USING ANT COLONY OPTIMIZATION

EFIKASNO BALANSIRANJE RUTA U LOGISTICI: RJEŠENJE PRIMJENOM METODE OPTIMIZACIJE KOLONIJOM MRAVA

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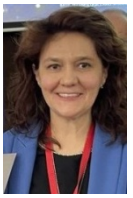
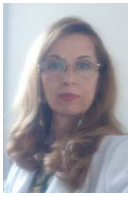
Mia Lešić Aganović



Lejla Banjanović-Mehmedović



Tatjana Konjić

ABSTRACT:
This paper addresses the vehicle routing problem, a fundamental task in transportation optimization and logistics, where efficient route planning can significantly impact cost savings, service quality, and operational efficiency. The study specifically examines the performance of different route balancing measure - minmax, range, and leximin - in achieving balanced routes across multiple objectives, using Ant Colony Optimization. By implementing and analyzing these measures in MATLAB, each approach's effectiveness in improving route balance while managing the trade-off with total traveled distance is evaluated.

Keywords:*logistics, vehicle routing problem, route balancing, ant colony optimization, multiple objectives optimization*

REZIME:
U ovom radu razmatran je problem usmjeravanja vozila koji predstavlja jedan od osnovnih zadataka u optimizaciji procesa transporta i logistike, gdje efikasno planiranje ruta može značajno uticati na smanjenje troškova, kvalitetu usluge i efikasnost rada. U radu je analizirana efikasnost različitih mjera za balansiranje ruta – minmax, raspon i leximin – u postupku postizanja uravnoteženih ruta u okviru višekriterijske optimizacije, primjenom metode optimizacije kolonijom mrava. Implementacijom i analizom navedenih mjera u MATLAB-u, analizirana je efikasnost svakog od navedenih pristupa u postizanju balansiranih ruta, uzimajući u ozbir i što manju ukupnu pređenu udaljenost.

Ključne riječi:*logistika, problem usmjeravanja vozila, balansiranje ruta, optimizacija kolonijom mrava, višekriterijska optimizacija*

A FRAMEWORK FOR STRUCTURAL MONITORING: DEEP LEARNING AND DIGITAL TWIN FOR ANOMALY DETECTION

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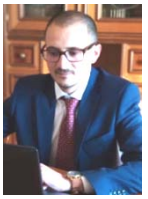
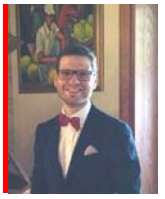
[1]Department of Industrial Engineering, University of Salerno, Fisciano (SA), Italy
[2]Department of Cultural Heritage Sciences, University of Salerno, Fisciano (SA), Italy


Zandra B. Rivera Chavez


Angelo Lorusso


Domenico Santaniello


Marco C. De Simone

ABSTRACT:
Structural monitoring plays an important role in ensuring the safety and longevity of infrastructure; nevertheless, conventional methods frequently lack the capacity for continuous and predictive analysis. This study presents an advanced Structural Health Monitoring (SHM) system that integrates IoT, Digital Twin (DT), and Deep Learning (DL) to automate the recognition of issues with structure and enhance preventive maintenance. The methodology entails obtaining vibrational data from MEMS accelerometer sensors, analyzing it with a Convolutional Autoencoder (CAE), and visualizing the anomalies immediately within the digital twin of the monitored structure. The deep learning model, trained on temporal sequences of vibration signals acquired during normal operating conditions, acquires a concise description of standard structural behaviour. During the inference phase, the reconstruction error is a metric to detect substantial deviations and produce real-time alerts. The paper delineates the issue, current advancements, methodology employed, outcomes, and a comparison with conventional procedures. The findings underscore the potential of merging IoT, DT, and DL to enhance structural monitoring, facilitating more efficient infrastructure management and mitigating the risk of unforeseen failures.

Keywords: *Predictive Maintenance, Vibration Analysis, Unsupervised Learning*

UNCOVERING MICROBIAL GENOMIC SIMILARITIES THROUGH PROPOSED K-MERS FEATURE EXTRACTION METHOD

OTKRIVANJE MIKROBNIH GENOMSKIH SLIČNOSTI UPOTREBOM PREDLOŽENE METODEEKSTRAKCIJE ZNAČAJKA K-MERA

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Lucija Brezočnik


Tanja Žlender


Maja Rupnik


Vili Podgorelec

ABSTRACT:
Regardless of computer hardware and software improvements, DNA sequence analysis is still very computationally complex and time-consuming. Therefore, novel approaches to tackle this challenge are morethan needed. In our study, we proposed a k-mers feature extraction method, which can identifyinformative k-mers. Such search is vital, among others, for microbial source tracking, where we need to defineprimers for an in-silico PCR. The results demonstrate that the proposed method is able to produce better resultsthan the compared n-grams approach, resulting in better clustering outcomes.

Keywords: *Machine Learning, Clustering, K-mers, Microbial Source Tracking, Metagenomics*

REZIME:
Bez obzira na poboljšanja kompjuterskog hardvera i softvera, analiza sekvence DNK je i dalje računski složena idugotrajna. Stoga su novi pristupi za rješavanje ovog izazova više nego potrebni. U našoj studiji predložili smometodu ekstrakcije osobina k-mera, koja može identificirati informativne k-mere. Takva pretraga je od vitalnognačaja, između ostalog, za praćenje mikrobnog izvora, gdje moramo definirati prajmere za in-silico PCR.Rezultati pokazuju da predložena metoda može dati bolje rezultate od upoređenog n-gramskog pristupa, štorezultira boljim rezultatima grupiranja.

Ključne reči: *mašinsko učenje, grupisanje, K-meri, praćenje mikrobnih izvora, metagenomika*

DEEP LEARNING FOR STRESS DETECTION – A 3D LSTM MODEL FOR EEG AND ECG DATA ANALYSIS

DUBINSKO UČENJE ZA DETEKCIJU STRESA – 3D LSTM MODEL ZA ANALIZU EEG I EKG SIGNALA

***Amina Radončić*[1]**
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Amina Radončić

ABSTRACT
The detection and interpretation of physiological signals such as electroencephalograms and electrocardiograms have emerged as critical tools in clinical diagnostics for assessing stress and emotional states. This paper introduces AIDAN, a multimodal deep learning system built on a 3D Long Short-Term Memory architecture, designed to analyze temporal patterns in EEG and ECG data, fully developed in MATLAB. AIDAN captures subtle physiological changes over time, enabling reliable classification of stress levels into LOW, MEDIUM, and HIGH categories. The system was evaluated on a small yet representative dataset, achieving notable performance in detecting low-stress levels with an F1 score of 0.58 and a corresponding AUC of 0.37. While medium-stress classification remains challenging due to overlapping signal features, AIDAN demonstrated resilience and adaptability during training, suggesting potential for improvement with enhanced feature representation and class balancing.

Keywords: *artificial intelligence, clinical engineering, recurrent neural network, biomedical engineering*

REZIME:
Detekcija i interpretacija fizioloških signala poput elektroencefalograma (EEG) i elektrokardiograma (ECG) postale su ključni alati u kliničkoj dijagnostici za procjenu stresa i emocionalnih stanja. Ovaj rad predstavlja AIDAN, multimodalni sistem dubokog učenja zasnovan na 3D arhitekturi Long Short-Term Memory (LSTM), dizajniran za analizu vremenskih obrazaca u EEG i ECG podacima, u potpunosti razvijen u MATLAB-u. AIDAN prepoznaje suptilne fiziološke promjene kroz vrijeme, omogućavajući pouzdanu klasifikaciju nivoa stresa u NISKI, SREDNJI i VISOKI. Sistem je evaluiran na malom, ali reprezentativnom skupu podataka, ostvarivši zapažene rezultate u detekciji niskog nivoa stresa sa F1 ocjenom od 0.58 i pripadajućom AUC vrijednošću od 0.37. Iako klasifikacija srednjeg nivoa stresa ostaje izazovna zbog preklapanja signalnih karakteristika, AIDAN je pokazao otpornost i prilagodljivost tokom treniranja, sugerirajući potencijal za poboljšanje uz unapređenje reprezentacije karakteristika i balansiranje klasa.

Ključne riječi: *vještačka inteligencija, kliničko inženjerstvo, rekurentna neuronska mreža, biomedicinsko inženjerstvo*

ARTIFICIAL INTELLIGENCE IN ORTHODONTICS DIAGNOSIS AND TREATMENT

VEŠTAČKA INTELIGENCIJA U ORTODONIJI - DIJAGNOSTIKA I LEČENJE

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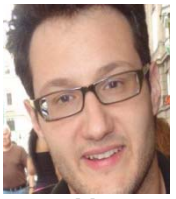


Nemanja Majstorović

Sonja Dimitrijević

ABSTRACT:
This paper aims to analyze, summarize, and discuss the results of studies addressing specifically AI/ML in orthodontics diagnosis and treatment published in the last five years. Orthodontics is characterized by an average treatment duration between 18 and 24 months, prognostic uncertainty, and influencing factors that are difficult to model. To this end, the review has excluded papers on automated cephalometric landmarking or classification if not conducted within diagnosis and treatment. Namely, the review analyzes application domains, common applications and their datasets, and subfields of AI/ML that have been reported in the literature. The review also considers how well AI/ML has performed in the reported applications. The results have shown that the leading application domain is diagnosis and treatment planning, followed by assessment of growth and development, treatment monitoring, and evaluation of treatment outcomes. The datasets have included various data such as cone beam computed tomography scans, cephalometric radiographs (e.g., cephalometric parameters), intraoral clinical images, different clinical data from case records, etc. ...

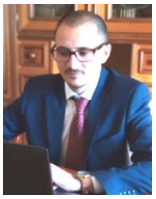
Keywords: *Orthodontics, Artificial Inteligence (AI) , Machine learning (ML), Clinical practice.*

REZIME:
Ovaj rad ima za cilj da analizira, sumira i diskutuje o rezultatima studija koje se posebno bave AI/ML u ortodontskoj dijagnozi i lečenju objavljenih u poslednjih pet godina. Ortodonciju karakteriše prosečno trajanje lečenja između 18 i 24 meseca, prognostička neizvesnost i uticajni faktori koje je teško modelirati. U tom cilju, pregled je isključio radove o automatizovanom kefalometrijskom označavanju ili klasifikaciji ako nisu sprovedeni u okviru dijagnoze i lečenja. Naime, u pregledu se analiziraju domeni aplikacija, uobičajene aplikacije i njihovi skupovi podataka, kao i podoblasti AI/ML koje su navedene u literaturi. Pregled takođe uzima u obzir koliko je AI/ML imao učinak u prijavljenim aplikacijama. Rezultati su pokazali da je vodeći domen primene dijagnostika i planiranje lečenja, zatim procena rasta i razvoja, praćenje lečenja i evaluacija ishoda lečenja. Skupovi podataka su uključivali različite podatke kao što su skeniranje kompjuterizovane tomografije konusnim snopom, kefalometrijske radiografije (npr. cefalometrijski parametri), intraoralne kliničke slike, različite kliničke podatke iz evidencije slučajeva, itd. ...

Ključne reči: *Ortodoncija, Veštačka inteligencija (AI), Mašinsko učenje (ML), Klinička praksa*

HUMAN IDENTIFICATION VIA IOT AND MACHINE LEARNING: A NEW APPROACH TO WORKSITE SAFETY

Angelo Lorusso[1], Domenico Santaniello[2], Zandra Betzabe Rivera Chavez[1], Francesco Villecco[1]
[1]University of Salerno, Department of Industrial Engineering, Fisciano, Italy
[2]University of Salerno, Department of Cultural Heritage, Fisciano, Italy


Angelo Lorusso


Domenico Santaniello


Zandra Betzabe Rivera Chavez


Francesco Villecco

ABSTRACT:
Ensuring worker safety is a basic concern in high-risk areas like construction sites, where accurate and efficient human identification is essential. Accurate identification of personnel at worksites is crucial for reducing security hazards. Contemporary approaches exhibit low identification rates, localization inaccuracies, and elevated latency, hence jeopardizing safety. This paper presents SECURITY YARDS, a framework utilizing cloud computing and the Internet of Things (IoT) for human identification through gait recognition. Our approach utilizes Speeded Up Robust Features (SURF) and Convolutional Neural Networks (CNNs) to extract and classify gait characteristics, providing a more nuanced and adaptable representation. A Support Vector Machine (SVM) at the Fog level optimizes classification, improving precision and processing efficacy. Final decision-making, data storage, and monitoring are conducted on the cloud, ensuring scalability and real-time safety management. The findings indicate that SECURITY YARDS markedly enhances accuracy and lowers latency relative to traditional biometric identification systems. This research advances the creation of more dependable and adaptive safety solutions, facilitating future improvements in worksite security and monitoring..

Keywords: *Internet of Things, Cloud computing, Machine Learning, Deep Learning*

DYNAMIC REQUIREMENT PRIORITIZATION IN SOFTWARE DEVELOPMENT USING ARTIFICIAL INTELLIGENCE

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Claudiu Florin Iuonas

Aurel Mihail Țîțu

Ioan Dănuț Iuonaș

ABSTRACT:
The rapid evolution of software development methods needs flexible ways to prioritize requirements. Traditional approaches often fail to manage the complexity and changing needs of modern projects. This paper explores how Artificial Intelligence (AI) changes requirement prioritization by offering adaptable, data-driven solutions. The study discusses key AI methods, their use in agile workflows, and their effect on project efficiency and risk reduction. Additionally, this research initiates further analysis to ensure data verification within projects, aiming to establish stable datasets as a foundation for effective AI implementation in prioritization processes.

Keywords: *Artificial Intelligence (AI), Requirement Prioritization, Software Development, Agile Workflows, Data Verification.*

INTEGRATED TECHNIQUES FOR RADIOLOGICAL IMAGE ANALYSIS USING GRAPHS AND COMPUTATIONAL METHODS

INTEGRISANE TEHNIKE ZA ANALIZU RADIOLOŠKIH SLIKA KORIŠTENJEM GRAFOVA I RAČUNARSKIH METODA

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[2]Faculty of Technical Sciences, University of Novi Sad, Novi Sad, Serbia
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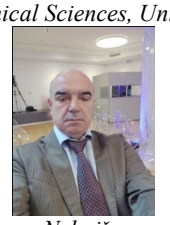
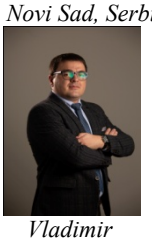
Irma Ibrišimović


Nebojša Ralević


Bratislav Iričanin


Vladimir Ilić

ABSTRACT:
The analysis of radiological images, especiallycomputed tomography (CT) scans, is crucial for the efficient detection and segmentation of pathological areas in human body. This approach applies dynamical systems theory, phase space reconstruction, andgraph analysis to enhance medical diagnostics. Utilizing entropy as a complexity measure allows for precise differentiation between healthy and pathological regions with a specific focus on kidney cancer, where exceptional resultshave been achieved in segmentation and anomaly detection.The implementation of the methodology in Python enables automated image processing and visualization of key patterns. In addition, entropy analysis reveals significant differences between healthy and pathological tissues. The results expand on existing methods based on fuzzy logic and neural networks, ...

Keywords: *Phase space reconstruction, dynamic systems theory, graph analysis, radiological images, kidney cancer detection.*

REZIME:
Analiza radioloških slika, posebno kompjutorizirane tomografije (CT), ključna je za učinkovito otkrivanje i segmentaciju patoloških područja u ljudskom tijelu. Ovaj pristup primjenjuje teoriju dinamičkih sustava, rekonstrukciju faznog prostora i analizu grafikona za poboljšanje medicinske dijagnostike. Korištenje entropije kao mjere složenosti omogućuje preciznu diferencijaciju između zdravih i patoloških regija s posebnim fokusom na rak bubrega, gdje su postignuti iznimni rezultati u segmentaciji i otkrivanju anomalija. Implementacija metodologije u Pythonu omogućuje automatiziranu obradu slike i vizualizaciju ključnih uzoraka . Osim toga, entropijska analiza otkriva značajne razlike između zdravih i patoloških tkiva. Rezultati proširuju postojeće metode temeljene na neizrazitoj logici i neuronskim mrežama, ...

Ključne riječi: *rekonstrukcija faznog prostora, teorija dinamičkih sistema, analiza grafova, radiološke slike, detekcija karcinoma bubrega.*

IRIS-BASED HUMAN-COMPUTER INTERACTION: EXPLORING EYE-DRIVEN INTERFACES

INTERAKCIJA ČOVJEKA I RAČUNARA ZASNOVANA NA IRISU: ISTRAŽIVANJE INTERFEJSA UPRAVLJANIH POGLEDOM

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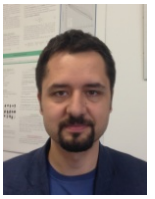
Amila Sabljica-Šojko



Emir Sokić

ABSTRACT:
The use of eye-based interaction with computers has gained significant attention, leading to the development of various methods tailored to this purpose. However, many existing approaches are constrained by environmental conditions and the user's facial expressions or rely on invasive techniques that may pose risks to human health. This project aims to overcome these limitations by proposing a noninvasive, user-friendly eye-tracking solution. The primary focus is on designing a device optimized for simplicity and usability, particularly for individuals with mobility impairments. The proposed method leverages image processing algorithms to achieve accurate and noninvasive eye tracking. This paper discusses the selection of appropriate hardware, techniques for extracting regions of interest, and the estimation of iris position from processed images.

Keywords: *eyetracking, human-computer interaction, image processing, assistive technologies*

REZIME:
Interakcija s računarima putem pogleda privukla je značajnu pažnju, što je rezultiralo razvojem različitih metoda prilagođenih ovoj tehnologiji. Ipak, mnogi postojeći pristupi suočavaju se s ograničenjima koja proizlaze iz utjecaja ambijentalnih uslova, izraza lica korisnika ili korištenja invazivnih tehnika koje mogu ugroziti ljudsko zdravlje. Ovaj projekat ima za cilj prevazilaženje tih prepreka kroz razvoj neinvazivnog i korisnički prilagođenog rješenja za praćenje pogleda. Fokus je na kreiranju uređaja koji je jednostavan za upotrebu i posebno optimiziran za osobe s ograničenom pokretljivošću. Predložena metoda koristi algoritme za obradu slike kako bi omogućila precizno i neinvazivno praćenje oka.U radu je razmatran izbor odgovarajućeg hardvera, tehnike za identifikaciju regija od interesa i procjenu položaja irisa iz obrađenih slika.

Ključne riječi: *praćenje pogleda, interakcija s računarom, obrada slike, asistivne tehnologije*

DECREASING PASSBAND DEVIATION IN LOW-POWER COMB DECIMATION FILTER WITH HIGH ALIAS REJECTION

SMANJENJE ODSTUPANJA U PROPUSNOMOPSEGUKOMB DECIMATORA NISKE SNAGE SA VISOKIM PRIGUŠENJEM ALIAS-a

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G. J. Dolecek

Isak Karabegovic

ABSTRACT:
This paper presents a simple method to design an efficient comb-based decimation filter thus satisfying high requirements in different applications. More specifically, we present here how to improve the passband characteristic of a low-power comb-based decimator with a high aliasing rejection, proposed in the literature. We proposed a low complexity multiplierless compensator to correct for the passband droop. First, the optimal compensator was designed using a Particle Swarm Optimization (PSO). Next, the compensator parameters are expressed in the Signed-Power-of-Two (SPT) form to obtain a multiplierless design since the SPT parameters are implemented using shifts and add. The proposed design is compared with the original comb-based decimation filter and one relevant literature work. Our comparison clearly demonstrates the advantages of our proposed design over existing methods, thereby highlighting its potential for practical applications.

Keywords: *decimation, comb, aliasing, compensator, multiplierless design.*

SAŽETAK:
Ovaj rad predstavlja jednostavnu metodu za projektovanje efikasnog decimacionog filtera čime se zadovoljavaju visoki zahtjevi u različitim primjenama. Konkretnije, ovdje predstavljamo kako poboljšati karakteristiku propusnog opsega decimatora male snage i visokog prigušenja aliasa, predloženog u literaturi. Prvo, optimalni kompenzator je dizajniran korištenjem Particle Swarm Optimization (PSO). Zatim, parametri kompenzatora se izražavaju u formi Signed-Power-of-Two (SPT) kako bi se dobio dizajn bez množitelja budući da se SPT parametri implementiraju korištenjem pomaka i zbrajanja. Predloženi dizajn je upoređen sa originalnim filterom za decimaciju i jednim relevantnim radom iz literature. Naše poređenje jasno pokazuje prednosti predloženog dizajna u odnosu na postojeće metode, naglašavajući na taj način njegov potencijal za praktičnu primjenu.

Ključne riječi: *decimacija, komb, aliasing, kompenzator, dizajn bez množitelja.*

TEXT-TO-SQL SYSTEMS: DEVELOPMENT, CHARACTERISTICS, PRACTICAL APPLICATIONS, AND FUTURE CHALLENGES

TEXT-TO-SQL SISTEMI: RAZVOJ, KARAKTERISTIKE, PRIMENA U PRAKSI I BUDUĆI IZAZOVI

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Vladan Čolić


Enes Sukić


Milica Tufegdžić


Marija Mojsilović

ABSTRACT:
Text-to-SQL Systems, based on artificial intelligence, represent a modern and innovative approach that enables users to generate SQL queries using natural language (NL), providing access to essential information from databases. The utility of these systems lies in their ability to allow a wide range of users, even those without technical knowledge, to easily obtain information for analysis, drawing conclusions, and making decisions, thus increasing the accessibility of databases and the data within them. This paper analyzes the concept of text-to-SQL systems, their characteristics, and the foundational elements on which they are built. A portion of the study is dedicated to the practical application of these systems in the fields of education. The paper examines both the advantages and potential drawbacks of such systems. Additionally, it explores the potential for the future development of text-to-SQL systems, addressing the challenges they face and proposing possible solutions to overcome these obstacles. ...
Keywords: *structured query language (SQL), databases , artificial intelligence, natural language processing (NLP), datasets, automated query generation*

REZIME:
Text-to-SQL sistemi, zasnovani na umjetnoj inteligenciji, predstavljaju savremen i inovativan pristup koji omogućava korisnicima da pomoću prirodnog jezika (PJ) generišu SQL upite koji će im omogućiti uvid u neophodne informacije iz baze podataka. Korisnost sistema se ogleda u tome da oni omogućavaju širokoj grupi korisnika, čak i onima koji nemaju “tehničkih” predznanja da na vrlo jednostavan način dođu do informacija koje im omogućavaju analize, izvođenje zaključaka i donošenje odluka, povećavajući tako pristupačnost bazama podataka, kao i samim podacima koji su u njima sadržani. Rad analizira sam koncept text-to-SQL sistema, njihove karakteristike, kao i elemente od kojih su izgrađeni. Dio rada je posvećen praktičnoj primjeni sistema u oblasti obrazovanja. Analiziraju se prednosti, ali i potencijalni nedostaci ovih sistema. Takođe, u radu se analiziraju i potencijali budućeg razvoja text-to-SQL sistema, uz sagledavanje izazova sa kojima se ovi sistemi suočavaju, kao i moguće načine za prevazilaženje ovih izazova. ...
Keywords: *SQL, baze podataka , umjetna inteligencija, obrada prirodnog jezika (NLP), skupovi podataka, automatsko generisanje upita*

LEVERAGING MACHINE LEARNING AS A PREREQUISITE FOR EFFECTIVE MAINTENANCE

KORIŠTENJE MAŠINSKOG UČENJA KAO PREDUVJET ZA EFIKASNO ODRŽAVANJE

Nevena Tufegdžić[1], Milica Tufegdžić[2], Raul Turmanidze,[3]Giorgi Popkhadze[4]
[1]University of Niš, Faculty of Electrical Engineering, Niš, Serbia
[2]Academy of Professional Studies Šumadija, Kragujevac, Serbia
[3,4]Georgian Technical University (GTU), Faculty of Transportation and Mechanical Engineering, Tbilisi, Georgia


Nevena Tufegdžić


Milica Tufegdžić


Raul Turmanidze


Giorgi Popkhadze

ABSTRACT:
This study employs a machine learning (ML) approach for predictive maintenance by addressing machine failure classification tasks, enabling effective interventions. Using a synthetic dataset of 10.000 instances with 14 features, ten ML algorithms are evaluated: AdaBoost, Bagging Classifier, CatBoost, Decision Tree, K-Nearest Neighbor, Naïve Bayes, Random Forest, Support Vector Classifier, Stacking Classifier, and Voting Classifier. Models are developed and tested in Python on various datasets, including all data, failure cases, balanced, and binary balanced datasets. Metrics such as accuracy, precision, recall, and F1 score are analyzed, cross-referenced with confusion matrices. CatBoost outperformed all models across datasets, achieving accuracy rates between 90.52% and 97.90%. Expanding the dataset is recommended in order to to further enhance performance.

Keywords: *machine failures, classification, predicted class, accuracy.*

SAŽETAK:
Studija koristi pristup mašinskog učenja (MU) za prediktivno održavanje fokusirajući se na klasifikacije kvarova mašina čime su omogućene efikasne intervencije. Na sintetičkom skupu podataka od 10.000 instanci sa 14 karakteristika, procijenjeno je deset algoritamaMU: AdaBoost, Bagging Classifier, CatBoost, Decision Tree, K-Nearest Neighbor, Naïve Bayes, Random Forest, Support Vector Classifier, Stacking Classifier i Voting Classifier. Modeli su razvijeni i testirani u Pythonu na različitim skupovima podataka, uključujući kompletan skup podataka, slučajeve kvarova, balansirani skup i binarno balansirani skup podataka. Metrike kao što su tačnost, preciznost, odziv i F1 skor su analizirane i ukrštene s matricama konfuzije. CatBoost se pokazao kao najbolji model na svim skupovima podataka, sa tačnošću u rasponu od 90,52% do 97,90%. Za postizanje boljih performansi preporučuje se proširenje skupa podataka.

Ključne riječi: *kvarovi mašina, klasifikacija, predviđena klasa, tačnost.*

LINGUISTIC CHALLENGES AND TECHNOLOGICAL SOLUTIONS IN MARITIME SAFETY: INTEGRATION OF SMART SYSTEMS AND ARTIFICIAL INTELLIGENCE

JEZIČNI IZAZOVI I TEHNOLOŠKA RJEŠENJA U POMORSKOJ SIGURNOSTI: INTEGRACIJA PAMETNIH SUSTAVA I UMJETNE INTELIGENCIJE

Marijana Medić[1], Jelena Žanić Mikuličić[2]
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Marijana Medić Jelena Žanić Mikuličić

ABSTRACT:
The maritime industry faces ongoing safety challenges due to linguistic barriers among multicultural crews. To address these issues, the International Maritime Organization developed Standard Marine Communication Phrases (SMCP), to help ensure clarity and uniformity. However, limitations in language proficiency persist, emphasizing the need for technological solutions. This paper explores the integration of Artificial Intelligence (AI) and Internet of Things (IoT) in maritime safety, focusing on real-time translation, Automatic Speech Recognition (ASR), and AI-driven training simulations. These technological solutions bridge language gaps, improve efficiency, and support competency development. The paper also highlights the role of cybersecurity in protecting linguistic data and ensuring smooth communication. ...

Keywords: *Maritime Safety, Artificial Intelligence, Language Barriers, Standard Marine Communication Phrases, Automatic Speech Recognition*

REZIME:
Pomorska industrija kontinuirano se suočava s izazovima sigurnosti zbog jezičnih barijera među multikulturalnim posadama. Kako bi se ti problemi ublažili, Međunarodna pomorska organizacija (eng. International Maritime Organization - IMO) razvila je standardizirane pomorske komunikacijske fraze (eng. Standard Marine Communication Phrases - SMCP) koje osiguravaju jasnoću i dosljednost u komunikaciji. Međutim, ograničenja u jezičnoj kompetenciji i dalje su prisutna, što naglašava potrebu za tehnološkim rješenjima. Ovaj rad istražuje integraciju umjetne inteligencije (eng. Artificial Intelligence - AI) i Interneta stvari (eng. Internet of Things - IoT) u pomorsku sigurnost, s naglaskom na prijevod u stvarnom vremenu, automatsko prepoznavanje govora (eng. Automatic Speech Recognition - ASR) i AI simulacije obuke. Ove tehnološke inovacije smanjuju jezične barijere, poboljšavaju učinkovitost i podržavaju razvoj kompetencija članova posade. Rad također ističe važnost kibernetičke sigurnosti u zaštiti jezičnih podataka i osiguravanju nesmetane komunikacije. ...

Ključne riječi: *pomorska sigurnost, umjetna inteligencija, jezične barijere, standardizirane pomorske komunikacijske fraze, automatsko prepoznavanje govora.*

AN IOT-BASED APPROACH FOR ENERGY OPTIMIZATION AND INTELLIGENT HOME ENVIRONMENT MANAGEMENT

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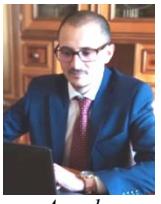
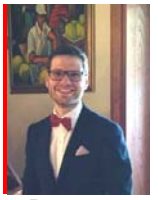

Angelo Lorusso


Domenico Santaniello


Zandra Betzabe Rivera Chavez


Francesco Villecco

ABSTRACT:
The Internet of Things (IoT) paradigm has transformed the establishment of interconnected technology settings, paving the way for novel approaches to intelligent service management. Smart Cities and Smart Homes are just a few examples of how this technology might improve people's lives.
This study proposes a novel way to Smart Home management that combines the Internet of Things with graphic representation and machine learning techniques. Our technology enables you to collect and analyze data from sensors and other devices, resulting in relevant information and autonomous actions that optimize energy and ventilation control. Our method was evaluated using a prototype, and the findings were positive in terms of energy efficiency and user happiness.

Keywords: *Internet of things, Smart Home, Energy Optimization, Environmental Monitoring, User-Centered Automation*

MOBILE APPLICATION MMEETING

MOBILNA APLIKACIJA MSASTANAK

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Suad Sućeska

ABSTRACT:
Mobile application mSastanak (mMeeting) enables to the user getting information about meetings of a company, institution or a work group by smartphone. This mobile application accesses the data of the Web application eSastanak via Internet. The data is stored in MySQL database on remote server. They are available permanently (24/7) and from anywhere. Access to the application is protected by authentication using data: Korisnik (User) and Lozinka (Password). User registration is mandatory before usage of the application and it is done using Web application eSastanak. Mobile application mSastanak is made for smartphones with the Android operating system.

Keywords: *mobile application, data, meetings, mSastanak (mMeeting), Android.*

REZIME:
Mobilna aplikacija mSastanak omogućava korisniku da pomoću smartphone-a dobije podatke o sastancima preduzeća, institucije ili neke radne grupe. Ova mobilna aplikacija putem Interneta pristupa podacima Web aplikcije eSastanak.Ovi podaci se čuvaju u bazi podataka MySQL na udaljenom serveru. Podaci o sastancima su dostupni stalno (24/7) i sa svakog mjesta. Pristup aplikaciji je zaštićen autentikacijom pomoću podataka: Korisnik i Lozinka. Registracija korisnika prije upotrebe aplikacije je obavezna i obavlja se pomoću Web aplikacije eSastanak. Mobilna aplikacija mSastanak je napravljena za smartphone sa operativnim sistemom Android.

Ključne riječi*: mobilna aplikacija, podaci, sastanci, mSastanak, Android.*

REVITALIZATION OF DRINKING FOUNTAINS IN SARAJEVO THROUGH THE PRISM OF CLIMATE CHANGE

REVITALIZACIJA ČESMI U SARAJEVU KROZ PRIZMU KLIMATSKIH PROMJENA

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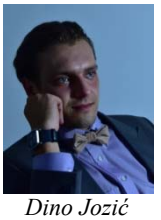
[2]Green Building Council, B&H
[3]University of Sarajevo, Faculty of Forestry, B&H


Sanela Klarić


Dino Jozić


Emira Hukić


Denis Fontana

ABSTRACT:*Sarajevo maintains a centuries old heritage of providing free drinking water for its inhabitants through public drinking fountains. The aim of this research is to emphasize the sustainable potentials of this tradition, and to evaluate the existing public drinking fountains network. The results showed that the local authorities should invest more efforts in promoting the high quality of tap water and preservation of existing public drinking fountains, that the drinking fountains which are cultural heritage should be maintained in a much more systematic way, that all the drinking fountains should be mapped out in an open access online platform. The conclusions these results imposed included that an online survey needed to be conducted in regards as to where the experts and residents of Sarajevo believe new drinking fountains to be necessary and that this data in combination with the location of existing drinking fountains could inform the best new locations.*

Keywords: *public drinking fountains, sustainability, green city, urban furniture*

Rezime: *Sarajevo njeguje stoljetnu tradiciju pružanja besplatne pitke vode svojim stanovnicima gradnjom javnih česmi. Cilj istraživanja je istaknuti održive potencijale koje ova tradicija predstavlja te ocijeniti postojeću mrežu javnih česmi. Rezultati su pokazali sljedeće: lokalne vlasti trebaju uložiti napor u promociju kvalitete vode i očuvanje postojećih javnih česmi; česme koje predstavljaju fragmente kulturne baštine Sarajeva treba održavati pažljivije i sustavnije te im posvetiti posebnu brigu; sve javne česme treba mapirati na platformi s otvorenim pristupom; dokumentovanje i promocija česmi mogu brendirati Sarajevo kao turističku destinaciju. Zaključci koji proizlaze iz ovih rezultata uključuju potrebu za provođenjem online ankete kako bi se utvrdilo gdje stručnjaci i stanovnici Sarajeva smatraju da su novečesme potrebne. Ovi podaci, u kombinaciji s lokacijama postojećih česmi, mogu informirati o najboljim novim lokacijama.*

Ključne riječi: *javne česme, održivost, zeleni grad, urbani mobilijar*

ADVANCED METHODS OF A MULTI-LANE MOTORWAY TRAFFIC SAFFETY CONTROL

NAPREDNE METODE UPRAVLJANJA SIGURNOSTI PROMETA NA VIŠETRAČNOJ AUTOCESTI

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Sadko Mandžuka


Goran Kos


Luka Dedić

ABSTRACT:
The paper presents the possibilities of applying some of the advanced methods of traffic safety management on multi-lane highways. This primarily refers to the application of variable speed limits on certain critical sections of the highway. The possibilities of applying a single variable speed limits (for all types of vehicles - freight and passenger vehicles) and for all lanes, as well as differential variable speed limits depending on the type of vehicle and a specific traffic lane, are analyzed. For these purposes, an appropriate model was developed on the VISSIM micro-simulation tool. Finally, in the final part, recommendations are given for the continuation of this research, considering future advanced technologies, such as cooperative systems in road traffic.

Keywords*: multi-lane motorway, variable speed limit control, micro-simulation model, crash detection*

REZIME:
U radu su prikazane mogućnosti primjene nekih od naprednih metoda upravljanja sigurnošću prometa na višetračnim autocestama. To se prvenstveno odnosi na primjenu promjenjivih ograničenja brzine na pojedinim kritičnim dionicama autoceste. Analizirane su mogućnosti primjene jedinstvenog promjenjivog ograničenja brzine (za sve vrste vozila - teretna i osobna vozila) i za sve prometne trake, kao i diferencijalnog promjenjivog ograničenja brzine ovisno o vrsti vozila i pojedinoj prometnoj traci. Za te potrebe razvijen je odgovarajući model na mikrosimulacijskom alatu VISSIM. Na kraju, u završnom dijelu dane su preporuke za nastavak ovog istraživanja, s obzirom na buduće napredne tehnologije, poput kooperativnih sustava u cestovnom prometu.

Ključne riječi*: višetračna autocesta, promjenjiva kontrola ograničenja brzine, mikrosimulacijski model, detekcija sudara*

CIRCULAR SOLUTIONS FOR CLEANER, QUIETER CITIES: THE FUTURE OF TRAFFIC POLLUTION BARRIERS

RJEŠENJA KRUŽNOG GOSPODARSTVA ZA ČIŠĆE I TIŠE GRADOVE: BARIJERE ZA ZAŠTITU OD ONEČIŠĆENJA UZ PROMETNICE

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Stjepan Lakušić


Ivo Haladin


Katarina Vranešić

ABSTRACT:
Urban environments face growing road traffic challenges, a significant source of noise and air pollution. Noise pollution affects about 125 million EU residents at harmful levels, while air pollution remains a leading environmental health risk. The urgency to address these threats is underscored by EU policies like the European Green Deal and the Zero Pollution Action Plan. In response, the CIRCLEAR project is pioneering an integrated barrier system to reduce noise and air pollution. By combining RUCONBAR (Rubberized Concrete Noise Barriers) with innovative APA (Air Pollution Abatement) technology, this project aims to create a product offering superior environmental performance. Rigorous testing will validate its ability to improve air quality, reduce noise and ensure durabilitywhile implementing circular economy principles.

Keywords: *noise, airquality, circulareconomy, barriers, transportation, urban space*

REZIME:
Urbane sredine suočavaju se sa sve većim izazovima cestovnog prometa, značajnim izvorom buke i onečišćenja zraka. Onečišćenje bukom pogađa oko 125 milijuna stanovnika EU-a na štetnim razinama, dok onečišćenje zraka ostaje vodeći rizik za zdravlje okoliša. Hitnost rješavanja ovih prijetnji naglašena je politikama EU-a kao što su Europski zeleni dogovor i Akcijski plan nultog onečišćenja. Kao odgovor na to, projekt CIRCLEAR nudi inovativno rješenje integriranog sustava barijera za smanjenje buke i zagađenja zraka. Kombinirajući RUCONBAR (barijere za zaštitu od buke s recikliranim agregatom od otpadnih guma) s inovativnom APA (Air PollutionAbatement) tehnologijom, ovaj projekt ima za cilj stvoriti proizvod koji nudi vrhunske ekološke performanse. Ispitivanje na probnoj instalaciji potvrdit će sposobnost proizvoda da poboljša kvalitetu zraka, smanji buku te osigura trajnost uz primjenu načela kružnog gospodarstva.

Ključne riječi: *buka, zagađenje zraka, kružno gospodarstvo, barijere, promet, urbana sredina*

APPLICATION OF ARTIFICIAL INTELLIGENCE IN THE CONTROL AND SUPERVISION OF ROAD TRANSPORT BY THE TRAFFIC INSPECTION

PRIMJENA UMJETNE INTELIGENCIJE U KONTROLI I NADZORU CESTOVNOG PRIJEVOZA OD STRANE SAOBRAĆAJNE INSPEKCIJE

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Nedim Kamenjašević *Maida Eljazović*

ABSTRACT:
The application of artificial intelligence (AI) in law enforcement agencies, including The Cantonal Administration for Inspection Affairs of the Canton of Sarajevo, namely the Traffic and Road Inspection Inspectorate, represents a significant problem-solving tool. The advantage of applying AI is the possibility of processing a large amount of data in real time. The main aim of this research is to show the possibilities of applying artificial intelligence in the control and supervision of traffic inspectors in the area of application of the Law on working hours, mandatory vacations of mobile workers and devices for recording in road traffic.

Keywords: *traffic inspection, artificial intelligence, road transport, mobile workers, control, supervison*

REZIME:
Primjena umjetne inteligencije (AI) u agencijama za provođenje zakona, uključujući i Kantonalnu upravu za inspekcijske poslove Kantona Sarajevo, odnosno Inspektorat saobraćajne i cestovne inspekcije, predstavlja značajan alat za rješavanje problema. Prednost primjene AI je mogućnost obrade velike količine podataka u realnom vremenu. Osnovni cilj ovog istraživanja je prikazati mogućnosti primjene umjetne inteligencije u kontroli i nadzoru kantonalnih saobraćajnih inspektora u oblasti primjene Zakona o radnom vremenu, obaveznim odmorima mobilnih radnika i uređajima za evidentiranje u cestovnom saobraćaju.

Ključne riječi: *saobraćajni inspektori, umjetna inteligencija, cestovni prijevoz, mobilni radnici, kontrola, nadzor*

ELECTRONIC DRIVER ASSISTANCE SYSTEMS AND THEIR LEGAL REGULATION

ELEKTRONSKI SISTEMI ZA POMOĆ VOZAČU I NJIHOVO PRAVNO NORMIRANJE

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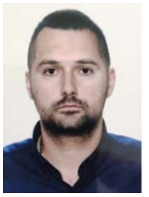
Enes Saletović


Malik Kriještorac


Muhamed Fetić


Mirzet Sarajlić

ABSTRACT:
Modern cars are equipped with various electronic driver assistance systems. These systems are implemented as optional, additional microprocessor-based embedded systems that perform specific functions within the vehicle using different sensors. The main motivations for integrating various embedded electronic systems include increasing traffic safety, adding new functionalities, reducing fuel consumption to protect the environment, and enhancing the value and competitiveness of the vehicle. The aim of this research is to analyze the effects of applying advanced electronic driver assistance systems and their legal regulation.

Keywords: *electronic, systems, driver, assistance, legal, regulation.*

REZIME:
Savremeni automobili opremljeni su različitim elektronskim sistemima za pomoć vozaču. Takvi sistemi realizuju se kao opcionalni dodatni mikroprocesorski bazirani ugradbeni sistemi koji obavljaju specifične funkcije unutar automobila, korištenjem različitih senzora. Glavni motivi za ugradnju različitih ugradbenih elektronskih sistema su: povećanje sigurnosti saobraćaja, dodavanje novih funkcionalnosti, smanjenje potrošnje goriva radi očuvanja okoline, te povećanje vrijednosti i konkurentnosti automobila. Cilj istraživanja je analiza efekata primjene naprednih elektronskih sistema za pomoć vozaču te njihovo pravno normiranje.

Ključne riječi: *elektronski, sistemi, vozač, pomoć, pravno, normiranje.*

LEGAL ASPECTS OF PROVING LIABILITY FOR TRAFFIC ACCIDENTS OCCURRING IN ROUNDABOUTS

PRAVNI ASPEKTI DOKAZIVANJA ODGOVORNOSTI ZA SAOBRAĆAJNE NEZGODE NASTALE U KRUŽNIM RASKRSNICAMA

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[2]Federalno ministarstvo unutrašnjih poslova, Sarajevo, Bosna i Hercegovina,
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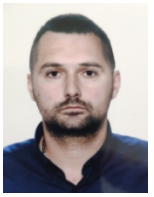
Mirzet Sarajlić


Muhamed Fetić


Michael Strand

ABSTRACT:
The paper presents the results of research on traffic accidents occurring at roundabouts, the determination of responsibility for those involved in the accidents, and legal proceedings. The determination of responsibility for individuals involved in traffic accidents at roundabouts varies, as do the proposals for resolving traffic accidents amicably, which directly impacts damage compensation. The aim of the research is to unify practices in processing and determining responsibility for damages arising from these accidents.

Keywords: *Traffic accident, roundabout, determination of responsibility, legal procedure.*

REZIME:
U radu su prikazani rezultati istraživanja saobraćajnih nezgoda nastalih u kružnim raskrsnicama, utvrđivanja odgovornosti lica koja su učestvovala u nezgodama i pitanja provođenja pravnih postupka. Utvrđivanje odgovornosti lica koja su učestvovala u saobraćajnim nezgodama u kružnim raskrsnicama je različita kao i prijedloga da se saobraćjana nezgoda riješi mirnim putem, a što direktno utiče na nadoknadu štete. Cilj istraživanja je unifikacija prakse u obradi i utvrđivanju odgovornosti za štete nastale u ovim nesrećama.

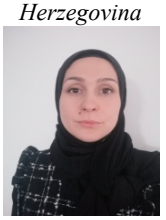
Ključne riječi: *Saobraćajna nezgoda, kružna raskrsnica, utvrđivanje odgovornosti, pravni postupak.*

CARGO TERMINALS: A COMPARATIVE ANALYSIS OF EUROPEAN AIRPORTS AND SARAJEVO AIRPORT

CARGO TERMINALA: KOMPARATIVNA ANALIZA EVROPSKIH AERODROMA I AERODROMA SARAJEVO.

Mirza Berković[1*], Lejla Nikšić[1], Edvin Šimić[1]
[1]University of Sarajevo - Faculty of Traffic and Communications, Sarajevo, Bosnia and Herzegovina


Mirza Berković


Lejla Nikšić


Edvin Šimić

ABSTRACT:
This paper examines the role and operational challenges of cargo terminals at major airports in Europe, with a particular focus on Sarajevo Airport. Cargo terminals are crucial hubs for international freight transport, facilitating the smooth movement of goods across global markets. The study explores the core functions of cargo operations, including handling, storage, sorting, and customs procedures, while highlighting the unique challenges faced by European airports in managing high freight volumes, ensuring security, and complying with regulatory standards.While large airports such as Frankfurt, Amsterdam Schiphol, London Heathrow, and Paris Charles de Gaulle set benchmarks for operational efficiency and technological innovation, Sarajevo Airport serves as an important regional transport center for Bosnia and Herzegovina and its neighboring markets. As such, it faces different challenges, including seasonal fluctuations, limited infrastructure capacity, ...
Keywords: *Cargo terminals, airport logistics, Sarajevo Airport, sustainable logistics, airport operations*

REZIME*:*
Ovaj rad ispituje ulogu i operativne izazove cargo terminala na glavnim aerodromima u Evropi, s posebnim fokusom na Međunarodni aerodrom Sarajevo. Cargo terminali su ključni čvorišta za međunarodni transport tereta, olakšavajući nesmetano kretanje robe na globalnim tržištima. Studija istražuje osnovne funkcije teretnih operacija, uključujući rukovanje, skladištenje, sortiranje i carinske procedure, uz isticanje jedinstvenih izazova s kojima se suočavaju evropski aerodromi u upravljanju velikim količinama tereta, obezbeđivanju sigurnosti i usklađivanju sa regulatornim standardima.
Dok veliki aerodromi poput Frankfurta, Amsterdama Schiphol, Londona Heathrow i Pariza Charles de Gaulle postavljaju standarde za operativnu efikasnost i tehnološke inovacije, aerodrom Sarajevo predstavlja važan regionalni transportni centar za Bosnu i Hercegovinu i susjedna tržišta. Kao takav, suočava se sa različitim izazovima, uključujući sezonske fluktuacije, ograničene kapacitete infrastrukture ...
Ključne rječi: *Cargo terminali, aerodromska logistika, Međunarodni aerodrom Sarajevo, održiva logistika, aerodromske operacije*

INNOVATIVE APPROACHES OF INCIDENT MANAGEMENT SYSTEMS ARCHITECTURE IN SMART CITY ENVIRONMENT

INOVATIVNI PRISTUPI ARHITEKTURI SUSTAVA UPRAVLJANJA INCIDENTIMA U OKRUŽENJU PAMETNOG GRADA

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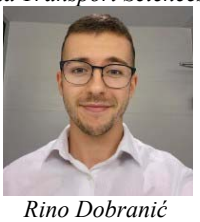
[1]Faculty of Traffic and Transport Sciences, Zagreb, Croatia


Miroslav Vujić


Rino Dobranić


Marijana Medić

ABSTRACT:
Effective and fast responsive incident management systems (IMS) are essential in growing urban city environments where everyday challenges (traffic accidents, public safety, etc.) are present. These systems depend strongly on fast and reliable information exchange between different stakeholders, and the development and deployment of communication architecture is necessary. Integration and usage of advanced information and communication technologies (ICT) and concepts such as IoT, cooperative approach, and mobile data transfer play a crucial role in enhancing the efficiency and effectiveness of incident management systems. This paper focuses on the communication architecture based on the European intelligent transport systems (ITS) architecture emphasizing IMS within smart city environments. Highlighting the key components and challenges of developing a robust communication architecture, capable of managing incidents in real-time, the advanced IMS structure is presented, which enables the successful management of incidents minimizing their impact on everyday smart city operations.
Keywords: *smart cities, intelligent transport systems, cooperative approach, Internet of Things, data transmission, emergency response*

REZIME:
Učinkoviti i brzo reagirajući sustavi upravljanja incidentima ključni su u rastućim urbanim gradskim sredinama gdje su prisutni svakodnevni izazovi (prometne nesreće, javna sigurnost, itd.). Ovi sustavi uvelike ovise o brzoj i pouzdanoj razmjeni informacija između različitih dionika, te su nužni razvoj i implementacija komunikacijske arhitekture. Integracija i korištenje naprednih informacijskih i komunikacijskih tehnologija (ICT) i koncepata kao što su IoT, kooperativni pristup i mobilni prijenos podataka igraju ključnu ulogu u poboljšanju učinkovitosti i efikasnosti sustava upravljanja incidentima. Ovaj se rad fokusira na komunikacijsku arhitekturu koja se temelji na arhitekturi europskih inteligentnih transportnih sustava (ITS) s naglaskom na sustave upravljanja incidentima unutar okruženja pametnih gradova. Naglašavajući ključne komponente i izazove razvoja robusne komunikacijske arhitekture, sposobne za upravljanje incidentima u stvarnom vremenu, predstavljena je napredna struktura sustava upravljanja incidentima koja omogućuje uspješno upravljanje incidentima minimizirajući njihov utjecaj na svakodnevne operacije pametnog grada.
Ključne riječi: *pametni gradovi, inteligentni transportni sustavi, kooperativni pristup, Internet stvari, prijenos podataka, hitne intervencije*

MULTIMODAL JOURNEY PLANNERS AND MICROMOBILITY: A STEP TOWARD SEAMLESS URBAN MOBILITY

MULTIMODALNI PUTNI PLANERI I MIKROMOBILNOST: KORAK PREMA POVEZANOJ URBANOJ MOBILNOSTI

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[2] *Ericsson Nikola Tesla, Zagreb, Croatia*



Bia Mandžuka *Krešimir Vidović* *Pero Škorput*

ABSTRACT:
The paper explores the integration of micromobility into multimodal journey planners (MJPs) as a key step toward improving urban mobility. MJPs are key tools for modern travellers in planning trips from point A to point B using various modes of transport (e.g., tram, bus, train, e-scooter). Micromobility, which includes e-scooters, bicycles and scooters, etc. represents a modern concept and emerging solution based on the use of small and lightweight mobility modes for short distances. The paper defines the role of MJPs in the context of urban mobility and presents their development. Special focus is placed on the importance of micromobility in addressing the accessibility issue known as the "first and last mile" problem. Furthermore, the paper identifies key user challenges and opportunities related to the integration of micromobility, including user acceptance, their travel habits and the balance between individual (user preferences) and societal goals. It also examines challenges related to open data, which are crucial for the realization of high-quality journey planners. Finally, the paper presents guidelines for future research and
Keywords: *micromobility, multimodal journey planners (MJPs), urban mobility, accessibility*

REZIME:
Ovaj rad istražuje integraciju mikromobilnosti u multimodalne planere putovanja (MPP) kao ključan korak za unaprjeđenje urbane mobilnosti. MPP planeri su ključni alat za suvremenog putnika pri planiranju putovanja od točke A do točke B koristeći raznovrsne oblike prijevoza (npr. tramvaj, autobus, e-romobil). Mikromobilnost, koja obuhvaća e-romobile, bicikle i skutere, i dr. predstavlja moderan koncept i rješenje temeljen na upotrebi malih i laganih prijevoznih sredstava za kraće udaljenosti. U radu je definirana uloga multimodalnih putnih planera u kontekstu urbane mobilnosti te je prikazan njihov razvoj. Poseban naglasak stavljen je na važnost mikromobilnosti u rješavanju problema pristupačnosti poznatog kao problem *„prvog i zadnjeg kilometra“. Nadalje, u radu se identificirani ključni korisnički izazovi i prilike povezane s integracijom mikromobilnosti, uključujući korisničko prihvaćanje, njihove navike te ravnotežu između individualnih i društvenih ciljeva. Također, razmatrani su izazovi povezani s otvorenim podacima koji su ključni za realizaciju visokokvalitetnih putnih planera. Na kraju, predstavljene su smjernice za buduća istraživanja i razvoj u području multimodalnih putnih planera i mikromobilnosti.*
Ključne riječi: *mikromobilnost, multimodalni putni planeri (MPP), urbana mobilnost, pristupačnost*

ANALYSIS AND MANAGEMENT OF LOGISTICS ACTIVITIES OF INDUSTRY 4.0

ANALIZA I UPRAVLJANJE LOGISTIČKIM AKTIVNOSTIMA INDUSTRIJE 4.0

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Sarajko Baksa

Ines Baksa

ABSTRACT:
Industry 4.0 significantly transforms logistics management through advanced technologies like IoT, machine learning, automation, and AI. This revolution improves efficiency, reduces costs, and enhances logistics flexibility. Key benefits include precise demand forecasting, reduced storage costs, improved transport efficiency, and various other savings. Predictive and preventive equipment maintenance reduces breakdown risks and increases equipment lifespan. Risk and security management ensures business continuity, while investing in employee skills enables effective technology application. Comprehensive analysis and optimization of logistics activities lead to greater operational efficiency, service quality, and business sustainability. This paper explores key logistics management tasks in Industry 4.0, providing insight into technological challenges and opportunities, aiming to show how companies can leverage advanced technologies for long-term competitive advantage and sustainable development.

Keywords:*logistics management, technology, Industry 4.0, logistics activities*

REZIME:
Industrija 4.0 značajno transformira upravljanje logistikom kroz napredne tehnologije poput IoT-a, strojno učenje, automatizaciju i AI. Ova revolucija poboljšava učinkovitost, smanjuje troškove i povećava fleksibilnost logističkih procesa. Ključne koristi uključuju precizno predviđanje potražnje, smanjenje troškova skladištenja, poboljšanje učinkovitosti transporta i razne druge uštede. Prediktivno i preventivno održavanje opreme smanjuje rizik od kvarova i povećava vijek trajanja opreme. Upravljanje rizicima i sigurnošću osigurava kontinuitet poslovanja, dok ulaganje u vještine zaposlenika omogućava učinkovitu primjenu tehnologije. Sveobuhvatna analiza i optimizacija logističkih aktivnosti vode do veće operativne učinkovitosti, kvalitete usluge i održivosti poslovanja. Ovaj rad istražuje ključne zadatke upravljanja logistikom u Industriji 4.0, pružajući uvid u tehnološkeizazove i prilike, te pokazuje kako tvrtke mogu iskoristiti napredne tehnologije za dugoročnu konkurentsku prednost i održivi razvoj.

Ključne riječi: *upravljanje logistikom, tehnologija, Industrija 4.0, logističke aktivnosti.*

USING ADVANCED TECHNOLOGIES FOR UNDERSTANDING AND PREVENTING PEER VIOLENCE AMONG ADOLESCENTS

KORIŠĆENJE NAPREDNIH TEHNOLOGIJA ZA RAZUMEVANJE I PREVENCIJU VRŠNJAČKOG NASILJA MEĐU ADOLESCENTIMA

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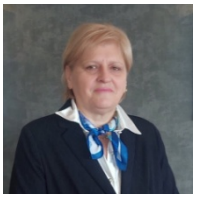
Valentina Smolovic


Velibor Spalevic

ABSTRACT:
This study explores adolescent peer violence, emphasizing its physical, verbal, social, and digital manifestations, with cyberbullying and emotional manipulation becoming increasingly prevalent. While educational institutions play a key role in prevention, limited institutional support, weak inter-agency cooperation, and declining educator authority hinder intervention effectiveness. Using LimeSurvey, 415 participants provided quantitative insights, complemented by semi-structured interviews and a focus group for deeper analysis. Findings underscore the importance of technology-driven solutions, such as predictive analytics, real-time monitoring, and automated reporting, in violence prevention. Aligning with NT-2025, the study highlights the potential of Industry 4.0 innovations to support data-driven policymaking, improve institutional cooperation, and foster safer learning environments through intelligent digital systems.

Keywords: *Peer violence, adolescent bullying, cyberbullying, LimeSurvey, digital tools.*

REZIME:
Ova studija istražuje vršnjačko nasilje među adolescentima, naglašavajući njegove fizičke, verbalne, socijalne i digitalne oblike, pri čemu su cyberbullying i emocionalna manipulacija sve prisutniji. Obrazovne institucije igraju ključnu ulogu u prevenciji, ali ograničena institucionalna podrška, slaba međusektorska saradnja i opadajući autoritet nastavnika umanjuju efikasnost intervencija. Korišćenjem LimeSurvey alata, 415 učesnika dalo je kvantitativne uvide, dopunjene polustrukturisanim intervjuima i fokus grupom za dublju analizu. Rezultati naglašavaju značaj tehnoloških rješenja, poput prediktivne analitike, praćenja u realnom vremenu i automatizovanog izvještavanja, u prevenciji nasilja. U skladu sa NT-2025 konferencijom, studija ističe potencijal Industrije 4.0 u podršci politici zasnovanoj na podacima, poboljšanju institucionalne saradnje i stvaranju sigurnijih obrazovnih sredina putem inteligentnih digitalnih sistema.

Ključne riječi: *vršnjačko nasilje, zlostavljanje, sajber nasilje, LimeSurvey, digitalni alati.*

AN EVOLVED BRIDGE DIGITAL TWIN FRAMEWORK: A NEW PARADIGM FOR INFRASTRUCTURE MONITORING AND MANAGEMENT

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ABSTRACT:
Managing existing infrastructures represents a growing challenge for civil engineering, particularly regarding risk assessment and maintenance of bridges and viaducts. In recent years, innovative methods have been developed to improve early damage identification and optimise intervention strategies. This study proposes an innovative framework integrating Bridge Information Modeling (BrIM) with the Digital Twin (DT) paradigm, designed to provide concrete answers to critical infrastructure management and safeguarding issues. Adopting integrated remote sensing technologies, IoT sensors, and artificial intelligence algorithms allows not only to overcome the difficulties associated with the absence of structured data but also to revolutionise the inspection process and infrastructure lifecycle management, enabling predictive monitoring strategies, proactive maintenance and resource optimisation. The aim is to outline a scalable and operational approach, applicable on a large scale, transforming infrastructure management into a more efficient and automated data-driven system.

Keywords: *Civil Infrastructure Survey, Bridge Information Modeling (BrIM), IoT, Digital Twin (DT), Predictive Monitoring*

DETERMINING THE EFFICIENCY OF INNOVATIVE ACTIVITIES IN THE CONTEXT OF ENTERPRISEMANAGEMENT

UTVRĐIVANJE EFIKASNOSTI INOVATIVNIH AKTIVNOSTI U KONTEKSTU UPRAVLJANJA PREDUZEĆEM

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Svitlana Kolontai


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Anastasiia Dyskina

ABSTRACT:
The characteristics of the stages of innovative activity of enterprises are considered. It was determined that the stages of innovative activity of enterprises are interconnected and each of them has its own specificity. Attention is paid to the tasks of innovative activity of enterprises. The definition of the organizational and economic mechanism, its elements and their specific characteristics, as well as its inherent functions, is clarified. It is noted that the organization of innovative activities of enterprises is influenced by their specificity, which has its own characteristics. The methodology to determine the efficiency of the innovative activity of enterprises is proposed, which is based on the method of expert evaluations.

Keywords: *innovations, innovative activity, stages of innovative activity, enterprises.*

REZIME:
Razmotrene su i opisane faze inovativne aktivnosti preduzeća. Utvrđeno je da su faze inovativne aktivnosti preduzeća međusobno povezane i svaka od njih ima svoje specifičnosti. Fokus je na zadacima inovativne delatnosti preduzeća i pojašnjava se definisanje organizacionog i ekonomskog mehanizma, njegovih elemenata i njihovih specifičnih karakteristika, kao i njegovih inherentnih funkcija.Uočeno je da na organizaciju inovativnih aktivnosti preduzeća utiču njihove specifičnosti, koje imaju svoje karakteristike.Predložena je metodologija za utvrđivanje procene efikasnosti inovativne delatnosti preduzeća, koja se zasniva na metodi stručnih procena.

Ključne riječi: *inovacije, inovativna aktivnost, faze inovativne aktivnosti, preduzeća.*

A SOCIOLOGIC PRACTICES OF PARTICIPATION IN SOCIAL NETWORKS IN UKRAINE, SERBIA AND OVER THE WORLD: A SOCIOLOGICAL ANALYSIS

SOCIOLOŠKA PRAKSA UČEŠĆA U DRUŠTVENIM MREŽAMA U UKRAJINI, SRBIJI I ŠIROM SVETA: SOCIOLOŠKA ANALIZA

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Oksana Shelomovska


Iryna Machulina


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Kostyantin Bohomaz

ABSTRACT:
The level of use of social networks around the world, in Ukraine and Serbia was determined. Dynamic changes in the consumption of Facebook, Instagram, TikTok, and X/Twitter content for the period 2016-2024 were revealed. The most popular social network in the world was determined. Based on the results of the primary sociological survey, real numerical indicators of the use of social networks, their duration, and frequency were determined. The level of activity of Ukrainian and Serbia society in social networks and actions regarding their content were established.

Keywords: *media, social network, Facebook, Instagram, TikTok, X/Twitter.*

REZIME:
Utvrđen je stepen korišćenja društvenih mreža širom sveta, u Srbiji i Ukrajini. Otkrivene su dinamičke promene u potrošnji sadržaja Facebook, Instagram, TikTok i Ks/Tvitter za period 2016-2024. Određena je najpopularnija društvena mreža na svetu. Na osnovu rezultata primarnog sociološkog istraživanja utvrđeni su realni brojčani pokazatelji korišćenja društvenih mreža, njihovo trajanje i učestalost. Utvrđen je nivo aktivnosti ukrajinskog i srpskog društva na društvenim mrežama i akcije u vezi sa njihovim sadržajem.

Ključne riječi: *mediji, društvena mreža, Facebook, Instagram, TikTok, X/Tvitter.*

TOWARDS ENERGY SUSTAINABLE CITIES

PREMA ENERGIJSKI ODRŽIVIM GRADOVIMA

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Vjekoslav Domljan Ivana Domljan

ABSTRACT:
A decentralised energy system has not yet been implemented by Bosnia and Herzegovina's power sector, which is dependent on large, central power plants and the long transmission and distribution lines that provide electricity to consumers. In addition to lowering transmission and distribution inefficiencies and the associated economic and environmental consequences, they aim to bring power sources closer to the final consumer.
The decentralised nature of renewable energy allows a variety of actors, such as businesses, citizens, and local authorities, to simultaneously produce and consume energy with the proper legal and regulatory framework.
This paper investigates whether biomass and geothermal energy can be used to produce energy in the Brcko District of Bosnia and Herzegovina and determines how much electricity generated from them could contribute to achieving the aim of energy sustainability.

Keywords:*decentralised energy, biomass, geothermal, solar, power plant, Brcko*

REZIME:
Decentralizovani energetski sustav tek treba da se uvede u elektroenergetski sektor u Bosni i Hercegovini u kojoj se elektroenergetski sektor zasniva na velikim, centraliziranim elektranama i prijenosu električne energije preko dugih prijenosnih i distribucijskih vodova do potrošača u općinama.Osim što nastoje smanjiti neefikasnost prijenosa i distribucije i s njima povezane ekonomske i okolišne troškove, decentralizovani energetski sustavi nastoje približiti izvore energije krajnjem korisniku.
Omogućuju raznimakterima kao što su poduzeća, građani i lokalne vlasti postati istodobno proizvođačima i potrošačima energije u okviru podesnog pravnog i regulatornog okvira.
Ovaj rad istražuje mogu li se biomasa i geotermalna energija koristiti za proizvodnju energije u Brčko Distriktu Bosne i Hercegovine i utvrđuje koliko električne energije proizvedene iz njih može doprinijeti postizanju cilja energijskeodrživosti.

Ključne riječi: *decentralizirana energija, biomasa, geotermal, solar, elektrana, Brčko*

MODELING OF POLLUTANT TRANSPORT IN DRINJAČA RIVER IN FEDERATION OF BOSNIA AND HERZEGOVINA

MODELIRANJE TRANSPORTA ZAGAĐIVAČA U RIJECI DRINJAČI U FEDERACIJI BOSNE I HERCEGOVINE

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Mirza Mujčić

Hata Milišić

Haris Kalajdžisalihović

ABSTRACT:
Modeling of pollution transport and dispersion is a key methodology for assessing water quality, particularly in the context of the impact of pollutants on the ecological status of water bodies. This study uses the HEC-RAS software package to simulate the transport of pollutants in the Drinjača River, taking into account the BOD5 (biochemical oxygen demand for 5 days) parameter. In this study, the discharge of pollutants into the Drinjača River was analyzed with the aim of monitoring the propagation of the dissolved oxygen concentration wave, particularly focusing on the maximum values and the time at which they are reached. The differences in pollution transport were also examined based on varying degradation and longitudinal dispersion coefficients. The results of the simulations can serve as a basis for future water quality management in the area and as a tool for predicting ecological changes due to pollution.

Keywords: *pollution transport, HEC-RAS simulation, BOD5, Drinjača River, ecological status*

REZIME:
Modeliranje transporta i disperzije zagađenja predstavlja ključnu metodologiju za procjenu kvaliteta voda, posebno u kontekstu utjecaja zagađivača na ekološko stanje vodenih tijela. U ovom istraživanju korišten je paket HEC-RAS za simulaciju transporta zagađenja u rijeci Drinjači, uzimajući u obzir parametar BPK5 (biološki potrebna količina kisika za 5 dana). U ovom istraživanju, ispuštanje zagađivača u rijeku Drinjaču je analizirana s ciljem praćenja propagacije vala koncentracije rastvorenog kisika, posebno u pogledu maksimalnih vrijednosti i vremena njihovog dostizanja. Također, istraživana je razlika u transportu zagađenja u odnosu na različite koeficijente razgradnje i uzdužne turbulentne disperzije. Rezultati simulacija mogu poslužiti kao osnova za buduće upravljanje kvalitetom voda u ovom području i kao alat za predviđanje ekoloških promjena uslijed zagađenja.

Ključne riječi: *transport zagađenja, HEC-RAS simulacija, BPK5, rijeka Drinjača, ekološko stanje*

CYBERCRIMES AND PROCEDURAL ISSUES: A CRIMINAL LAW PERSPECTIVE ON BITCOIN FORENSICS

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Arben Prifti

ABSTRACT:
Over the past fifteen years, technological advancements have transformed cultural and social dimensions, along with the methods of consumption and production of products and services. However, this evolution also leads to notable shifts in social behavior and individual lifestyles, often not rooted in conscious and informed decisions. The primary catalyst for this digital transformation of the economy lies in the rapid development of online service platforms, which facilitate communication and market access for exchanging goods and services by consumers and enterprises. From this perspective, contemporary technological innovation necessitates that the criminal system addresses current scenarios by developing solutions and designing new regulatory frameworks. Considering these premises, the present research aims to evaluate whether the Albanian legal system currently possesses the necessary tools to tackle criminal phenomena or if it requires enhancement through the introduction of non-punitive measures that are essential or beneficial. Within this context, significant attention was directed toward assessing the alignment of the legislation on money laundering and illegal activities with the empirical-criminological perspective. Ultimately, the article concludes with reflections on the relationship between Bitcoin, regulation, and criminal law, along with the potential implications for the security of national and international transactions.

Keywords: *bitcoin forensics, criminal law, procedural issues, technological advancements, regulatory frameworks*

MODELING OF THE IMPACT OF FLIGHT DELAYS ON PASSENGER SATISFACTION USING LOGISTIC REGRESSION

MODELIRANJE UTICAJA KAŠNJENJA LETOVA NA ZADOVOLJSTVO PUTNIKA PRIMJENOM LOGISTIČKE REGRESIJE

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Amel Kosovac


Adisa Medić


Amer Kurešepi


Azra Neimarlija

ABSTRACT:
This research paper aimed to analyze the impact of delays on passenger satisfaction in air transport using logistic regression as the primary analytical method. Logistic regression was chosen for its ability to estimate the probability of certain events occurring, in this case, passenger satisfaction depending on arrival delays. The modeling results showed a negative impact of delays on passenger satisfaction, with each additional minute of delay reducing the probability of satisfaction by approximately 0.34%. Model validation using various metrics, such as p-value, chi-square test, and R-squared, confirmed a significant relationship between arrival delays and passenger satisfaction. These findings have important applications in improving air transport services, as they contribute to optimizing operations and enhancing the passenger experience.

Keywords: *customers, flight delays, passenger satisfaction, logistic regression, airline industry*

SAŽETAK:
Cilj ovog istraživačkog rada bio je analizirati uticaj kašnjenja na zadovoljstvo korisnika u zračnom prometu primjenom logističke regresije kao glavne analitičke metode. Logistička regresija je odabrana zbog svoje sposobnosti da procijeni vjerovatnoću pojave određenih događaja, u ovom slučaju korisničkog zadovoljstva u zavisnosti od kašnjenja pri dolasku. Rezultati modeliranja pokazali su negativan uticaj kašnjenja na zadovoljstvo korisnika, pri čemu svaka dodatna minuta kašnjenja smanjuje vjerovatnoću zadovoljstva za oko 0.34%. Validacija modela korištenjem različitih metrika, kao što su p-vrijednost, chi-kvadrat test i R-squared, potvrdila je značajnu povezanost između kašnjenja pri dolasku i zadovoljstva putnika. Ova saznanja imaju značajnu primjenu u unapređenju usluga zračnog prometa, jer pomažu u optimizaciji operacija i poboljšanju korisničkog iskustva.

Ključne riječi: *korisnici, kašnjenja letova, zadovoljstvo putnika, logistička regresija, avio-industrija, korisničko iskustvo*

BIOMEDICAL APPLICATION OF NANOCOMPOSITES IN WEARABLE AND IMPLANTABLE NANO/BIOSENSOR DEVICES

BIOMEDICINSKA PRIMJENA NANOKOMPOZITA U NOSIVIM I IMPLANTIRANIM NANO/BIOSENZORSKIM UREĐAJIMA

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Amra Bratovcic

ABSTRACT:
Design and development of new materials, especially nanocomposites, and their application in biomedicine, from diagnostics and monitoring of physiological parameters and analyte (biomolecule) concentrations in patients to drug delivery, is a very interesting and inexhaustible area of research.The paper studies conductive materials such as fibers, hydrogels, and various nanomaterials, which are used to produce electrochemical nano/biosensors for biomedical applications (for early cancer detection, drug delivery systems, and neuromonitoring).The advantages of using nano/biosensor devices in remote patient monitoring systems are reflected in the measurement of physiological parameters such as heart rate/pulse, respiratory rate, body temperature, blood pressure and blood oxygen saturation, and wireless connection of sensors, whereby physiological data can be measured and transmitted (tele-health).

Keywords: *nanocomposites,cancer detection, drug delivery systems, tele-health*

REZIME:
Dizajn i razvoj novih materijala, naročito nanokompozita, te njihova primjena u biomedicini, od dijagnostike i praćenja fizioloških parametara i koncentracija analita (biomolekula) bolesnika do isporuke lijekova, vrlo je zanimljivo i neiscrpno područje istraživanja.U radu su izučavani vodljivi materijali kao što su vlakna, hidrogelovi, ugljikovi nanomaterijali, koji se koriste za proizvodnju elektrohemijskih nano/biosenzora za biomedicinske primjene (za rano otkrivanje raka, sisteme za dostavu lijekova, neuromonitoring).Prednosti korištenja nano/biosenzorskih uređaja u sistemima daljinskog praćenja pacijenata ogledaju se u mjerenju fizioloških parametara poput otkucaja/pulsa, brzine disanja, tjelesne temperature, krvnog pritiska i zasićenosti kisikom u krvi, te bežičnom povezivanju senzora, pri čemu se fiziološki podaci mogu mjeriti i prenositi (tele-zdravlje).

Ključne riječi: *nanokompoziti, otkrivanje raka, sistemi za isporuku lijekova, tele-zdravlje*

THE ERA OF DIGITAL TRANSFORMATION: A WORLD TAKEN OVER BY AI, AND THE ADVENTURE OF TECHNOLOGY IN THE CULTURE OF REAL VIRTUALITY

ERA DIGITALNE TRANSFORMACIJE: SVIJET KOJI PREUZIMA AI I AVANTURA TEHNIKE U KULTURI STVARNE VIRTUALNOSTI

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ABSTRACT:
Contemporary technology is increasingly becoming a mediator of our experience of the world. There is no doubt that technology is the most recognizable medium of our time, which is precisely why understanding the principle of responsibility (Jonas) is of essential importance in an era of profound societal transformation. The technological transformation of the world itself is unquestionable and evident. New social practices of action emerge under the influence of new technologies, along with sectors of various new industries, as scientific and technical progress opens up unprecedented possibilities for building a new world-a world that, in a specific way, adopts AI, offering a panorama of the emergence of a new epoch of society. The changes in our actions and experiences in the process of continuous digitalization of society call for a reflection on new social rationality.
Keywords: *Technoculture, Principle of responsibility, Digital transformation, AI epoch, New social practices.*

SAŽETAK:
Savremena tehnologija sve više postaje posrednik našeg iskustva svijeta. Nema sumnje da je tehnologija najprepoznatljiviji medij našeg doba, upravo zato je od esencijalne važnosti razumjeti princip odgovornosti (Jonas) u vrijeme duboke transformacije društva. Sama tehnološka transformacija svijeta je neupitna i očigledna. Nastaju nove društvene prakse djelovanja pod utjecajem novih tehnologija i sektori niza novih industrija, jer znanstveno – tehnički napredak otvara neslućene mogućnosti izgradnje jednog novog svijeta – svijeta koji na specifičan način preuzima AI dajući panoramu nastanka jedne nove epohe društva. Promjena naših djelovanja i iskustava u procesu kontinuirane digitalizacije društva, poziva nas na promišljanje nove društvene racionalnosti.
Ključne riječi*: Tehnokultura, Princip odgovornosti, Digitalna transformacija, AI epoha, Nove društvene prakse.*

DETERMINANTS OF ECONOMIC GROWTH: EMPIRICAL EVIDENCE FROM BOSNIA AND HERZEGOVINA

DETERMINANTE EKONOMSKOG RASTA: EMPIRIJSKI POKAZATELJI IZ BOSNE I HERCEGOVINE

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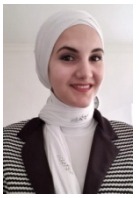
Irfan Djedovic


Lejla Pindzo Haznadarevic


Edin Djedovic

ABSTRACT:
The main goal of the study is to empirically investigate the factors that have potential influence on the economic growth of B&H. The factors that were used as the potential determinants of the economic growth include export, import, producer price index, physical capital, government consumption, and household consumption. For the purpose of the study quarterly observations of the above mentioned variables spanning from 2008 to 2022 are collected from the International Monetary Fundand the Agency for Statistics of BiH data bases. Ordinary least squares regression analysis is used to empirically investigate the influence of the macroeconomic variables on the economic growth in BiH. There sults indicate that there is a significant influence of export, import, physical capital, government debt, and household consumption on economic growth in BiH. Furthemore, there sults indicate that there is no significant influence of producer price index and government debt on the economic growth in BiH.
Keywords:*economic growth, export, import, physical capital, household spending, government spending, government debt, producer price index.*

REZIME:
Osnovni cilj studije je empirijski istražiti faktore koji potencijalno utiču na ekonomski rast BiH. Faktori koji su korišteni kao potencijalne determinante ekonomskog rasta uključuju izvoz, uvoz, indeks cijena proizvođača, fizički kapital, državnu potrošnju i potrošnju domaćinstava. Za potrebe studije iz baza podataka Međunarodnog monetarnog fonda i Agencije za statistiku BiH prikupljeni su kvartalni podaci za navedene varijable u periodu od 2008. do 2022. godine. Uobičajena regresiona analiza najmanjih kvadratase koristi za empirijsko istraživanje uticaja makroekonomskih varijabli na ekonomski rast u BiH. Rezultati ukazuju da postoji značajan uticaj izvoza, uvoza, fizičkog kapitala, državnog duga i potrošnje domaćinstava na ekonomski rast u BiH. Nadalje, rezultati ukazuju da nema značajnog uticaja indeksa proizvođačkih cijena i državnog duga na privredni rast u BiH.
Ključne riječi: *ekonomski rast, izvoz, uvoz, fizički kapital, potrošnja domaćinstava, državna potrošnja, državni dug, indeks proizvođačkih cijena.*

REFINEMENT OF ULTRASOUND-DRIVEN ZEOLITE-ASSISTED ELECTROCOAGULATION

POBOLJŠANJE ULTRAZVUČNO POTPOMOGNUTE ELEKTROKOAGULACIJE UZ PRIMJENU ZEOLITA

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Ladislav Vrsalović


Nediljka Vukojević Medvidović


Sandra Svilović


Amalija Kulić

ABSTRACT:
Expanding on previous research, this study investigates the impact of an ultrasound-driven zeolite-assisted electrocoagulation process for compost wastewater treatment, focusing on optimizing treatment efficiency and minimizing electrode fouling. The study systematically evaluates the effects of ultrasound intensity, mixing speed, and duration time using aluminium, carbon steel, and zinc electrodes. The results of the hybrid treatment system showed fluctuations in turbidity removal, as well as difficulties in the settling test of the suspension.Microscopic analysis revealed distinct corrosion patterns on the electrodes, demonstrating ultrasound's dual effects on electrode and electrolyte interactions. Additionally, operational costs were assessed, highlighting the potential of hybrid process for efficient and adaptable wastewater treatment.

Keywords: *electrocoagulation, ultrasound-driven treatment, zeolite, remediation, electrode corrosion*

REZIME:
Nastavno na prethodna istraživanja, ovaj rad ispituje utjecaj ultrazvučno vođenog procesa elektrokoagulacije uz pomoć zeolita na obradu procjednih voda iz komposta, s naglaskom na optimizaciju učinkovitosti obrade i smanjenje onečišćenja na elektrodama. Sustavno su procijenjeni učinci intenziteta ultrazvuka, brzine miješanja i trajanja postupka pri korištenju aluminijskih, čeličnih i cinkovih elektroda. Rezultati hibridnog sustava obrade pokazali su oscilacije u uklanjanju mutnoće, kao i otežano taloženje suspenzije. Mikroskopska analiza pokazala je specifične obrasce korozije na elektrodama, ukazujući na dvostruki učinak ultrazvuka na interakcije između elektroda i elektrolita. Također su procijenjeni operativni troškovi, čime je istaknut potencijal hibridnog sustava za učinkovitu i prilagodljivu obradu otpadnih voda.

Ključne riječi: *elektrokoagulacija, ultrazvučna obrada, zeolit, remedijacija, korozija elektroda*

DETERMINATION OF THE TOTAL NUMBER OF LIVING MICROORGANISMS AS INDICATORS OF PROBIOTIC ACTIVITY IN FERMENTED PRODUCTS AVAILABLE ON THE MARKET OF BOSNIA AND HERZEGOVINA

ODREĐIVANJE UKUPNOG BROJA ŽIVIH MIKROORGANIZAMA KAO POKAZATELJA PROBIOTIČKE AKTIVNOSTI U FERMENTISANIM PROIZVODIMA DOSTUPNIM NA TRŽIŠTU BOSNE I HERCEGOVINE

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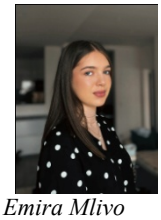
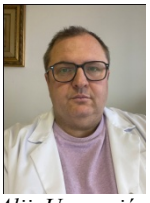

Emira Mlivo


AlijaUzunović


Saša Pilipović

ABSTRACT:
This work aims to to examine the presence, respectively, the number of living microorganisms, yeasts and molds as indicators of probiotic activity in three different fermented products available on the market of Bosnia and Herzegovina. The aim of work is also to compare the total number of living microorganisms in the samples with commercially available supplements that are registered as medicines. The following results were found: CFU in sample 1 is 3.91 x 10^5, in sample 2 is 2.01 x 10^6, in sample 3 is 3.88 x 10^6 in 100 grams of sample, total number of live molds and yeasts in sample 1 is 3.63 x 10^5, in sample 2 is 7.63 x 10^4, in sample 3 is 2.92 x 10^6 in 100 grams of sample. From results it can be concluded that fermented milk products can be a good alternative for food supplements, as source of probiotic cultures.

Keywords:*agar, fermented procucts, microorganisms, molds, probiotic, yeasts*

REZIME:
Ovaj rad ima za cilj ispitati prisutnost, odnosno broj živih mikroorganizama, kvasaca i plijesni kao pokazatelja probiotičke aktivnosti u tri različita fermentirana proizvoda dostupna na tržištu Bosne i Hercegovine. Cilj rada je također usporediti ukupan broj živih mikroorganizama u uzorcima s komercijalno dostupnim suplementima koji su registrirani kao lijekovi. Utvrđeni su sljedeći rezultati: CFU u uzorku 1 je 3,91 x 10^5, u uzorku 2 je 2,01 x 10^6, u uzorku 3 je 3,88 x 10^6 u 100 grama uzorka, ukupan broj živih plijesni i kvasaca. u uzorku 1 je 3,63 x 10^3, u uzorku 2 je 7,63 x 10^4, u uzorku 3 je 2,92 x 10^6 u 100 grama uzorka. Iz rezultata se može zaključiti da fermentirani mliječni proizvodi mogu biti dobra alternativa dodacima prehrani.

Ključne riječi: *agar, fermentirani proizvodi, kvasci, mikroorganizmi, plijesni, probiotici*

DEVELOPMENT AND EVALUATION OF A CLINDAMYCIN HYDROCHLORIDE GEL FORMULATION FOR TOPICAL APPLICATION

RAZVOJ I PROCJENA FORMULACIJE KLINDAMICIN HIDROHLORID GELA ZA LOKALNU PRIMJENU

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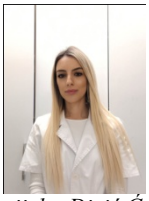
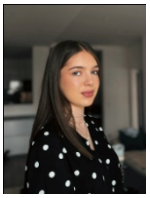

Danijela Đivić Ćorić


Emira Mlivo


Berina Pilipović

ABSTRACT:
The aim of this study was to formulate and monitor the stability of clindamycin hydrochloride gel used in the treatment of acne. Four formulations of clindamycin gel were prepared using the active substance clindamycin hydrochloride and clindamycin capsules 300 mg, and two gelling agents (Carbopol® 940 and Carbopol® Ultrez 10). The formulations were packed in plastic and aluminum packaging. Macroscopic analysis was performed on the prepared formulations: color, transparency and homogeneity. Also, pH value, spreadability, active substance content and stability over 3 months were determined. Formulations showed satisfactory appearance, clarity, pH value, spreadability and homogeneity. The content of clindamycin for all analyzed samples was in the satisfactory range from 94.55% to 107.41%. The developed formulations can represent reliable alternatives when it comes to galenic and magisterial preparations.

Keywords: *acne, Carbopol® 940, Carbopol® Ultrez 10, clindamycin hydrochloride, HPLC method*

REZIME:
Cilj ovog istraživanja bio je formulirati i pratiti stabilnost klindamicin hidrohlorid gela koji se koristi u liječenju akni. Pripremljene su četiri formulacije klindamicin gela od aktivne tvari klindamicin hidrohlorida i klindamicin kapsula 300 mg, te dva sredstva za želiranje (Carbopol® 940 i Carbopol® Ultrez 10). Formulacije su pakirane u plastičnu i aluminijsku ambalažu. Na pripremljenim pripravcima provedena je makroskopska analiza: boja, prozirnost i homogenost. Također je određena pH vrijednost, razmazivost, sadržaj aktivne tvari i stabilnost tokom3 mjeseca. Formulacije su pokazale zadovoljavajući izgled, bistrinu, pH vrijednost, razmazivost i homogenost. Sadržaj klindamicina za sve analizirane uzorke bio je u zadovoljavajućem rasponu od 94,55% do 107,41%. Razvijene formulacije i mogu predstavljati.

Ključne riječi: *akne, Carbopol® 940, Carbopol® Ultrez 10, HPLC metoda, klindamicin hidrohlorid*

EFFICIENCY OF HYDRATED LIME IN REMOVAL OF LEAD IONS FROM AQUEOUS SOLUTIONS

EFIKASNOST HIDRATISANOG KREČA U UKLANJANJU IONA OLOVA IZ VODENIH RASTVORA

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Sabina Begić


Edisa Papraćanin


Amra Selimović

ABSTRACT:
The paper investigated the optimal conditions for lead removal from synthetic aqueous solutions using hydrated lime as a precipitant. The results of measuring the lead concentration in the solution after treatment, obtained using flame atomic absorption spectrometry, showed that from an aqueous solution with an initial pH of 10 and an initial Pb^{2+} concentration of 100 mg/L, it is possible to achieve 99.827% lead removal by precipitation using a hydrated lime dose of 100 mg, at a mixing speed of 300 rpm and a mixing time of 5 minutes. It was also found that mixing speed has a more significant effect on precipitation efficiency than time, and that the presence of PO_4^{3-} in water increases lead precipitation.

Keywords: *hydrated lime,precipitation, heavy metal, water treatment*

SAŽETAK:
U radu su laboratorijski istraženi optimalni usloviuklanjanja olova iz sintetskih vodenih rastvora upotrebom hidratisanog kreča kao precipitanta. Rezultati mjerenja koncentracije olova u otopini nakon tretmana, dobiveni primjenom plamene atomske apsorpcione spektrometrije, pokazali su da je iz vodene otopine s inicijalnim pH 10 i inicijalnom koncentracijom Pb^{2+} od 100 mg/L moguće postići 99,827% uklanjanje olova precipitacijom dozom hidratiziranog vapna od 100 mg, pri brzini miješanja od 300 o/min i vremenu miješanja 5 min. Također je utvrđeno da brzina miješanja ima značajniji uticaj na efikasnost precipitacije od vremena te da prisustvo PO_4^{3-} u vodi povećava precipitaciju olova.

Keywords: *hidratisani kreč, precipitacija, teški metal, tretman vode*

LATEST ACHIEVEMENTSON THE APPLICATION OF AI IN STEM EDUCATION

NAJNOVIJA DOSTIGNUĆA U PRIMJENI AI U STEM OBRAZOVANJU

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Amra Bratovcic

ABSTRACT:
In recent years, artificial intelligence (AI) integration in education has gained global attention, especially in enhancing STEM education and addressing gender disparities. AI, including machine learning and natural language processing, is reshaping industries and is now influencing education. Schools are incorporating AI concepts like perception and learning into curricula, though careful consideration is needed regarding age-appropriate tools and simplifying AI without losing real-world relevance. AI supports personalized learning, student assessment, and behavior tracking, with chatbots providing 24/7 programming help. Despite benefits, privacy concerns reduce human interaction, and the decline in critical thinking persists. Countries like South Korea and Japan have integrated AI into national curricula, but challenges remain, such as teacher competence in AI and ethics. AI literacy and ethical guidelines are essential for responsible use in schools globally.

Keywords: *artificial intelligence, STEM education,ChatGPT*

REZIME:
Posljednjih je godina integracija umjetne inteligencije (AI) u obrazovanje privukla globalnu pozornost, posebice u poboljšanju STEM obrazovanja i rješavanju rodnih razlika.AI, uključujući strojno učenje i obradu prirodnog jezika, preoblikuje industrije i sada utječe na obrazovanje.Škole u nastavne planove i programe uključuju koncepte umjetne inteligencije poput percepcije i učenja, iako je potrebno pažljivo razmotriti alate koji su primjereni dobi i pojednostaviti umjetnu inteligenciju bez gubitka relevantnosti u stvarnom svijetu.AI podržava personalizirano učenje, ocjenjivanje učenika i praćenje ponašanja, a chatbotovi pružaju 24/7 pomoć pri programiranju.Unatoč prednostima, briga o privatnosti smanjuje ljudsku interakciju, a pad kritičkog mišljenja i dalje postoji.Zemlje poput Južne Koreje i Japana integrirale su umjetnu inteligenciju u nacionalne nastavne planove i programe, ali izazovi ostaju, poput kompetencije nastavnika u području umjetne inteligencije i etike.Pismenost i etičke smjernice o umjetnoj inteligenciji bitne su za odgovornu upotrebu u školama diljem svijeta.

Ključne riječi: *umjetna inteligencija, STEM obrazovanje, ChatGPT*

TAXONOMIC COMPOSITION OF EPILITHIC DIATOM FLORA FROM RIVER SPREČA IN BOSNIA AND HERZEGOVINA

TAKSONOMSKI SASTAV FLORE EPILITSKIH DIJATOMEJA RIJEKE SPREČE U BOSNI I HERCEGOVINI

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Samela Selimović Ćehajić


Sanida Bektić


Jasmina Kamberović

ABSTRACT:
The study provides an overview of the diversity of diatoms present from the source to the mouth of the river Spreča(130km) and recorded in the periodof July and October 2021.with the aim of providing comparative results that could be used for further monitoring of the state of the community. The locations were chosen taking into account the immediate presence of potential pollutants(great anthropogenic pressure, industrial plants).The paper presents 128 determined taxa with their spatial and seasonal distribution. Community diversity is shown by Margalef,Shannon-Wiener, Pielou's evenness index and Simpson's index.The distribution of epilithon taxa indicated two groups of samples according to similarity. One of them is made up of localities six, seven and eight, which according to all quality parameters indicate the worst condition and the greatest anthropogenic influence.

Keywords*: Diatoms, diversity, taxa, Spreča River*

REZIME:
Studija daje pregled raznolikosti dijatomeja prisutnih od izvora do ušća rijeke Spreče (130 km) zabilježenih u periodu jula i oktobra 2021. s ciljem davanja komparativnih rezultata koji bi mogli poslužiti za daljnje sistemsko praćenje stanja zajednica.Lokacije su odabrane uzimajući u obzir neposrednu prisutnost potencijalnih zagađivača (veliki antropogeni pritisak, industrijska postrojenja).U radu je prikazano 128 determiniranih taksona s njihovom prostornom i sezonskom distribucijom. Diverzitet zajednica je prikazan kroz Margalefov, Shannon-Wiener-ov, Pielouov indeks ujednačenosti i Simpsonov indeks.Raspodjela taksona epilithona ukazuje na dvije skupine uzoraka prema sličnosti. Jednu od njih čine lokaliteti šest, sedam i osam koji po svim parametrima kvalitete pokazuju najlošije stanje i najveći antropogeni utjecaj.

Ključne riječi*: dijatomeje, raznolikost, takson, rijeka Spreča*

OPTIMIZATION OF THE PROCESS PARAMETERS OF THE BIOSORPTION PROCESS OF Zn (II) AND Mn(II) IONS USING A BIOSORBENT BASED ON TOMATO PEEL

OPTIMIZACIJA PROCESNIH PARAMETARA PROCESA BIOSORPCIJE JONA Zn (II) I Mn (II) PRIMJENOM BIOSORBENTA NA BAZI KORE PARADAJZA

Lamija Kovačević[1], Amra Odobašić[1], Indira Šestan[1], Melisa Ahmetović[1]
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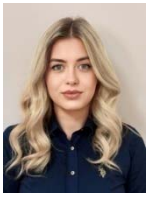
Lamija Kovačević


Amra Odobašić


Indira Šestan


Melisa Ahmetović

ABSTRACT:
Today, various toxins are released into the water, which lead to great water pollution. Many heavy metals from various industries. The most frequently found heavy metals are copper, lead, chromium, zinc and manganese. In order to obtain clean and safe water, it is necessary to remove toxic substances such as heavy metals. Household waste such as the remains of fruit and vegetable peels can be used as a good adsorbent for the removal of heavy metals from polluted water. The paper will examine the effects of various parameters such as pH, mixing speed, contact time and temperature on the adsorption capacity of the adsorbent prepared on the basis of tomato peel.

Keywords: *heavy metals, Zn, Mn, biosorption, polluted water*

REZIME:
Danas se u vodu ispuštaju razni toksini koji dovode do velikog zagađenja vode. Mnogi teški metali iz raznih industrija. Najčešće pronađeni teški metali su bakar, olovo, hrom, cink i mangan. Da bi se dobila čista i sigurna voda potrebno je ukloniti toksične supstance poput teških metala. Otpad iz domaćinstva poput ostataka kore od voća i povrća može da se koristi kao dobar adsorbens za uklanjanje teških metala iz onečišćene vode. U radu će biti ispitani uticaji različitih parametara poput pH, brzine miješanja, vremena kontakta i temperature na adsorcioni kapacitet adsorbensa pripremljenogna bazi kore paradajza.

Ključne riječi: *teški metali, Zn, Mn, biosorpcija, onečišćena voda*

APLICATION OF GIS IN URBAN INVENTORY – STUDY CASE

APLIKACIJA GISA PRI INVENTURI URBANOG ZELENILA – STUDIJ SLUČAJA

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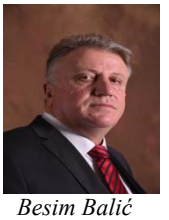
Admir Avdagić


Dino Hadžidervišagić


Besim Balić


Bajro Erović

ABSTRACT:
In this paper, we present the application of GIS technology and data collection tools for conducting an inventory of urban greenery. The case study focuses on the Sports and Recreational Center "Safet Zajko" in the municipality of Novi Grad, where we developed an interactive GIS map. Data was collected using FieldMap devices and the QField mobile application. The total research area covers 79,719.60 m².Using the Visual Tree Assessment (VTA) method, we evaluated the health status, height, crown shape, and crown position of the trees. A total of 728 trees were documented and264 shrubs were recorded. Within SRC "Safet Zajko," various types of park furniture were also inventoried, amounting to 313 pieces. The facility includes 16 sports fields, 6 children's playgrounds, and one artificial lake.Based on the collected data, we analyzed the results and proposed measures for the preservation and maintenance of SRC "Safet Zajko." The created interactive GIS map can serve as a valuable tool for future park monitoring and management.

Keywords: *Urban greenery inventory, GIS, QGIS, QField*

REZIME:
U ovom radu predstavljamo primjenu GIS tehnologije i alata za prikupljanje podataka u svrhu provođenja inventarizacije urbanog zelenila. Studija slučaja fokusira se na Sportsko-rekreativni centar "SafetZajko" u općini Novi Grad, gdje smo razvili interaktivnu GIS mapu. Podaci su prikupljeni korištenjem uređaja FieldMap i mobilne aplikacije QField. Ukupna istraživana površina iznosi 79.719,60 m².Korištenjem metode vizualne procjene stabala (VTA) ocijenjeno je zdravstveno stanje, visina, oblik krošnje i položaj krošnje stabala. Zabilježeno je ukupno 728 stabala i 264 grma. U okviru SRC-a "SafetZajko" evidentirane su i različite vrste parkovskog mobilijara, ukupno 313 komada. Objekat uključuje 16 sportskih terena, 6 dječijih igrališta i jedno umjetno jezero.
Na osnovu prikupljenih podataka izvršena je analiza rezultata, koja je dovela do prijedloga i mjera za očuvanje i održavanje SRC-a "SafetZajko". Kreirana interaktivna GIS mapa može služiti kao vrijedan alat za buduće praćenje i upravljanje parkom.

Ključne riječi: *inveturaurbanogzelenila, GIS, QGIS,QField*

INFLUENCE OF THE QUANTITY OF ADDITIVES IN THE EXTRUSION MASS OF Al_2O_3 CERAMICS ON THE CHARACTERISTICS OF SINTERED CERAMIC PARTS

UTICAJ KOLIČINE ADITIVA U MASI ZA EKSTRUDIRANJEAl_2O_3 KERAMIKE NA KARAKTERISTIKE SINTEROVANIH KERAMIČKIH DIJELOVA

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Zenaida Hodžić Sinanović


Sabina Begić


Indira Šestan


Zlata Ibrišimović Subašić

ABSTRACT:
The paper investigated the influence of the mass fraction (2.5, 9.5, and 15 wt%) of the additive mixture (methyl-hydroxy-ethyl-cellulose, glycerol, and tung oil in a mass ratio of 4:3:6) on the possibility of shaping using the extruding process of the Al_2O_3 ceramic parts, as well as the characteristics of the final product. The characteristics of ceramic products tested after sintering included the following: specific density, open porosity, dimensional shrinkage, Vickers hardness, grain size distribution and surface defects. The results obtained showed that insufficient additive content in the ceramic mass prevents its extrusion, while excessive additive content negatively impacts the properties of the final product.

Keywords: *aluminum oxide ceramics, additive, extrusion*

REZIME:
U radu je izvršeno istraživanje uticaja masenog udjela (2.5, 9.5 i 15 mas%) smjese aditiva (metil-hidroksi-etil-celuloza, glicerol i tungovo ulje u masenom omjeru 4:3:6) u masi za ekstrudiranje Al_2O_3 keramike na mogućnost oblikovanja, kao i karakteristike finalnog proizvoda.Ispitivane karakteristike proizvoda nakon sinterovanja su uključivale: specifičnu gustinu, otvorenu poroznost, dimenzionalno skupljanje, Vickersovu tvrdoću, raspodjelu veličina zrna i površinske defekte. Dobijeni rezultati su pokazali da nedovoljan sadržaj aditiva u keramičkoj masi onemogućava njeno ekstrudiranje, dok prevelik sadržaj aditiva ima negativan uticaj na svojstva konačnog proizvoda.

Ključne riječi: *aluminijum oksidna keramika, aditiv, ekstruzija.*

SUSTAINABILITY OF RASPBERRY (Rubus idaeus L.) CULTIVATION IN MONTENEGRO WITH A FOCUS ON PRODUCTION SYSTEMS AND MARKET DYNAMICS

ODRŽIVOST UZGOJA MALINE (Rubus idaeus L.) U CRNOJ GORI S FOKUSOM NA PROIZVODNE SISTEME I DINAMIKU TRŽIŠTA

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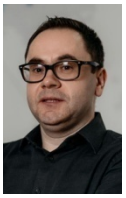
Dejan Zejak


Velibor Spalevic


Branislav Dudić

ABSTRACT:
Raspberry cultivation is crucial for Montenegro, especially in northern regions like Bijelo Polje, Mojkovac, and Berane. This study examines its economic impact, production systems, price trends, and sustainability challenges. Dominated by the 'Willamette' variety, average prices ranged from 1.2 €/kg to 4.3 €/kg (2018–2022). Key challenges include labor shortages, high costs, and 40% post-harvest losses. Innovations in mechanization, resistant varieties, and cold storage are vital to boost efficiency, reduce losses, and enhance profitability, ensuring sustainable growth and export potential.

Keywords:*Raspberry, Montenegro, fruit production, price, sustainability.*

REZIME:
Uzgoj malina je od ključnog značaja za Crnu Goru, posebno u sjevernim regijama poput Bijelog Polja, Mojkovca i Berana. Ova studija analizira ekonomski uticaj, sisteme proizvodnje, cjenovne trendove i izazove održivosti. Proizvodnjom dominira sorta 'Willamette', sa prosječnim cijenama od 1,2 €/kg do 4,3 €/kg (2018–2022). Glavni izazovi uključuju nedostatak radne snage, visoke troškove i 40% gubitaka nakon berbe. Inovacije u mehanizaciji, otpornim sortama i hladnjačama ključne su za povećanje efikasnosti, smanjenje gubitaka i unapređenje profitabilnosti, osiguravajući održiv rast i izvoz.

Ključne riječi: *malina, Crna Gora, proizvodnja voća, cijena, održivost.*

INNOVATIVE FARMING PRACTICES: PRECISION AGRICULTURE IN MONTENEGRO'S FRUIT SECTOR

INOVATIVNE POLJOPRIVREDNE PRAKSE: PRECIZNA POLJOPRIVREDA U VOĆARSTVU CRNE GORE

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Dejan Zejak


Velibor Spalevic


Milica Filipovic


Aleksandar Radović

ABSTRACT:
Precision agriculture presents a transformative opportunity for Montenegro's fruit sector, particularly in apple and raspberry production. This study explores the feasibility of implementing advanced farming technologies, leveraging the country's diverse agroecological conditions. With 253,058 hectares of agricultural land, Montenegro has significant potential, but challenges such as small-scale farming, labor shortages, and limited technology adoption persist. Case studies in Nikšić apple orchards and northern raspberry farms highlight the benefits of automated harvesting, sensor-based monitoring, and data-driven farming. Overcoming barriers like high costs and skill gaps is crucial. By embracing precision agriculture, Montenegro can enhance sustainability, productivity, and competitiveness, securing the future of its agricultural sector.

Keywords:*Precision Agriculture, Fruit Production, Agroecology, Montenegro*

REZIME:
Precizna poljoprivreda predstavlja transformacijsku priliku za voćarski sektor Crne Gore, posebno u proizvodnji jabuka i malina. Ova studija istražuje mogućnost primjene naprednih poljoprivrednih tehnologija, koristeći raznolike agroekološke uslove zemlje. Sa 253.058 hektara poljoprivrednog zemljišta, Crna Gora ima značajan potencijal, ali se suočava sa izazovima poput malih poljoprivrednih površina, nedostatka radne snage i ograničene primjene tehnologije. Studije slučaja u voćnjacima jabuka u Nikšiću i malinjacima na sjeveru ističu prednosti automatizovane berbe, senzorskog nadzora i vođenja poljoprivrede zasnovane na podacima. Prevazilaženje prepreka, poput visokih troškova i nedostatka stručnih kadrova, ključno je. Usvajanjem precizne poljoprivrede, Crna Gora može poboljšati održivost, produktivnost i konkurentnost, osiguravajući budućnost svog poljoprivrednog sektora.

Ključne riječi: *precizna poljoprivreda, voćarska proizvodnja, agroekologija, Crna Gora*

THE IMPORTANCE OF CURRENT KNOWLEDGE ABOUT THE GENUS Tilia FOR THE PURPOSE OF PLANTING FOR SUSTAINABLE BEEKEEPING AND HONEY PRODUCTION

ZNAČAJ SADAŠNJIH ZNANJA O RODU Tilia U SVRHU SADNJE ZA ODRŽIVO PČELARSTVO I PROIZVODNJU MEDA

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Selma Vejzagić

Adisa Omerbegović-Arapović

ABSTRACT:
The sustainability of honey production in Bosnia and Herzegovina is highly related to forest tree species dominant in beekeeping, such as chestnut, linden and pine. This review paper focuses on the potential of Tilia spp., which is one of the key genus in honey production in many European countries. Different scientific studies provide critical insight into the richness of the Tilia "gene pool", which can help conservation efforts and the selection of drought and pest resilient genotypes. Medical research shows the importance of usage of Tilia, and forestry related studies implicate potential of further Tilia plantations to help sustainable beekeeping and insect populations. Benefits of growing Tilia in private lands and potential mass planting of Tilia should be researched in detail since there are implications that the Tilia is one of the "trees of future" thanks to its drought tolerance, which could help different products to sustain in the market.
Keywords: *Tilia, linden trees, bees, Tilia usage, honey production, linden honey.*

REZIME:
Održivost proizvodnje meda u Bosni i Hercegovini u velikoj mjeri je povezana sa šumskim vrstama drveća koje dominiraju u pčelarstvu, poput kestena, lipe i bora. Ovaj pregledni rad fokusira se na potencijal Tilia spp., koji je jedan od ključnih rodova u proizvodnji meda u mnogim europskim zemljama. Različite naučne studije pružaju kritički uvid u bogatstvo „genetskog fonda“ roda Tilia, koji može pomoći u naporima za očuvanje i odabir onih genotipova koji su otporni na sušu i štetočine. Medicinska istraživanja pokazuju važnost upotrebe lipa, dok studije vezane za šumarstvo impliciraju potencijal budućih plantaža lipa, kako bi pomogle održivosti pčelarstva i populacija insekata. Prednosti uzgoja lipa na privatnim zemljištima i potencijalnu masovnu sadnju lipa treba detaljno istražiti jer postoje implikacije da je Tilia jedno od "stabala budućnosti" zahvaljujući svojoj otpornosti na sušu, što bi moglo pomoći različitim proizvodima da opstanu na tržištu.
Ključne riječi: *Tilia, lipa, pčele, upotreba Tilie, proizvodnja meda, lipov med.*

OPTIMIZING YIELD AND SUSTAINABLE MANDARIN PRODUCTION: ECONOMIC AND BUSINESS INSIGHTS ON PRECISION AGRICULTURE

OPTIMIZACIJA PRINOSA I ODRŽIVA PROIZVODNJA MANDARINA: EKONOMSKI I POSLOVNI UVIDI U PRECIZNU POLJOPRIVREDU

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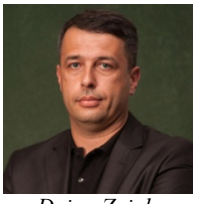
Dejan Zejak


Nikola Abramovic


Velibor Spalevic

ABSTRACT:
Mandarin cultivation plays a crucial role in Montenegro's agriculture, with Unshiu mandarins dominating citrus production. This study examines production trends from 2007 to 2016, analyzing plantation expansion, yield fluctuations, and sustainability challenges. Key factors include precision agriculture, optimized fertilization, irrigation advancements, and disease-resistant varieties. The integration of Industry 4.0 technologies, predictive analytics, and smart monitoring enhances productivity. Investments in infrastructure, market expansion, and research collaborations are essential for long-term sustainability, positioning Montenegro as a competitive player in regional and global citrus markets.

Keywords: *Mandarins, Montenegro, citrus production, sustainability, agricultural practices, yield.*

REZIME:
Uzgoj mandarina ima ključnu ulogu u poljoprivredi Crne Gore, pri čemu Unshiu mandarine dominiraju proizvodnjom citrusa. Ova studija analizira trendove proizvodnje od 2007. do 2016. godine, uključujući tu širenje plantaža, varijacije u prinosima i izazove održivosti. Ključni faktori obuhvataju preciznu poljoprivredu, optimizovanu ishranu, napredne sisteme navodnjavanja i sorte otporne na bolesti. Integracija tehnologija Industrije 4.0, prediktivne analitike i pametnog nadzora poboljšava produktivnost. Ulaganja u infrastrukturu, širenje tržišta i istraživačke saradnje ključni su za dugoročnu održivost, pozicionirajući Crnu Goru kao konkurentnog igrača na regionalnom i globalnom tržištu citrusa.

Ključne riječi: *Mandarine, Crna Gora, citrusi, održivost, poljoprivredne prakse, prinos.*

STUDY OF THE INTENSITY OF SOIL EROSION BY USING COMPUTER GRAPHIC GLOBAL INTERO MODEL IN THE COAST OF MONTENEGRO

PROUČAVANJE INTENZITETA EROZIJE ZEMLJIŠTA KORIŠĆENJEM RAČUNARSKOG GRAFIČKOG MODELAGLOBAL IntErO NA CRNOGORSKOM PRIMORJU

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Milica Filipovic


Velibor Spalevic

ABSTRACT:
Soil erosion is significant environmental and economic challenge worldwide. This study employs the computer-graphic Global IntErO model to evaluate erosion intensity across 40 river basins in Coastal Montenegro. The model integrates 26 parameters, including geomorphology, climate, land use, and hydrology, to quantify erosion potential. Results highlight variations in erosion intensity, with torrents such as Rikavac (200.0 m^3sec^{-1}; B–III–0,52) and Željeznica (150.0 m^3sec^{-1}; B–III–0,60) exhibiting extreme sediment transport capacity, impacting infrastructure and transport systems. The study underscores the need for erosion control measures, Industry 4.0 solutions for environmental monitoring, reforestation, and sustainable watershed management. The application of intelligent systems in erosion risk analysis is explored, validating Global IntErO modelas a valuable predictive tool for similar Mediterranean regions.

Keywords: *Erosion, Global IntErO, watershed management, intelligent systems, sustainability.*

REZIME:
Erozija predstavlja značajan ekološki i ekonomski izazov širom svijeta. Primjenom računarsko-grafičkog modela Global IntErO urađena je procjena intenziteta erozije u 40 riječnih slivova na crnogorskom primorju. Model integriše 26 parametara, uključujući geomorfologiju, klimu, korišćenje zemljišta i hidrologiju, kako bi kvantifikovao potencijal erozije. Rezultati ukazuju na varijacije u intenzitetu erozije, pri čemu bujični tokovi poput Rikavca (200,0 m^3sec^{-1}; B–III–0,52) i Željeznice (150,0 m^3sec^{-1}; B–III–0,60) pokazuju izuzetnu transportnu sposobnost sedimenata, što utiče na infrastrukturu i saobraćajne sisteme. Studija naglašava potrebu za mjerama kontrole erozije, primjenom rješenja Industrije 4.0 za praćenje životne sredine, pošumljavanjem i održivim upravljanjem slivovima. Istražena je i primjena inteligentnih sistema u analizi rizika od erozije, potvrđujući Global IntErO model kao vrijedan prediktivni alat za slične mediteranske regione.

Ključne riječi: *Erozija, Global IntErO, upravljanje slivovima, inteligentni sistemi, održivost.*

ONCOGENIC POTENTIAL OF CYP24A1: IMPLICATIONS FOR CANCER DIAGNOSIS AND TREATMENT

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Fatma Nur Çeven

Idris Arslan

ABSTRACT:
Vitamin D is a fat-soluble vitamin synthesized in the skin from 7-dehydrocholesterol and activated through some hydroxylase enzymes in liver and kidney. Cytochrome P450 enzymes are a group of essential enzymes in the body responsible for metabolizing a wide range of substances, including drugs, toxins, and hormones. They play a vital role in detoxification, drug metabolism, and the synthesis of critical compounds. Vitamin D is critically essential for not only tumorigenesis but also cancer treatment and drug rsistance. Expression imbalance in the level of CYP24A1 has been observed in several cancer types such as adenocarcinoma, breast carcinoma, and colon cancer. CYP24A1 trigggers the deficiency of vitamin D_3through catalizing the production of lactone or calcitroic acid.Overexpression of CYP24A1 is associated with enhanced RAS signaling, suggesting a potential mechanism by which CYP24A1 promotes tumor growth.Since balancing CYP24A1 is effective not only in cancer development but also in cancer treatment and drug resistance, oncogenic CYP24A1 level should be monitored at all clinical stages.

Keywords: *CYP24A1, vitamin D, calcitriol, cancer, oncogen.*

SOCIAL ENTREPRENEURSHIP AND CHALLENGES OF THE FOURTH INDUSTRIAL REVOLUTION: THE CONTEXT OF BOSNIA AND HERZEGOVINA

DRUŠTVENO PREDUZETNIŠTVO I IZAZOVI ČETVRTE INDUSTRIJSKE REVOLUCIJE: KONTEKST BOSNE I HERCEGOVINE

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Savo Stupar

ABSTRACT:
Next generations may experience large corporations and governments of developed countries dominating the development and benefits of new technologies, while other social actors become "powerless observers". There are also opportunities for the social economy in all its forms to strategically shape the development and application of 4IR technologies to achieve social good (Mulgan, 2021). Forth industrial revolution (4IR) brings new opportunities for social entrepreneurs through digitization, innovative technologies and new business models. Through the integration of technologies such as the Internet of Things (IoT), artificial intelligence (AI) and blockchain, social enterprises can improve their operations, increase efficiency and achieve greater social impact. The question arises whether the actors of social entrepreneurship in Bosnia and Herzegovina recognize the challenges of 4IR and whether their programs, strategies and policies are in line with the challenges that await them? The paper will analyze the existing models of social entrepreneurship in Bosnia and Herzegovina, the degree of their readiness to adopt 4IR technologies, as well as the challenges that 4IR brings to social enterprises in our country.
***Keywords**: Social Entrepreneurship, Fourth Industrial Revolution, Bosnia and Herzegovina*

SAŽETAK:
Sljedeće generacije mogu iskusiti da korporacije i vlade razvijenih zemalja dominiraju razvojem i benefitima novih tehnologija, a ostali društveni akteri postaju „nemoćni posmatrači“. Postoje i prilike za socijalnu ekonomiju da u svim svojim oblicima strateški oblikuje razvoj i primjenu 4IR tehnologija za postizanje društvenog dobra (Mulgan, 2021). Četvrta industrijska revolucija (4IR) donosi nove mogućnosti za društvene preduzetnike kroz digitalizaciju, inovativne tehnologije i nove poslovne modele. Kroz integraciju tehnologija poput interneta stvari (IoT), umjetne inteligencije (AI) i blockchaina, društvena preduzeća mogu unaprijediti svoje operacije, povećati efikasnost i postići veći društveni uticaj. Postavlja se pitanje da li akteri društvenog preduzetništva u Bosni i Hercegovini prepoznaju izazove koje nosi 4IR te da li su njihovi programi, strategije i politike u skladu s izazovima koje ih očekuju? Rad će analizirati postojeće modele društvenog preduzetništva u Bosni i Hercegovini, nivo njihove spremnosti za usvajanje 4IR tehnologija kao i izazove koje nosi 4IR za društvena preduzeća u našoj zemlji.
***Ključne riječi:** društveno preduzetništvo, četvrta industrijska revolucija, Bosna i Hercegovina*

APPLICATION OF INTELLIGENT SYSTEMS FOR BUSINESS PROCESS OPTIMIZATION IN THE BALKAN CONSTRUCTION INDUSTRY

PRIMJENA INTELIGENTNIH SISTEMA ZA OPTIMIZACIJU POSLOVNIH PROCESA U GRAĐEVINSKOJ INDUSTRIJI BALKANA

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Bojana Vasiljevic Poljasevic

Mladen Radivojevic

Mirsad Imamovic

Selma Otuzbir - Mecan

ABSTRACT:
This paper explores the application of intelligent information systems (IIS) based on artificial intelligence in construction companies in the Balkans, aiming to reduce operating costs, increase competitiveness, and improve work efficiency. The paper proposes two key technologies: data warehouses and intelligent software agents, which enable real-time data collection and analysis, providing employees with the necessary information and knowledge for more efficient work and decision-making. Research conducted in 2023 in Balkan construction companies shows a low level of new technology adoption, with 92% of surveyed companies using information and communication technologies solely for basic business monitoring. The use of advanced technologies such as drones, IoT, and BIM remains limited, while a lack of management support further slows their adoption. ...
Keywords*: construction companies, intelligent software agents, artificial intelligence, efficient business operations*

***REZIME*:**
Ovaj rad istražuje primjenu inteligentnih informacionih sistema (IIS) zasnovanih na vještačkoj inteligenciji u građevinskim preduzećima na Balkanu, sa ciljem smanjenja troškova poslovanja, povećanja konkurentnosti i efikasnosti rada. U radu se predlažu dvije ključne tehnologije: skladišta podataka i inteligentni softverski agenti, koji omogućavaju realno-vremensko prikupljanje i analizu podataka, pružajući zaposlenima neophodne informacije i znanja za efikasniji rad i odlučivanje. Istraživanje provedeno 2023. godine u balkanskim građevinskim preduzećima pokazuje nizak nivo korištenja novih tehnologija, pri čemu 92% ispitanih preduzeća informaciono-komunikacione tehnologije koristi samo za osnovno praćenje poslovanja. Upotreba naprednih tehnologija poput dronova, IoT-a, i BIM-a, i dalje je ograničena, dok nedostatak podrške menadžmenta dodatno usporava njihovo usvajanje. ...
Keywords*: građevinska preduzeća, inteligentni softverski agenti, vještačka inteligencija, efikasnije poslovanje*

ASSESSMENT OF CYBERHATTING MOTIVES IN THE CONTEXT OF BEHAVIORAL MARKETING THEORIES

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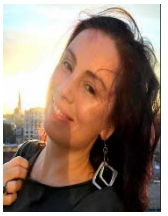
Chukurna Olena


Yatvetska Hanna


Kryvosheia Tetiana


Stepova Oleksandra

ABSTRACT:
The purpose of the article is to analyse the emergence of cyberhating motives in the context of the evolution of behavioural theories of marketing. The authors have proven the hypothesis of the emergence of cyberhating as part of culture and behavioural patterns as a result of changes in the theory of generations, which is considered as the main factor of behavioural reactions in marketing. As a result of the sociological study, the causes and motives of the emergence of cyberhating were considered and proven using the example of an audience of teenagers. As a result of the study, the definition of the motives of the emergence of cyberhating is considered in the context of the interaction of the evolution of behavioural theories in marketing and the development of the theory of generations.
In preparing the article, sociological research methods were used, particularly survey-based questionnaires. Methods applied for analyzing sociological and marketing data included the Rosenberg Self-Esteem Scale (RSES), the Likert scale, and scales for measuring frequency and intensity of social media usage.
The scientific novelty of the obtained results lies in the substantiation and proof of the motive behind the emergence of cyberhating in the context of the evolution of behavioral marketing theories, through the formation of behavioural patterns in cyberspace as a consequence of generational changes.
The practical significance of the research findings consists in identifying specific behavioural motives of Generation Alpha and Zoomers. The practical results of the study illustrate the transformation driven by generational shifts, their behavioral patterns, cultural outlooks, and values, as influenced by the development of generational theory in the context of behavioural marketing theories.

Keywords: *cyber-hating; motivation; generational theory; behavioral theories; sociological research; marketing research; cognitive marketing*

ANALYZING THE DRIVERS OF ECONOMIC GROWTH IN BOSNIA AND HERZEGOVINA: TRADE, INVESTMENT, ENERGY, AND LABOR FORCE DYNAMICS

ANALIZA FAKTORA EKONOMSKOG RASTA U BOSNI I HERCEGOVINI: TRGOVINA, INVESTICIJE, POTROŠNJA ENERGIJE I RADNA SNAGA

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Jasna Imamovic

Lejla Sehanovic

Naida Misimovic Custovic

ABSTRACT:
This study analyzes the impact of trade openness, FDI, non-renewable energy consumption, and labor force participation on B&H's economic growth using ARDL methodology with data from 1996 to 2023. The results show that trade openness and FDI are insignificant, non-renewable energy consumption has mixed effects, and labor force participation positively correlates with growth. The study emphasizes assessing the roles of trade, FDI, and labor in sustainable development, while noting the modest potential benefits of non-renewable energy use.

Keywords: *trade openness, FDI, non-renewable energy consumption, labor force, economic growth*

REZIME:
Ovo istraživanje analizira uticaj otvorenosti trgovine, stranih direktnih investicija, potrošnje neobnovljive energije i učešća radne snage na ekonomski rast BiH koristeći ARDL metodologiju s podacima od 1996. do 2023. godine. Rezultati pokazuju da otvorenost trgovine i FDI nisu značajni, potrošnja neobnovljive energije ima mješovite efekte, dok učešće radne snage pozitivno korelira s rastom. Studija naglašava važnost procjene uloge trgovine, FDI-a i rada u održivom razvoju, uz napomenu o skromnim, ali potencijalno korisnim efektima korištenja neobnovljive energije.

Ključne riječi: *trgovinska otvorenost, strane direktne investicije, potrošnja neobnovljivih izvora energije,radna snaga, ekonomski razvoj.*

PROPOSING A HUMAN-RIGHTS-BASED APPROACH IN OPEN-SOURCE INTELLIGENCE

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Pjereta Agalliu

Tevia Agalliu

ABSTRACT:
The data we create through our online activities is regularly gathered and utilized by businesses to advertise to third parties, which then promote their products or services to us. Furthermore, there are additional footprints we leave that can be collected, processed, and analyzed by anyone, including governments, for various potentially concerning purposes. With the emergence of the global free software movement, and with the introduction and dialogue concerning various regulatory initiatives on free software worldwide, particularly in the Western Balkans, there is an effort to ensure that both the public and private sectors utilize information systems and open-source computing tools, thereby safeguarding national security, fostering the protection of citizens' constitutional rights, and promoting the technological advancement of the Nation. This paper aims to be an empirical approximation and a comparative analysis of the use of OPEN SOURCE services by public or non-public services in the region for surveillance purposes. Qualitative results reveal that the extent of the use of these techniques and the way that stakeholdersuse them have a great legal impact in the presence of human rights.In the end, this work will propose a human-rights-based approach as a background guideline for prevention and addressing Open Source Intelligence.

Keywords: *open source intelligence, human rights-based approach, public rights, regulatory guidelines, digital society.*

IMPACT OF DIGITAL MARKETING STRATEGIES ON BUSINESS TRANSFORMATION

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Tardaskina Tetiana


Stanislavyk Olena


Kovalenko Oleksandr

ABSTRACT:
The article examines the role of digital marketing strategy as a tool for business adaptation to the conditions of the digital economy. The analysis of the key elements of the digital marketing strategy was carried out, in particular its impact on interaction with the target audience, optimization of costs and improvement of the effectiveness of marketing activities. The main stages of development and implementation of digital strategies in the context of modern market conditions, which are characterized by the rapid development of technologies and increased competition, are defined. Scientific approaches to the interpretation of the concepts of «digital strategy» and «digital marketing» are considered, which reflect the multifaceted impact of digital transformation on business. The results of consumer research and their attitude towards digital marketing tools are presented, which allows to evaluate their effectiveness and impact on long-term relations with consumers. Based on the attitude of consumers towards digital marketing, effective communication channels have been identified and the main tools contributing to the achievement of marketing goals have been identified. The results of the study confirm the relevance of developing digital marketing strategies to ensure the competitiveness of enterprises in the digital economy. Based on the conducted research, the authors proposed the stages of digital marketing strategy formation, which take into account modern challenges and the specifics of the digital environment.

Keywords: *digital marketing, digital business transformation, digital marketing strategy, digital economy, competitive advantages, target audience, digital platforms, communication channels..*

SUSTAINABLE MANAGEMENT AND VALORISATION OF CRVENA STIJENA, A PREHISTORIC ARCHAEOLOGICAL AND GEOSITE IN MONTENEGRO

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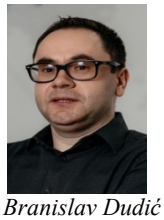
Željko Kalezić


Velibor Spalevic


Branislav Dudić

ABSTRACT:
This study explores the sustainable management and valorization potential of Crvena Stijena, a prehistoric archaeological and geosite in Montenegro, renowned for its scientific and aesthetic significance. The research highlights Crvena Stijena's unique archaeological depth, offering insights into Neanderthal subsistence strategies and environmental adaptations, positioning it as a significant site for both archaeotourism and geotourism. However, current limitations, including inadequate infrastructure, insufficient promotional materials, and a lack of interpretive resources, restrict its accessibility and attractiveness. This paper evaluates the site's potential for sustainable tourism development, analyzing visitor motivations and behaviors and the role of geodiversity and arheodiversity in heritage conservation. The study provides targeted recommendations for enhancing the visitor experience through infrastructure improvements, interpretive signage, and community involvement, while emphasizing conservation measures to preserve Crvena Stijena's geological and cultural integrity. Additionally, it includes a SWOT and PESTEL analysis to guide policy makers, conservators, and academic institutions in developing a collaborative approach to the site's management. By integrating these strategies, Crvena Stijena can evolve as a model of sustainable heritage tourism, benefiting Montenegro's cultural tourism sector and fostering appreciation for its prehistoric legacy.

Keywords: *Arheodiversity, Crvena Stijena, cultural heritage, geodiversity, Sustainable tourism, management, Montenegro.*

THE MOST IMPORTANT COMPANIES IN THE GLOBAL E-COMMERCE

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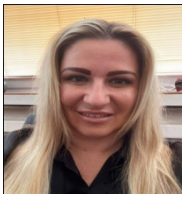
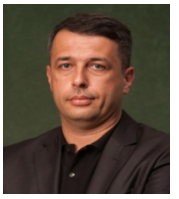
Branislav Dudić


Alexandra Mittelman


Jaroslav Vojtechovský


Dejan Zejak

ABSTRACT:
Nowadays, e-commerce is being used very much mainly by means of online trade. It can be defined as a sale or purchase of goods or services performed by means of mobile phones and computers. The aim of e-commerce is to sell as many goods as possible, consequently, to earn as much profit as possible and to get mainly stable customers. Online shopping is one of the most popular online activities all around the world. Electronic trade works by means of the internet and it is available 24 hours a day and 7 days a week. Prices in e-commerce are much preferable then in brick-and-mortar shop. Companies started to realize that the internet is a new medium available to millions of people all around the world. Chinese retail group Alibaba is the largest e-commerce retailer in the world. It is assumed that Amazon will become a leader in the coming years.

Keywords: *e-commerce, electronic sales, e-market, consumer behaviour.*

ENTREPRENEURSHIP: Concept, Paradoxes and Environment

PREDUZETNIŠTVO: koncept, paradoksi i okruženje

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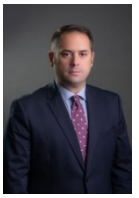

Ivan Jovetic

ABSTRACT:
Current age is the age of buzzwords. Media supports respective usage. Definitions of the words are important in every sector with particular emphasis on entrepreneurship, startups, sustainability and environment. Entrepreneurship has to be seen as the transformative function of executed ideas. And startups as one of its extractions. The paper provides some of the potentially usable definitions as well as meanings of entrepreneurship and startups. Aside the buzzwords age, we are in the paradox age. And entrepreneurship is not an exception at all. The papers provide set of identified paradoxes regarding entrepreneurship. In addition, paper drafts the framework for uprise and sustain-ability of entrepreneurial environment emphasizing the role of entrepreneurs as well as entrepreneurial universities.

Keywords: *entrepreneurship, startups, environment, paradoxes, policy, education, HEI*

REZIME:
Aktuelno doba predstavlja upotrebe (često besmislenih) krilatica. Problem dodatno usložnjavaju i mediji posebno društvene mreže. Definisanje riječi je neizostavan aspekt u svakom sektoru a naročito kada se odnosi na preduzetništvo, startupove, održivost i okruženje. Preduzetništvo je neophodno posmatrati kao transformativnu funkciju ideja. Istovremeno, startupovi su drugi izvod preduzetništva. Cilj rada je i da predstavi potencijalno korisne definicije kao i značenja konteksta preduzetništva i startupova. Istovremeno, pored vremena krilatica, živimo i u vremenu paradoksa. Paradoksi preduzetništva, svakako, nisu izuzetak. Rad za cilj ima i da uvid u skup identifikovanih paradoksa preduzetništva. Pored toga, rad predstavlja i nacrt ili mapu puta za uspon i odr-živost preduzetničkog okruženja sa naglasom na uloge preduzetnika ali i preduzetničkih univerziteta.

Ključne riječi: *preduzetništvo, startupovi, okruženje, paradoksi, politike, obrazovanje*

IMPACT OF DIGITAL TRANSFORMATION ON HRM ACTIVITIES: EVIDENCES FROM THE TRANSITION CONTEXT OF BOSNIA AND HERZEGOVINA

UTICAJDIGITALNE TRANSFORMACIJE NA HRM AKTIVNOSTI: PRIKAZI TRANZICIJSKOG KONTEKSTA BOSNE I HERCEGOVINE

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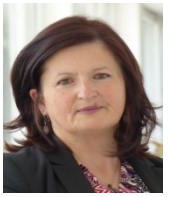
Zijada Rahimić


Sibela Karačić


Elvir Čizmić


Munira Šestić

ABSTRACT:
The digital transformation of the organization implies the integration of digital technologies into all aspects of the business model and it is a condition for the competitiveness of organizations in dynamic business environment. Human resource management (HRM) represents a strategic approach to managing the organization's key resources - employees. The focus of this paper is the impact of digital transformation on human resource management activities. The aim of the research is to determine the effects of using digital technologies in HRM activities. Quantitative research was conducted through a survey among 82 employees of the HR department in different sectors in Bosnia and Herzegovina. The results were analyzed using a regression model to identify key correlations between digital transformation and applied HRM practices. Research results show that digital transformation improves the HRM process, rationalizing the time and resources needed. Digital transformation affects the HRM practices, ...
***Keywords**: Digital transformation, Human Resource Management, HR department, HR practices, Bosnia and Herzegovina*

SAŽETAK:
Digitalna transformacija organizacije podrazumijeva integraciju digitalnih tehnologija u sve aspekte poslovnog modela i uslov je konkurentnosti organizacija u dinamičnom poslovnom okruženju. Menadžment ljudskih resursa (HRM) predstavlja strateški pristup upravljanju ključnim resursima organizacije – zaposlenicima. Predmet istraživanja ovog rada je uticaj digitalne transformacije na aktivnosti upravljanja ljudskim resursima. Cilj istraživanja je utvrđivanje efekata korištenja digitalnih tehnologija u HRM aktivnostima. Kvantitativno istraživanje sprovedeno je putem ankete među 82 zaposlenika unutar HR odjela u različitim sektorima u Bosni i Hercegovini. Rezultati su analizirani regresionim modelom kako bi se identifikovale ključne korelacije između digitalne transformacije i primjenjenih HRM praksi. Rezultati istraživanja pokazuju da digitalna transformacija unapređuje HRM proces, racionalizirajući potrebno vrijeme i resurse. Digitalna transformacija utiče na HRM prakse, ...
***Ključne riječi:** Digitalna transformacija, Upravljanje ljudskim resursima, HR odjel, HR prakse, Bosna i Hercegovina*

IMPACT OF EMPLOYEE TRANSITION MANAGEMENT ON SATISFACTION AND EFFICIENCY OF EMPLOYEES IN THE NON-GOVERMENTAL SECTOR

UTICAJUPRAVLJANJA TRANZICIJOM ZAPOSLENIKA NA ZADOVOLJSTVO I UČINKOVITOSTZAPOSLENIH U NEVLADINOM SEKTORU

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Elvir Čizmić


Ena Ovčina


Zijada Rahimić


Munira Šestić

ABSTRACT:
Both contingency and temporary jobs are a way of engaging human resources in project-oriented organizations that have an "uncertain" budget, so those organizations strive to provide a greater level of flexibility in their human resource management. This pattern is prevalent among non-governmental organizations, engaging human resources through a contingency or temporal concept, depending on the needs of current projects. In addition to the non-governmental sector, the mentioned pattern is increasingly used also by private businesses and government institutions. The focus of this paper is to measure the impact of systemic employee transition management on their satisfaction and efficiency, after project completion. The research sample consists of one hundred (100) employees who come from randomly selected ten non-governmental organizations in Bosnia and Herzegovina. Research findings confirm the importance of both organizational and management supports in effective employee transition processes, underlying the need to improve opportunities for their professional development. ...
***Keywords**: Non-governmental organizations, Transition management, Employee Satisfaction, Employee Efficiency*

SAŽETAK:
Kontingencijski i temporalni poslovi predstavljaju način angažiranja ljudskih resursa u projektno orijentiranim organizacijama koje imaju neizvjestan budžet i koje nastoje osigurati viši nivo fleksibilnosti u upravljanju ljudskim resursima. Upravo na ovaj način funkcioniraju nevladine organizacije koje angažiraju ljudske resurse kroz kontingencijski ili temporalni koncept zavisno od potreba aktuelnih projekata. Pored nevladinog sektora, navedeni obrazac sve ćešće se koristi u funkcioniranju privatnih biznisa i vladinih institucija. Predmet ovog rada jeste mjerenje uticaja sistemskog upravljanja tranzicijom zaposlenika nakon završetka projektana njihovo zadovoljstvo i učinkovitost. Istraživački uzorak čini stotinu (100) zaposlenika koji dolaze iz slučajno odabranih deset nevladinih organizacija u Bosni i Herecegovini. Rezultati empirijskog istraživanja potvrđuju važnost organizacijske i upravljačke podrške u postizanju efikasnijeg procesa tranzicije zaposlenika te ukazuju na potrebu poboljšanja mogućnosti za njihov profesionalni razvoj. ...
***Ključne riječi:** Nevladine organizacije, Upravljanje tranzicijom, Zadovoljstvo zaposlenih, Učinkovitost zaposlenih*

USING MACHINE LEARNING FOR TEACHER RETENTION IN SCHOOLS

UPOTREBA MAŠINSKOG UČENJA ZA ZADRŽAVANJE NASTAVNIKA U ŠKOLAMA

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Edisa Zilić

Mirdin Zilić

ABSTRACT:
Teacher retention remains a critical issue in elementary and high schools, influencing the quality of education and school stability. This study employes several machine learning algorithms, including logistic regression, decision tree, and random forest to predict which teachers are at the highest risk of leaving their positions. Using a dataset of 1144 teachers in Bosnia and Herzegovina, factors such as job satisfaction, workload, salary, professional development opportunities, and school administration are analyzed. The results highlight key predictors of teacher attrition and provide actionable insights for developing targeted retention strategies.

Keywords: *teacher retention, machine learning, predictive models, schools, Bosnia and Herzegovina*

REZIME:
Zadržavanje nastavnika je ključno pitanje u osnovnim i srednjim školama koje utiče na kvalitet obrazovanja i stabilnost škole. Ovo istraživanje koristi nekoliko algoritama mašinskog učenja, uključujući logističku regresiju, stablo odlučivanja i slučajne šume, kako bi se predvidjelo koji nastavnici su u najvećem riziku od napuštanja svojih radnih mjesta. Koristeći bazu podataka od 1144 ispitanika u Bosni i Hercegovini, analizirani su faktori kao što su zadovoljstvo poslom, opterećenje, plata, mogućnosti profesionalnog razvoja i školska administracija. Rezultati ističu ključne prediktore odlazaka nastavnika i pružaju korisne uvide koji se mogu primijeniti za razvoj ciljanih strategija zadržavanja.

Ključne riječi: *zadržavanje nastavnika, mašinsko učenje, prediktivni modeli, škole, Bosna i Hercegovina.*

MANAGING ONLINE BANKING ADOPTION USING EXTENDED TECHNOLOGY ACCEPTANCE MODEL

UPRAVLJANJE PROCESOM USVAJANJA ONLINE BANKARSTVA UPOTREBOM PROŠIRENOG MODELA PRIHVATANJA TEHNOLOGIJE

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Ensar Mekić


Azra Sarajlić


Irfan Djedović


Mahmood Shubbak

ABSTRACT:
The study examines online banking adoption in Bosnia and Herzegovina through an extended Technology Acceptance Model. Results of Structural Equation Modelling shows that web security affects trust, which influences perceived usefulness and ease of use. Both factors predict customers' intention to adopt online banking, providing valuable guidance for improving adoption strategies.

Keywords: *Online Banking; Technology Acceptance Model (TAM); Perceived Usefulness; Perceived Ease of Use; Trust; Behavioral Intention; Bosnia and Herzegovina*

REZIME:
Ova studija ispituje usvajanje online bankarstva u Bosni i Hercegovini kroz prošireni Model prihvatanja tehnologije. Rezultati modeliranja strukturnih jednačina pokazuju da web sigurnost utiče na povjerenje, koje dalje utiče na percipiranu korisnost i jednostavnost korištenja. Oba faktora predviđaju namjeru korisnika da usvoje online bankarstvo, pružajući vrijedne smjernice za unapređenje strategija usvajanja.

Ključne riječi: *Online bankarstvo; Model prihvatanja tehnologije (TAM); Percipirana korisnost; Percipirana jednostavnost korištenja; Povjerenje; Namjera ponašanja; Bosna i Hercegovina*

THE SUCCESSION PROCESS OF FAMILY-OWNED COMPANIES IN BOSNIA AND HERZEGOVINA: ASPECT OF FAMILY COUNCILS

PROCES SUKCESIJE PORODIČNIH KOMPANIJA U BOSNI I HERCEGOVINI: ASPEKT PORODIČNIH VIJEĆA

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Ermin Neimarlija


Elvir Čizmić


Zijada Rahimić


Munira Šestić

ABSTRACT:
Family councils support the management of family companies, including support beyond classic business issues, especially in the context of the „inheritance“ process, thusin the process of business succession to the next generation. However, despite the numerous family companies in Bosnia and Herzegovina, which are significant business actors, the impact of this important organizational aspect of the family business on the succession process is unknown. In order to shed light on the that question, a research was modeled with the aim of examining the influence of significant family business factors on satisfaction with the succession process, where an independent variable was designed as a separate construct in the model, which takes into account the role of family councils in the aforementioned process. The conducted empirical research aimed to analyze the cause-and-effect relationship between satisfaction and perception of the success of the succession process and key business characteristics of family companies in Bosnia and Herzegovina against the existence of a family council as an organizational body in this type of company. ...
Keywords: *family companies, succession process, family councils*

SAŽETAK:
Porodična vijeća podržavaju upravljanje porodičnim kompanijama, uključujući i podršku izvan klasičnih poslovnih pitanja, posebno u kontekstu procesa nasljeđivanja odnosno u procesu sukcesije biznisa na sljedeću generaciju. Ipak, uprkos brojnim porodičnim kompanijama u Bosni i Hercegovini, koje su značajni poslovni akteri, nepoznat je uticaj ovog važnog organizacionog aspekta porodičnog preduzeća na proces sukcesije. U namjeri da se rasvjetli navedeno pitanje modelirano je istraživanje sa ciljem ispitivanja uticaja značajnih faktora porodičnog biznisa na zadovoljstvo procesom sukcesije gdje se kao posebna konstrukt projektirala nezavisna varijabla u modelu koja uobzirava ulogu porodičnih vijeća u navedenom procesu. Provedeno empirijsko istraživanje, imalo je za cilj analizirati uzročno-posljedični odnos između zadovoljstva i perecepcije uspješnosti procesa nasljeđivanja i ključnih poslovnih karakteristike porodičnih kompanija u Bosni i Hercegovini spram postojanja porodičnog vijeća kao organizacionog tijela u ovom tipu kompanija. ...
Ključne riječi: *porodične kompanije, proces sukcesije, porodična vijeća*

FEMALE BOSNIA-HERZEGOVINA'S DIASPORA ENTREPRENEURS IN AUSTRIA: EXPERIENCES AND CHALLENGES

PREDUZETNICE BOSANSKOHERCEGOVAČKE DIJASPORE U AUSTRIJI: ISKUSTVA I IZAZOVI

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Munira Šestić


Almina Bešić


Zijada Rahimić

ABSTRACT:
The diaspora may play an important role in business development in their home and host countries. Through networks, knowledge, and competencies, diaspora members can add great economic value across borders. Focusing on female diaspora entrepreneurs, it might be said that their impact to the development of networks and collaborations can contribute to the most needed empowerment of female entrepreneurial ecosystems between their home and host societies. However, to date little is known about female entrepreneurs in the context of transitional entrepreneurship between Bosnia and Herzegovina on one, and Austria on other side.The general aim of this paper is to portray Bosnia and Herzegovina Diaspora Female Entrepreneurs in Austria through their key endeavor motivations, behaviors, and strategies, networking and their perception of success. Thus, the resultswill provide recommendations for policymakers to create more open and effective diaspora female entrepreneurship ecosystems, as influencing factor of their transnational entrepreneurial activities.

***Keywords**: Diaspora, Female Entrepreneurs, Bosnia and Herzegovina, Austria*

SAŽETAK:
Dijaspora može imati važnu ulogu u razvoju poslovanja u svojim matičnim zemljama i zemljama domaćinima. Kroz mreže, znanje i kompetencije, članovi dijaspore imaju priliku dodati veliku ekonomsku vrijednost preko granica dvije države. Fokusirajući interes na preduzetnice iz dijaspore, njihov utjecaj na razvoj mreža i saradnje može doprinijeti potrebnom osnaživanju ženskih preduzetničkih ekosistema unutar njihovih matičnih država i država u kojima trenutno žive i rade. Ipak, do danas se malo zna o preduzetnicama u kontekstu tranzicijskog preduzetništva između Bosne i Hercegovine s jedne, i Austrije s druge strane. Opšti cilj ovog rada je prikazati preduzetnice iz bosanskohercegovačke dijaspore u Austriji kroz njihove ključne motivacije, ponašanja i strategije, umrežavanje i njihovu percepciju uspjeha. Dakle, rezultati će dati preporuke kreatorima politike da stvore otvorenije i efikasnije ekosisteme ženskog preduzetništva u dijaspori, kao faktor uticaja na njihove transnacionalne preduzetničke aktivnosti.

***Ključne riječi:** Dijaspora, Preduzetnice, Bosna i Hercegovina, Austrija*

ASSESSMENT OF THE IMPORTANCE OF EMPLOYEE COMPETENCIES USING AN EXPERT SYSTEM

PROCJENA VAŽNOSTI KOMPETENCIJA ZAPOSLENIKA PRIMJENOM EKSPERTNOG SISTEMA

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Stupar Savo


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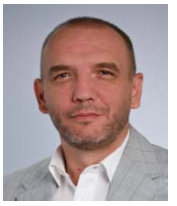
Nenad Beganović

ABSTRACT:
The modern approach to human resource management in public administration requires continuous development and adaptation to new challenges. A flexible and proactive human resource management model is crucial for public administration institutions to effectively achieve their strategic goals and respond to the needs of modern society. The aim of this work is to analyze key behavioral competency indicators that have the greatest impact on employee work performance, with a focus on the possibility of developing a prototype expert system for evaluating behavioral competencies. Using the Doctus Knowledge-Based system, the significance of individual attributes of behavioral competencies will be analyzed, providing concrete recommendations for improving the evaluation process in public administration.

Keywords: *Behavioral competencies, Human Resource Management, Expert systems, Doctus Knowledge Based Systems, Case Based Reasoning*

REZIME:
Savremeni pristup upravljanju ljudskim resursima u javnoj upravi zahtijeva kontinuirani razvoj i prilagođavanje novim izazovima. Fleksibilan i proaktivan model upravljanja ljudskim resursima je ključan za institucije javne uprave kako bi efikasno ostvarile svoje strateške ciljeve i odgovorile na potrebe savremenog društva. Cilj ovog rada je analiza ključnih indikatora bihejvioralnih kompetencija koji imaju najveći uticaj na radni učinak zaposlenih, sa fokusom na mogućnost razvoja prototipa ekspertskog sistema za evaluaciju bihejvioralnih kompetencija. Koristeći Doctus sistem zasnovan na znanju, analiziraće se značaj pojedinačnih atributa bihevioralnih kompetencija, dajući konkretne preporuke za unapređenje procesa evaluacije u javnoj upravi.

Ključne riječi: *Kompetencije u ponašanju, Upravljanje ljudskim resursima, Ekspertni sistemi, Doctus sistemi zasnovani na znanju, Zaključivanje na osnovu slučajeva*

FORENSIC ACCOUNTING TECHNIQUES IN BANKRUPTCY PROCEEDINGS

TEHNIKEFORENZIČKOG RAČUNOVODSTVA U STEČAJNOM POSTUPKU

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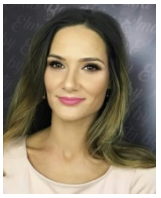
Dijana Vuković


Senada Kurtanović


Edina Šehić

ABSTRACT:
Financial statements serve as the foundation for any rational analysis of the bankrupt debtor. When analyzing the financial statements of a bankrupt debtor, the identification of the causes of business changes is conducted, which have led to changes in balance sheet positions, often resulting in the annulment of nearly all balance sheet positions. The bankrupt debtor frequently engages in excessive and intentional selection and application of accounting principles and procedures to achieve personal interests of the owners, often exceeding the limits permitted by standards or applying certain standard provisions in cases where there are no justified reasons for their use.The aim of this paper is to present how the application of forensic accounting can maximize the benefits for the creditors of the bankrupt debtor.

Keywords:*Bankruptcy proceedings, forensic accounting, balance sheet cleansing of the bankrupt debtor.*

REZIME:
Finansijski izvještaji predstavljaju podlogu svake racionalne analize stečajnog dužnika. Prilikom analize finansijskih izvještaja stečajnog dužnika vrši se identifikacija uzroka poslovnih promjena, koje su uslovile promjene na bilansnim pozicijama, na način da su uglavnom sve bilansne pozicije anulirane. Stečajni dužnik koristi pretjeran i namjeran izbor i primjenu računovodstvenih načela i postupaka kako bi se ostvarili lični interesi vlasnika često prekoračujući norme koje dopuštaju standardi ili se odredbe pojedinih standarda primjenjuju i u slučajevima kada za njihovu primjenu ne postoje opravdani razlozi. Cilj ovog rada je prikazati način primjene forenzičnog računovodstva može da maksimizira koristi povjerilaca stečajnog dužnika.

Ključne riječi: *Stečajni postupak, forenzičko računovodstvo, čišćenja bilansa stečajnog dužnika*

FIRE RESISTANCE OF STEEL SKELETON MEMBERS

OTPORNOST NA POŽAR ELEMENATA ČELIČNIH OKVIRNIH KONSTRUKCIJA

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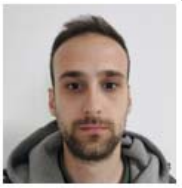

Amir Ademović

Sanin Dzidic

ABSTRACT:
This paper evaluates fire resistance of principal girders and frame parts of a steel skeleton structural system, considering both constant and variable actions. The fire resistance of steel beams and columns was evaluated according to the exposure to the ISO 834-1 fire curve and using the critical temperature approach in compliance with Eurocode 3 requirements. The research uses qualitative research techniques and depends on empirical investigation of various beams and columns that have different geometric properties. Steel has a major disadvantage in that it has a limited ability to resist fire, despite being famous for having great mechanical properties at ambient temperature. However, several methods exist to improve the fire resistance of steel structures and their members. Furthermore, the fire resistance of all structures can be significantly increased by combining active and passive fire protection measures and enforcing them. Results found in this research show that members of steel skeleton systems, without any fire-resistant materials, can withstand short periods of fire duration before losing their load bearing function. ...
Keywords: *steel, beams, columns, Standard fire, fire resistance, Eurocode 3*

SAŽETAK:
Ovo istraživanje razmatra otpornost na požar glavnih nosača i elemata čeličnih okvirnih konstrukcija uzimajući u obzir stalna i promjenljiva djelovanja. Otpornost na požar čeličnih greda i stubova je odredjena u skladu sa metodom kritične temperature i zahtjevima Eurokoda 3, a pri izlaganju Standardnoj krivulji požara ISO 834-1. U ovom istraživanju je primjenjen kvalitativni pristup u zavisnosti od empirijskih nalaza za različite čelične grede i stubove sa različitim geometrijskim karakteristikama. Jedna od najosnovijih manjkavosti čeličnih elemenata je ograničena otpornost na požar, uprkos iznimnim mehaničkim svojstvima na ambijentalnoj temperaturi. Medjutim, postoji nekoliko metoda za unaprijedjenje otpornosti na požar čeličnih konstrukcija i njenih elemenata. Općenito, otpornost na požar svih vrsta nosivih konstrukcija se može značajno unaprijediti primjenom aktivnih i pasivnih mjera zaštite od požara na samom objektu. Ovo istraživanje pokazuje da elementi čeličnih okvirnih konstrukcija bez primjene dodatnih mjera zaštite mogu izdržati kratko vrijeme trajanja požara prije nego izgube svoju nosivu funkciju. ....
Ključne riječi: *čelik, grede, stubovi, Standardni požar, otpornost na požar, Eurokod 3*

GPR MEASUREMENTS FOR UTILITY DETECTION

GPR MJERENJA U SVRHU DETEKCIJE PODZEMNE INFRASTRUKTURE

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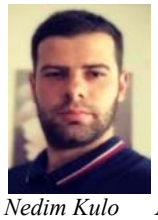

Muamer Đidelija *Nedim Kulo* *Adis Hamzić* *Admir Mulahusić*

ABSTRACT:
Ground Penetrating Radar (GPR) is a geodetic-geophysical method used for subsurface utility detection and mapping. This paper presents an overview of GPR principles, applications in utility detection, and key factors influencing the accuracy and precision of measurements. Radargrams from utility surveys, including gas pipelines, telephone cables, and sewer systems, are analyzed to illustrate practical outcomes. Using the Leica DS2000 georadar, various frequencies, grid orientations, and scanning parameters were evaluated. This study emphasizes GPR's role in non-destructive utility mapping and highlights considerations for improving detection accuracy.

Keywords: *ground penetrating radar, utilities, detection, measurements*

SAŽETAK:
Georadar (GPR) je geodetsko-geofizička metoda koja se koristi za detekciju i kartografisanje objekata podzemne infrastrukture. Ovaj rad predstavlja pregled principa GPR-a, njegovih primjena u detekciji infrastrukture i ključnih faktora koji utiču na tačnost i preciznost mjerenja. Radargrami dobiveniterenskim snimanjem infrastrukture, uključujući gasovode, telefonske kablove i kanalizacione sisteme, analizirani su kako bi se ilustrovali praktični rezultati. Korištenjem georadara Leica DS2000, ispitane su različite frekvencije, orijentacije mreže i parametri skeniranja. Ova studija naglašava ulogu GPR-a u neinvazivnom kartografisanju infrastrukture i razmatra poboljšanje tačnosti detekcije.

Ključne riječi: *georadar, komunalna infrastruktura, detekcija, mjerenja*

ADAPTIVE REUSE AS A STRATEGY FOR SUSTAINABLE DEVELOPMENTAND A CONTEMPORARY CONSERVATION METHOD OF HISTORIC BUILDINGS

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Yousef Zaarir


Adnan Novalič


Ahmed Elsayed

ABSTRACT:
Historic buildings, often located in city centers, frequently become unused or underutilized spaces. Their rehabilitation, through reconstruction or preservation, presents a significant opportunity for sustainable urban development. Adaptive reuse not only revitalizes these structures but also offers social and cultural benefits, ensuring their preservation for future generations.
This study aims to emphasize the importance of adaptive reuse as a sustainable approach to construction and urban development. A qualitative research methodology is employed, incorporating a review of related literature and an analysis of European case studies showcasing adaptive reuse projects.
The findings highlight the pivotal role of adaptive reuse in sustainable development by preserving historic architecture, reducing environmental impact, and fostering cultural continuity. By analyzing several adaptation examples, the study underscores adaptive reuse as an essential strategy for balancing heritage conservation with modern development needs.

Keywords: *Sustainability, Contemporary Conservation, Adaptive Reuse, Heritage, sustainable development.*

THE ROLE OF RECYCLED MATERIALS IN SUSTAINABLE CONSTRUCTION

RECIKLIRANI MATERIJALI I NJIHOVA ULOGA U ODRŽIVOJ GRADNJI

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Azra Avdagić

Aida Husetić

ABSTRACT:
Recycling construction waste is not only environmentally beneficial, but can also be financially profitable. Many recyclable materials can be resold or used in new projects at a lower cost than new construction materials. Recycling can also help reduce the cost of landfilling waste and can contribute to better resource management. This paper describes the basic concepts and methods of recycling construction waste, as well as a brief overview of the recycling of the most commonly used materials such as asphalt, wood, glass, brick and concrete, which constitute the main source of construction waste (40%-70%).

Keywords: *recycling, construction waste recycling, sustainable construction*

REZIME:
Reciklaža građevinskog otpada nije samo ekološki korisna, već može biti i finansijski isplativa. Mnogi materijali koji se mogu reciklirati mogu se ponovo prodati ili upotrijebiti u novim projektima po nižim troškovima u odnosu na nove građevinske materijale. Također, reciklaža može pomoći u smanjenju troškova odlaganja otpada na deponijama i može doprinijeti boljem upravljanju resursima. U ovom radu su opisani osnovni pojmovi i načini reciklaže građevinskog otpada kao i kratak pregled reciklaže najčešće korištenih materijala kao što su asfalt, drvo, staklo, opeka i beton koji čini glavni izvor građevinskog otpada (40%-70%).

Ključne riječi: *reciklaža, recikliranje građevinskog otpada, održiva gradnja*

HYDRAULIC IMPACTS OF CONFLUENCE ANGLES: LESSONS FROM RECENT FLOOD EVENTS IN BOSNIA AND HERZEGOVINA

HIDRAULIČKI UTJECAJI UGLOVA UŠĆA: POUKE IZ NEDAVNIH POPLAVA U BOSNI I HERCEGOVINI

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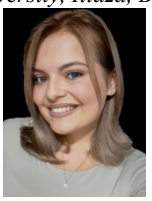
Ahmed El Sayed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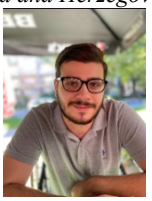
Edin Džino

ABSTRACT:
In regions where the connections between rivers or streams are made with sharp angle, the generated energy leads to flood events. In Bosnia and Herzegovina recently, fatal floods occurred that led to loss of lives and materials. Recommendations about the angle of the confluences are generally ignored, and after the occurrence of floods, the role of the connection geometry is highlighted. Additionally, extreme precipitation events with a high return period increase the possibility of floods in such areas, as well as the severity of them. The aim of this research is to investigate the impact of the confluence angle and flood occurrences. Qualitative research design is used and is based on the analysis of case studies of flood location from the last major flood event in Bosnia and Herzegovina. The evaluation criteria included the location analysis, the type of confluence, and the flood severity. Results proved that there is a direct relationship between the confluence angle and the flood frequency and severity. Key findings suggest the urban analysis of the regions of the connection in order to find solutions with slight angles of confluence, and better clear-space junctions.
Keywords: *floods, river confluence angle, backwater effects, river junctions, Bosnia and Herzegovina*

REZIME:
U regijama gdje su spojevi rijeka ili potoka formirani pod oštrim uglom, generisana energija može dovesti do poplava. U Bosni i Hercegovini su se nedavno dogodile fatalne poplave koje su rezultirale gubitkom života i materijalne štete. Preporuke u vezi s uglovima spojeva rijeka se generalno zanemaruju, a nakon pojave poplava često se ističe uloga geometrije spojeva. Osim toga, ekstremne padavine s visokim povratnim periodom povećavaju mogućnost nastanka poplava u ovakvim područjima, kao i njihovu ozbiljnost. Cilj ovog istraživanja je ispitati uticaj ugla spoja rijeka na pojavu poplava. Koristi se kvalitativni istraživački dizajn baziran na analizi studija slučaja lokacija poplava iz posljednjeg velikog poplavnog događaja u Bosni i Hercegovini. Kriteriji evaluacije uključuju analizu lokacije, tip spoja rijeka i ozbiljnost poplava. Rezultati su pokazali da postoji direktna veza između ugla spoja rijeka i učestalosti te ozbiljnosti poplava. Ključni nalazi sugeriraju urbanu analizu regija spojeva kako bi se pronašla rješenja s blagim uglovima spoja i bolje prilagođenim prostorima u njihovoj blizini.
Ključne riječi: *poplave, ušća rijeka, efektilinija uspora, spojevi rijeka, Bosna i Hercegovina.*

STRENGTH AND SUSTAINABILITY: COMPARING MECHANICAL PROPERTIES OF PHOTOCATALYTIC AND CONVENTIONAL CONCRETE

ČVRSTOĆA I ODRŽIVOST: UPOREDBA MEHANIČKIH SVOJSTAVA FOTOKATALITIČKOG I KONVENCIONALNOG BETONA

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Farah Mešanović *Sanin Džidić*

ABSTRACT:
This research paper examines the effect of titanium dioxide (TiO_2) on the compressive strength of concrete with an emphasis on the properties and functionality of photocatalytic concrete in comparison to conventional concrete. The basic ideas of photocatalytic concrete, with its advantages for the environment and aesthetics, will be briefly discussed. The study will compare photocatalytic concrete's compressive strength to that of regular concrete to evaluate its mechanical properties. The main focus of this research paper is compressive strength because it is a crucial factor in determining a concrete's capacity to support loads. Four different testing techniques will be examined and discussed in the study to assess the compressive strength of samples with different additions of percentages of titanium dioxide. Through the methodological measurement and analysis of these findings, this study seeks to clarify how titanium dioxide affects concrete's mechanical qualities. The final goal of the study is to determine whether photocatalytic concrete has a higher compressive strength than conventional concrete.
Keywords: *photocatalyst, titanium dioxide, concrete, compressive strength, NOx oxidatition*

SAŽETAK:
Ovaj istraživački rad ispituje uticaj titandioksida (TiO2) na čvrstoću betona na pritisak sa naglaskom na osobine i funkcionalnost fotokatalitičkog betona u poređenju sa konvencionalnim betonom. Glavna ideja fotokatalitičkog betona, sa svojim prednostima za okolini i estetiku bit će ukratko objašnjene. Ovo istraživanje će uporediti čvrstoću fotokatalitičkog betona na pritisak sa onom konvencionalnog betona, kako bi ocijenili njegova mehanička svojstva. Glavni fokus istraživanje jeste čvrstoća na pritisak, iz razloga što je to glavni faktor određivanja kapaciteta betona koliko opterećenje može da podnese. Četiri različita testa bit će proučena i diskutovana kako bi se procijenila čvrstoća uzoraka sa različitim procentima dodatnog titandioksida. Kroz sistematsku analizu ovih ispitivanja, rad teži otkrivanju kako titandioksid utiče na mehanička svojstva. Cilj jeste da se odredi da li fotokatalitički beton ima veću čvrstoću na pritisak od konvencionalnog betona.
Ključne riječi: *fotokatalizator, titanium dioksid, beton, čvrstoća na pritisak, NOx oksidacija*

FRICTION COEFFICIENT FOR BOLTED CONNECTIONS WITH HIGH STRENGTH M12 BOLTS ON ALUMINIUM STRUCTURES

KOEFICIJENT TRENJA KOD VIJČANIH SPOJEVA OSTVARENIH SA VV VIJCIMA M12 NA ALUMINIJSKIM KONSTRUKCIJAMA

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Emir Hodžić

Sanin Džidić

ABSTRACT:
Slip resistant bolted connections are often used in metal structures. Their application is of particulary interesting in aluminium constructions when there is need to avoid HAZ zone. Behaviour of slip-resistan connections is highly dependent on the coefficient of friction between surfaces and preloading force in bolts. The paper presents the investigation of the behaviour of the joint made of aluminium and connected with hight strength M12 bolts, and determination of the coefficient of friction for three different treatments of friction surfaces.

Keywords: *slipp connection, bolts, friction, coefficient of friction, aluminium structures*

REZIME:
Vijčani spojevi otporni na klizanje se često upotrebljavaju u metalnim konstrukcijama. Njihova primjena je posebno interesantna kod aluminijumskih konstrukcija gdje se javlja potreba izbjegavanja HAZ zone. Ponašanje vijčanih spojeva otpornih na klizanje uveliko zavisi od koeficiijenta trenja između spojenih površina i sile prednaprezanja vijka. U radu je prikazano istraživanje ponašanja spoja sa prednapregnutim vv M12 i određivanje koeficijenta trenja na tri različite obrade spojnih površina.

Ključne riječi: *spojevi otporni na klizanje, vijci, trenje, koeficijent trenja, aluminijumske konstrukcije*

INVESTIGATION OF ROBUSTNESS FOR TUNED MASS DAMPER INERTER

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Yaren Aydın


Sinan Melih Nigdeli


Gebrail Bekdaş

ABSTRACT:
Tuned mass damper inerters (TMDIs) are devices used to reduce unwanted vibrations and displacements in a structure. To maximize the effectiveness of TMDI, its parameters should be optimally adjusted. The design variables in the TMDI optimization problem are the mass (m_{tmdi}), period (T_{tmdi}), damping (c_{tmdi}) and inerter (b) of the TMDI system. TMDI's parameters affect TMDI's control performance. Uncertainty about the mass of the TMDI can have an impact on the effectiveness of the TMDI. In this study, a robust optimal design of the TMDI is proposed by taking into account the uncertainty in one of the parameters, the mass. The aim of the robustness analysis is to assess the impact of the variation of mass, one of its parameters, on the effectiveness of the TMDI. The robustness analysis is performed by connecting a TMDI to a 10-story building and using mass ratios between 5% and 20%.The effects of the obtained results on the structural displacement are analyzed. The numerical results show that an optimally designed TMDI can achieve satisfactory vibration reduction and stiffness.

Keywords: *robustness, tuned mass damper inerter, optimization, control*

DIMENSIONING OF THE RETAINING WALL USING LINEAR REGRESSION, RIDGE REGRESSION AND LASSO REGRESION

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Yaren Aydın

Gebrail Bekdaş

Sinan Melih Nigdeli

ABSTRACT:
Retaining walls are engineering structures that hold the ground at two different levels and are under the influence of lateral pressures.Since the retaining wall is a common structure, its low-cost design is preferred.Parameters such as the geometric properties of the reinforced concrete retaining wall and the presence of surcharge load are effective in retaining wall design.Since retaining walls are designed to hold slopes, calculations are important. In this study, the optimum dimensions and cost of a retaining wall were predicted using the height of the wall (H) and surcharge load (q). For this purpose, Linear Regression (LR), Ridge Regression and Lasso Regresion are used as base learners for Multioutput Regression. The results are evaluated using performance metrics such as Mean Square Error (MSE), Mean Absolute Error (MAE), Coefficient of Determination (R^2), Mean Absolute Percentage Error (MAPE). While Ridge Regresion (R^2=0.79972) and Linear Regresion (R^2=0.79979) performed similarly, Lasso Regresion performed the worst (foroptimum dimension and cost prediction of reinforced retaining wall.

Keywords: *retaining wall, optimization, machine learning, cost, prediction*

FIRE RESISTANCE ASSESSMENT OF TIMBER ELEMENTS

PROCJENA OTPORNOSTI NA POŽAR DRVENIH ELEMENATA

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[2]International BURCH University, Faculty of Engineering, Natural and Medical Sciences, Sarajevo


Sanin Džidić Omar Alfarouk Aktee

ABSTRACT:
Timber, as a sustainable and versatile construction material, has been widely used for centuries in building structures. Its natural aesthetic appeal, ease of use, and environmental benefits have made it increasingly popular in modern construction. However, a critical aspect of timber structures is their fire resistance. Wood is a combustible material, but it has certain desirable properties in terms of reaction to fire due to the charring of the outer layer, which serves as an insulator against heat penetration to the core of cross section. The focus of this research is the fire resistance of timber elements and the effect of changing the dimensions of the cross-sections on the fire resistance of these elements. This research has a quantitative approach in exploring the fire resistance of timber structures. The results found through the calculations and presented in diagrams show that the bigger the cross-section the greater the fire resistance for both beams and columns. The results also show the importance of the cross-sectional dimensions of timber elements, as well as the moment of inertia, especially for beams, in considering the fire resistance of timber elements.

Keywords: *wood, timber, beams, columns, Standard fire, fire resistance, Eurocode 5*

SAŽETAK:
Drvo, kao održiv i upotrebljiv građevinski materijal, vjekovima se značajno koristi u izgradnji građevinskih konstrukcija. Njegova prirodna estetska privlačnost, jednostavnost upotrebe i ekološke prednosti, učinili su ga popularnim i u modernoj izgradnji. Međutim, kritični aspekt drvenih konstrukcija je njihova otpornost na požar. Drvo je zapaljiv materijal, ali ima određena poželjna svojstva sa aspekta reakcije na vatru zbog ugljenisanja vanjskog sloja, koji služi kao izolator prodoru toplote u jezgro presjeka. Fokus ovog istraživanja je otpornost drvenih elemenata na požar i uticaj promjene dimenzija poprečnog presjeka na otpornost na požar drvenih elemenata. Ovo istraživanje ima kvantitativni pristup u istraživanju otpornosti na požar drvenih konstrukcija. Rezultati dobijeni proračunima i prikazani na dijagramima pokazuju da što je veći poprečni presjek tim je veća otpornost na požar kod greda i stubova. Rezultati također pokazuju značaj dimenzija poprečnog presjeka drvenih elemenata kao i momenta inercije, posebno kod greda u razmatranju otpornosti na požar drvenih elemenata.

Ključne riječi: *drvo, grede, stubovi, Standardni požar, otpornost na požar, Eurokod 5*

EXAMINATION OF THE (IN)ADEQUATE DESIGN OF FIRE EVACUATION ROUTES FOR WHEELCHAIR OCCUPANTS IN EXISTING HEALTHCARE FACILITIES

ANALIZA (NE)ADEKVATNOG PROJEKTOVANJA EVAKUACIONIH PUTEVA ZA OSOBE U INVALIDSKIM KOLICIMA U POSTOJEĆIM ZDRAVSTVENIM USTANOVAMA

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ABSTRACT:
The main aim of the research is to analyze whether the architectural design of a healthcare facility should consider the detailed design of fire escape exit routes within a healthcare facility based on the mobility level of wheelchair occupants rather than just fulfilling the existing recommendations and regulations in terms of the design of the building. For qualitative research, a case study of existing healthcare facility in Bosnia and Herzegovina is chosen. The findings demonstrated that the mobility level of wheelchair occupants who are exposed to the risk of inhaling smoke and other combustion byproducts—which can also affect occupants' ability to navigate—weren't taken into consideration during the design of the fire escape exit routes within the analyzed Building X.

Keywords: *fire escape routes, fire in a building, healthcare facilities, safe-haven*

SAŽETAK:
Glavni cilj ovog istraživanja je analizirati da li arhitektonsko projektovanje dravstvenih ustanova treba uključivati detaljno projektovanje puteva za evakuaciju u slučaju požara, uzimajući u obzir mobilnost korisnika u invalidskim kolicima, umjesto da se isključivo pridržava postojećih preporuka i propisa za projektovanje objekata. Za kvalitativno istraživanje odabrana je studija slučaja postojeće zdravstvene ustanove u BiH. Rezultati istraživanja pokazali su da prilikom projektovanja analizirane zgrade (Zgrada X) nije uzeta u obzirmobilnostkorisnika u invalidskimkolicima, koji su u riziku od udisanjadimaidrugihprodukatasagorijevanja. Ovi faktoridodatnoutičunasposobnostkorisnika da se krećukrozevakuacionerute.

Ključne riječi: put za evakuacijuodpožara, požar u zgradi, zdravstveneustanove, sigurnosneprostorije

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COMPREHENSIVE GUIDELINES AND DESIGN APPROACHES FOR INTEGRATING NEW ADDITIONS INTO HISTORIC CONTEXTS: A DETAILED LITERATURE ANALYSIS OF RELATED INTERNATIONAL CHARTERS AND STANDARDS

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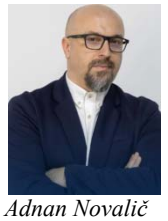
Adnan Novalič


Ahmed Elsayed

ABSTRACT:
Designing new additions to historic buildings as part of the adaptive reuse process is a nuanced and challenging task. Designers must adhere to international agreements, charters, and regulations governing preservation and conservation to ensure all interventions align with these standards. This paper aims to explore and consolidate the design principles and guidelines for creating contemporary additions to historic structures within the framework of adaptive reuse.
The research employs an in-depth analysis of relevant literature, examining studies focused on the adaptive reuse of historic buildings and the associated design processes for new additions. The findings aim to distill and highlight general principles for designing contemporary additions to historic buildings, providing a comprehensive and structured review of this critical subject.

Keywords:*New additions, Contemporary Addition, Adaptive Reuse, Heritage, Additions Design Principles.*

USABILITY OF RECYCLED CONCRETE ON THE EXAMPLE OF A WALL PANEL

ISKORISTIVOST RECIKLIRANOG BETONA NA PRIMJERU ZIDNOG PANELA

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Aida Husetić

Azra Avdagić

ABSTRACT:
The construction industry is one of the largest sources of waste. Large quantities of construction waste are generated during the construction and demolition of buildings, thus creating a burden on the environment and natural resources. Construction waste contains various types of materials such as concrete, brick, wood, and glass, which are disposed of in landfills or burned, leading to negative environmental consequences. For this reason, recycling construction waste contributes not only to the preservation of natural resources but also to the reduction of lanfill waste and carbon dioxide emissions. Recycling construction waste represents a key step in improving sustainable construction. This paper will present the basic charactersistics of ECO SANDWICH panels made from concrete with recycled aggregates, their composition, manufacturing, process, and potential applications.

Keywords: *recycled aggregate, eco sandwich panel, sustainable construction*

REZIME:
Građevinska industrija predstavlja jedan od najvećih izvora otpada. Velike količine građevinskog otpada nastaju tokom gradnje i rušenja objekata, te se na taj način stvara opterećenje za okoliš i prirodne resurse. Građevinski otpad sadrži različite vrste materijala kao što su beton, opeka, drvo, staklo koji se odlažu na deponijama ili spaljuju, što ima negativne posljedice na okoliš. Iz tog razloga, reciklaža građevinskog otpada ne doprinosi samo očuvanju prirodnih resursa, već smanjenju otpada na odlagalištima, kao i smanjenju emisije Co_2. Reciklaža građevinskog otpada predstavlja glavni korak za unaprjeđenje održive gradnje. Kroz ovaj rad će se prikazati osnovne karakteristike ECO-SANDWICH panela koji se dobijaju od betona sa recikliranim agregatom, njihov sastav, proces prizvodnje, te mogućnosti primjene istog.

Ključne riječi: *reciklirani agregat, eco-sandwich panel, održiva gradnja*

THE INFLUENCE OF MULTIPLE FACTORS ON THE SELECTION OF STRUCTURAL SYSTEM IN THE DESIGN, CONSTRUCTION AND LIFE CYCLE OF HIGH-RISE BUILDINGS

UTICAJ VIŠE FAKTORA NA IZBOR KONSTRUKTIVNOG SISTEMA U PROJEKTOVANJU, IZGRADNJI I ŽIVOTNOM CIKULU VISOKIH ZGRADA

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Sanin Džidić

ABSTRACT:
There are many variables that influence the choice of structure of a characteristic building. In this dissertation, a qualitative comparative method was used to analyze the construction of a high-rise building whose character is residential, and which was constructed in three different ways and from three different types of structures: reinforced concrete, steel and composite steel and concrete structures. Structural software ETABS is used for modeling and analysis of structural elements. All structural elements are designed according to Eurocodes with regard to all possible combinations of actions. In this dissertation, selected structural systems for different types of materials were applied according to the recommendations of the reviewed literature. ...

Keywords: *Structural systems, Tall buildings, Structural material, Gravity loads, Variable actions, Lateral actions, High-rise structures, Seismic and Wind – resistant systems, Corrosion, Fire resistance, Maintenance, Progressive collapse.*

SAŽETAK:
Mnogo je varijabli koje utječu na izbor konstrukcije neke karakteristične zgrade. U ovoj disertaciji kvalitativnom komparativnom metodom analizirana je konstrukcija visoke zgrade čiji je karakter stambeni, a koja je građena na tri različita načina i od tri različite vrste konstrukcija: armiranobetonska, čelična i kompozitna – čelično-betonska konstrukcija. Za modeliranje i analizu elemenata konstrukcijekoristi se softver ETABS. Svi elementi konstrukcije su projektovani prema Evrokodovima s obzirom na sve moguće kombinacije dejstava. U ovoj disertaciji primijenjeni su odabrani sistemi konstrukcije za različite vrste materijala prema preporukama recenzirane literature. ...

Ključne riječi: *Konstruktivni sistemi, Visoke zgrade, Konstrukcijski materijal, Gravitaciono opterećenje, Promenljiva dejstva, Bočna dejstva, Visoke konstrukcije, Sistemi otporni na seizmiku i vjetar, Korozija, Otpornost na požar, Održavanje, Progresivno urušavanje*

GLULAM BEAMS STRENGTHENED WITH FRP STRIPES - EXPERIMENTAL STUDY

LIJEPLJENO LAMELIRANE GREDE OJAČANE SA FRP TRAKAMA – EKSPERIMENTALNA STUDIJA

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Azra Mahinić Vrce


Fuad Ćatović

ABSTRACT:
The enhancement of mechanical properties in existing timber structures is becoming increasingly common. Numerous studies have explored the use of FRP materials as reinforcement in timber construction. FRP has gained prominence due to its lightweight nature and exceptional mechanical performance, particularly in terms of strength and stiffness. The choice of reinforcing material in timber structures is significantly influenced by the type of fibres used in the composite material. Currently, the market offers FRP materials made from synthetic fibres, natural fibres, and more recently, hybrid fibres, which combine both types. In this paper is presented experimental program of reinforced glulam beams with CFRP stripes. Glulam beams were manufactured in Bosnia and Herzegovina at Krivaja Zavidovići. CFRP reinforcement percentage was 0,78%. The result that was obtained by this research show increment in load bearing capacity by 67,84%.

Keywords: *timber, FRP reinforcement, stiffness, load-bearing capacity, glulam*

REZIME:
Poboljšanje mehaničkih karakteristika postojećih drvenih konstrukcija postaje sve češće. Brojne studije su istraživale upotrebu FRP materijala kao ojačanja u drvenim konstrukcijama. FRP je dobio na značaju zbog svoje lagane prirode i izuzetnih mehaničkih performansi, posebno u pogledu nosivosti i krutosti. Na izbor materijala za ojačanje u drvenim konstrukcijama značajno utiče vrsta vlakana koja se koriste u kompozitnom materijalu. Trenutno tržište nudi FRP materijale napravljene od sintetičkih vlakana, prirodnih vlakana, a odnedavno i hibridnih vlakana, koja kombinuju obje vrste. U ovom radu je prikazan eksperimentalni program ojačanja lijepljeno lameliranig greda sa CFRP trakama. Lijepljeno lamelirane grede su proizvedene u Bosni i Hercegovini u Krivaji Zavidovići. Postotak ojačanja CFRP-om bio je 0,78%. Rezultati koji su dobijeni ovim istraživanjem pokazuju povećanje nosivosti za 67,84%.

Ključne riječi: *drvo,FRP ojačanje,krutost, nosivost, lijepljeno lamelirano drvo*

APPLICATION OF DIFFERENT CONSTITUTIVE SOIL MODELS TO SOIL SETTLEMENT UNDER EMBANKMENT

PRIMJENA RAZLIČITIH KONSTITUTIVNIH MODELA TLA NA SLIJEGANJE TLA ISPOD NASIPA

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Amir Ačkar


Azra Špago

ABSTRACT:
The paper considers the application of different constitutive soil models to soil settlement in the road body. It also compares settlement results obtained by software analysis, with the value of settlement measured by geodetic instruments during the exploitation of the road. The software analysis was carried out in softwares based on the FEM for 5 different constitutive soil models: Linear elastic, Mohr-Coulomb, Drucker-Prager, Hardening soil model and Hardening soil model with small strain stiffness. The analysis of soils behavior from examples with and without plasticity activation is presented.Geodetic measurements were carried out on a benchmarks installed at the top and in the foot of the embankmentin the periods after the construction of the embankment as an initial measurement, and during exploitation of 4 months, 19 months and 56 months.The basics of the finite element method, as well as the 5 mentioned constitutive soil models, are also given.

Keywords: *constitutive soil models, soil settlement, finite element method, geodetic measurements*

REZIME:
U radu se razmatra primjena različitih konstitutivnih modela tla na slijeganje tla u trupu ceste. Uspoređuju se i rezultati slijeganja dobiveni softverskom analizom sa geodetski izmjerenim vrijednostima slijeganja tokom eksploatacije ceste. Softverska analiza je provedena u softverima baziranim na MKE-a za 5 različitih konstitutivnih modela tla: linearno elastični, Mohr-Coulomb, Drucker-Prager, model očvršćavajućeg tla i model očvršćavajućeg tlapri malim deformacijama. Prikazana je analiza ponašanja tla iz primjera sa i bez aktivacije plastičnosti. Geodetska mjerenja su izvršena na reperima ugrađenim na kruni i u nožici nasipau periodima nakon izgradnje nasipa kao početno mjerenje, te u toku eksploatacije od 4 mjeseca, 19 mjeseci i 56 mjeseci. Date su i osnove metode konačnih elemenata, kao i 5 spomenutih konstitutivnih modela tla.

Ključne riječi: *konstitutivni modeli tla, slijeganje tla, metoda konačnih elemenata, geodetska mjerenja.*

DISTRIBUTION OF SHRINKAGE AND SWELLING DEFORMATIONS ON CONCRETE INTERFACES

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Hanna Zinchenko


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Volodymyr Tigariev

ABSTRACT:
This paper presents the results of study of distribution of shrinkage and swelling deformations on concrete interfaces. The conducted studies of composite materials have shown that regardless of the mechanisms occurring at different levels of structural inhomogeneities, what is common to composites is the formation of internal interfaces capable of transforming into cracks with increasing loads and impacts. Such cracks are classified as hereditary or technological, present in the material of structures or products before operational loads and impacts are applied to them. Of interest is the distribution of shrinkage and swelling deformations in materials with technological cracks, as well as their influence on the deformation characteristics of concrete and on resistance under low-cycle fatigue loading conditions. It should be noted that the formation and development of technological cracks at the macro level is determined by technological cracks at the micro level. This made it possible to qualitatively assess the change in damage to concrete and structures, as well as to propose a method that takes into account the deformation of concrete containing technological and operational cracks in its structure.
It is necessary to study the mechanism of the origin and development of initial cracks under the action of alternating loads, the mechanism of fatigue growth of technological cracks under alternating volumetric swelling deformations and during a cycle of decreasing volume of the material, as well as under the action of different shrinkage deformations on its edges. It is important to study the influence of initial damage on the nature and kinetics of development of operational cracks. Therefore, the study of the transformation of technological cracks into operational cracks under the action of low-cycle loads in concrete products and structures is of particular relevance.

Keywords: *composite material, interface, deformation, shrinkage, swelling, cracks*

GLASS PERFORMANCE AT ELEVATED TEMPERATURES

PONAŠANJE STAKLA NA POVIŠENIM TEMPERATURAMA

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Sanin Džidić


Ilhana Sinanović

ABSTRACT:
This paper examines glass's properties, its manufacturing process, types, and specific behavior under high temperatures, particularly in fire situations. Glass, an amorphous and generally non-combustible material, reacts to fire in complex ways, depending on its type. Fire-resistant glass types, such as tempered, wired, and laminated, are designed to withstand high temperatures for specific durations, useful in fire barriers. Fire-rated glass can endure high heat without immediate breaking, thus enhancing building safety. The paper also discusses theoretical and experimental studies exploring glass cracking and breaking patterns in fire, showing how varying heat flux and structural factors impact glass failure. It highlights thermal expansion, color shift, thermal stress, and devitrification as common responses of glass to heat, with double-glazed and laminated glass showing better fire resistance.

Keywords: *glass, reaction to fire, fire-resistant, elevated temperature*

SAŽETAK:
U ovom radu se razmatraju svojstva stakla, proizvodni procesi, vrste i specifično ponašanje stakla pri visokim temperaturama, posebno u situacijama požara. Staklo koje je amorfan i općenito nezapaljiv materijal, reagira na vatru na složene načine, ovisno o svojoj vrsti. Tipovi požarno otpornog stakla, kao što su kaljeno, armirano i laminirano, predviđeni su da izdrže visoke temperature u određenom trajanju, što je korisno posebno kod protupožarnih barijera. Požarno-otporno staklo može izdržati visoku toplotu bez momentalnog loma, čime se povećava sigurnost objekta. U radu se također razmatraju teorijske i eksperimentalne studije koje istražuju pucanje stakla i obrasce loma u požaru, pokazujući kako različiti toplotni fluksi i konstruktivni faktori utiču na lom stakla. Ovaj rad naglašava i razmatra toplotno širenje, promjenu boje, termički stres i devitrifikaciju kao uobičajene reakcije stakla na toplotu, pri čemu dvostruko staklo i laminirano staklo pokazuju bolju otpornost na požar.

Ključne riječi: *staklo, reakcija na vatru, otpornost na požar, povišena temperatura*

Autors Index – Indeks autora

SOCIETY FOR ROBOTICS OF BOSNIA AND HERZEGOVINA

The Society for Robotics has years of experience in education and training of personnel in Bosnia and Herzegovina. The Society for Robotics is working to increase the role of knowledge in Bosnia and Herzegovina, and thus to influence the positioning of Bosnia and Herzegovina as high as possible on an innovative scale in Europe and the world. The role of the Society for Robotics is to encourage the development of science and technology, as well as to increase their contribution to the development of society, with the widest possible application of new knowledge and new technologies. Thus, it aims to encourage the transformation of Bosnian-Herzegovinian society into a modern knowledge-based society. For these reasons, the objectives of the Society for Robotics are: scientific and technical research in the field of robotics and robotic systems; education and improvement of education in robotics, robotic systems and mechatronics; application of robots and robotic systems in the industry; establishment of laboratories for education and knowledge transfer; establishment of centers for robotics and robotic systems at universities, secondary and vocational schools; innovators in the wider field of robotic systems conducting various activities; organizing scientific and professional conferences in the country and abroad; having innovators in the field of robotics, robotic systems and mechatronics organize exhibitions; cooperation with similar societies abroad. Activities of the Society for Robotics are the following: gathering scientists, researchers, engineers, teachers and students who work in all areas of robotics; publishing and encouraging the publication of monographs, textbooks, journals and other publications in the field of robotics; helping teachers to introduce new ideas and modern methods in teaching robotics; organizing congresses, conferences, symposia, seminars, and other scientific meetings of scientists and engineers; cooperation with similar professional organizations in the country, international societies and associations; popularization and dissemination of knowledge, as well as training and assistance in the training of scientific novices and researchers.

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DRUŠTVO ZA ROBOTIKU U BOSNI I HERCEGOVINI

Društvo za robotiku ima višegodišnje iskustvo u edukaciji i obrazovanju kadrova u Bosni i Hercegovini. Društvo za robotiku radi na tome da poveća ulogu znanja u Bosni i Hercegovini, a samim tim da utiče na pozicioniranje Bosne I Hercegovine na što više mjesto na inovativnoj skali u Evropi i svijetu. Uloga Društva za robotiku je da postiče razvoj nauke i tehnologije , te poveća njihov doprinos razvoju društva, uz najveću moguću primjenu novih znanja i novih tehnologija, i da na taj način podstakne transformaciju bosanskohercegovačkog društva u moderno društvo temeljno na znanju. Zbog navedenih razloga ciljevi Društva za robotiku su slijedeći: naučno-stručna istraživanja u oblasti robotike i robotskih sistema, edukacija i unapređenje obrazovanja iz robotike, robotskih sistema i mehatronike, aplikacija robota i robotskih sistema u industriji, formiranje laboratorija za edukaciju i transfer znanja, formiranje centara za robotiku i robotskih sistema na univerzitetima, srednjim i stručnim školama, održavanje aktivnosti inovatora iz šire oblasti robotskih sistema, organiziranje naučno-stručnih skupova u zemlji i inostranstvu, organiziranje izložbi inovatora iz oblasti robotike, robotskih sistema i mehatronike, saradnja sa sličnim društvima u inozemstvu. Djelatnosti Društva za robotiku su slijedeće: okupljanje naučnika, istraživača, inženjera, nastavnika, studenata i učenika koji rade u svim područjima robotike, objavljivanje i poticanje objavljivanja monografija, udžbenika, časopisa i ostalih publikacija u području robotike, pomaganje nastavnicima u uvođenju novih ideja i modernih metoda u nastavi robotike, organiziranje kongresa, konferencija, simpozijuma i seminara te ostalih naučnih okupljanja naučnika i inženjera, surađivanje sa sličnim stručnim organizacijama u zemlji, surađivanje sa sličnim međunarodnim društvima i savezima društva, populariziranje i širenje znanja kao i izobrazba i pomoć u izobrazbi znanstvenih novaka i istraživača.

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Proceedings of the International Conference on New Technologies, Development and Application,
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BALKAN SOCIETY of TEXTILE ENGINEERS

https://sites.google.com/view/baste/

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- We consider knowledge to be the greatest value of any society.
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- We promote and support knowledge competitions with the best.
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- Our service is dedicated to children and society, wholeheartedly

Core Purpose

The purpose is to enhance children's competencies by elevating the status of teachers and strengthening functional knowledge.

Envisioned Future (BHAG)

Our imperative is to ensure that by 2028, every child in Bosnia and Herzegovina experiences a brilliant childhood in excellent kindergartens. Simultaneously, we strive for every student to shine with functional literacy by 2040, and for our country to secure a place among the top 20 according to relevant international standards of functional knowledge, such as the PISA tests.

Vivid Descriptions

Setting the goal for all high school students in Bosnia and Herzegovina to achieve functional literacy by 2040 represents an ambitious plan with a key focus on education as the foundation for societal development. This objective not only promotes individual student success but also enhances the overall competitiveness of the country on the international stage. Developing functional literacy entails creating a generation of young individuals capable of applying their knowledge in real-life situations, solving complex problems, and contributing to societal innovations.

The indicators that will track progress toward achieving this goal include:

- Availability of Excellent Kindergartens: Monitoring the number and distribution of high-quality kindergartens across the country to ensure that every child, regardless of location, has access to top-notch preschool education;
- Child Participation in Preschool Education: Tracking the percentage of children actively participating in preschool education programs up to the age of six, with a special emphasis on inclusivity and equal opportunities for all;
- Program Quality Excellence: Monitoring quality standards in preschool institutions, including not only educational methods and teacher expertise but also infrastructure conditions that support holistic child development in line with global best practices;
- Social Inclusion: Monitoring progress in achieving inclusive approaches to preschool education, ensuring that children, teachers, parents, and society as a whole are fully integrated into the educational environment;
- Parent Collaboration: Developing programs and practices that encourage collaboration between kindergartens, parents, and local communities, ensuring continuous parental support in their children's education and development;
- PISA Tests: Monitoring students' performance on PISA tests with the aim of gaining an objective insight into their abilities in reading, mathematics, and science. Additionally, tracking Bosnia and Herzegovina's position on the global education scale, which includes criteria such as teaching quality, educational access, and student outcomes, provides a comprehensive overview of the educational system's success;
- Student Success in Continuing Education: Monitoring the percentage of students who successfully complete high school education and continue further studies or secure successful employment in relevant sectors;
- Innovations in Teaching: Supporting and monitoring the development of innovative teaching methods, introducing new technologies, and adapting the curriculum to make all of the above possible. This goal is set with the intention of creating an educated society that will be a cornerstone for Bosnia and Herzegovina's economic and social development.

Olimpijada znanja FONDACIJA

FOUNDATION 'OLYMPIAD OF KNOWLEDGE'
https://olimpijadaznanja.ba/

VIZIJA FONDACIJE „OLIMPIJADA ZNANJA“

Ključne vrijednosti

Znanje držimo za najveću vrijednost jednog društva. Podstičemo i tragamo za kreativnošću i inovacijama u izgradnji i dijeljenju znanja. Promoviramo i podržavamo natjecanje u znanju s najboljima. Njegujemo poštenje i integritet. Služimo djeci i društvu sa srcem

Svrha

Unapređivanje kompetencija djece kroz podizanje statusa učitelja i jačanje funkcionalnog znanja.

Strateški izazov

Naš imperativ je do 2028. osigurati svakom djetetu u Bosni i Hercegovini blistavo djetinjstvo u izvrsnim vrtićima, istovremeno težeći da do 2040. svaki učenik svijetli funkcionalnom pismenošću, a naša zemlja zauzme mjesto među 20 najboljih prema relevantnim međunarodnim standardima funkcionalnog znanja, poput PISA testova.

Živopisni prikaz – šta to zapravo znači

Postavljanje cilja da svi srednjoškolci u Bosni i Hercegovini postignu funkcionalnu pismenost do 2040. godine predstavlja ambiciozan plan s ključnim fokusom na obrazovanje kao temelju razvoja društva. Ovaj cilj ne samo da promovira pojedinačni uspjeh učenika, već i ukupnu konkurentnost zemlje na međunarodnoj razini. Razvijanje funkcionalne pismenosti podrazumijeva stvaranje generacije mladih koji su sposobni primijeniti svoje znanje u stvarnom životu, rješavati kompleksne probleme i pridonositi inovacijama u društvu.

Indikatori kroz koje će se pratiti napredak prema postizanju ovog cilja uključuju:

- **dostupnost izvrsnih vrtića**: praćenje broja i rasprostranjenosti visokokvalitetnih vrtića diljem zemlje kako bi se osiguralo da svako dijete, neovisno o lokaciji, ima pristup vrhunskom predškolskom obrazovanju;
- **participacija djece u predškolskom obrazovanju**: praćenje postotka djece koja aktivno sudjeluju u programima predškolskog obrazovanja do dobi od šest godina, s posebnim naglaskom na inkluzivnosti i osiguravanju jednakih prilika za sve;
- **vrhunska kvaliteta programa**: praćenje standarda kvalitete u predškolskim ustanovama, uključujući ne samo edukativne metode i stručnost odgajatelja, već i infrastrukturne uslove koji podržavaju holistički razvoj djece u skladu sa najboljim svjetskim praksama;
- **socijalna inkluzija**: praćenje napretka u ostvarivanju inkluzivnih pristupa predškolskom obrazovanju, osiguravajući da su djeca, učitelji, roditelji, i društvo u cjelini, u potpunosti integrirani u obrazovno okruženje;
- **saradnja s roditeljima**: razvoj programa i praksi koji potiču saradnju između vrtića, roditelja i lokalne zajednice, osiguravajući kontinuiranu podršku roditelja u obrazovanju i razvoju svoje djece;
- **PISA testovi**: praćenje rezultata učenika na PISA testovima s ciljem sticanja objektivnog uvida u njihove sposobnosti u čitanju, matematici i nauci, i praćenja pozicije Bosne i Hercegovine na globalnoj ljestvici obrazovanja, koja uključuje kriterije kao što su kvaliteta nastave, pristup obrazovanju i rezultate učenika, te pruža cjelovit pregled uspješnosti obrazovnog sistema.
- **uspješnost učenika u nastavku školovanja**: praćenje postotka učenika koji uspješno završavaju srednjoškolsko obrazovanje i nastavljaju dalje školovanje ili se uspješno zapošljavaju u relevantnim sektorima;
- **inovacije u nastavi**: podupiranje i praćenje razvoja inovativnih metoda podučavanja, uvođenje novih tehnologija i prilagodbe nastavnog plana i programa kako bi sve gore navedeno bilo moguće. Ovaj cilj postavljen je s namjerom stvaranja obrazovanog društva koje će biti oslonac za ekonomski i društveni razvoj Bosne i Hercegovine


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