SOCIETY FOR ROBOTICS OF BOSNIA AND HERZEGOVINA
9th International Conference
„NEW TECHNOLOGIES, DEVELOPMENT AND APPLICATION" NT-2023
ISSN 2303-7512

NT-2023

NEW TECHNOLOGIES DEVELOPMENT AND APPLICATION

NOVE TEHNOLOGIJE RAZVOJ I PRIMJENA

BOOK OF ABSTRACTS
KNJIGA SAŽETAKA

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

Sarajevo
Bosnia and Herzegovina
22nd-24th June 2023
NT-IX, Br-IX

Sarajevo
Bosna i Hercegovina
22.-24. Juna 2023
NT-IX, Br-IX

ACADEMY OF SCIENCES AND ARTS OF BOSNIA AND HERZEGOVINA
SOCIETY FOR ROBOTICS OF BOSNIA AND HERZEGOVINA
“DŽEMAL BIJEDIĆ” UNIVERSITY OF MOSTAR
UNIVERSITY OF SARAJEVO
UNIVERSITY OF TUZLA
UNIVERSITY OF ZENICA
SARAJEVO SCHOOL OF SCIENCE AND TECHNOLOGY
INTERNATIONAL UNIVERSTY OF SARAJEVO
INTERNATIONAL BURCH UNIVERSITY OF SARAJEVO
FOREIGN TRADE CHAMBER OF BOSNIA AND HERZEGOVINA
INTERNATIONAL ASSOCIATION FOR TECHNOLOGICAL DEVELOPMENT AND INNOVATIONS UKRAINA
TECHNOLOGY PARK “INTERA” OF MOSTAR

AKADEMIJA NAUKA I UMJETNOSTI BOSNE I HERCEGOVINE
DRUŠTVO ZA ROBOTIKU U BOSNI I HERCEGOVINI
“DŽEMAL BIJEDIĆ” UNIVERZITET U MOSTARU
UNIVERZITET U SARAJEVU
UNIVERZITET U TUZLI
UNIVERZITET U ZENICI
SARAJEVSKA ŠKOLA ZA NAUKU I TEHNOLOGIJU
INTERNACIONALNI UNIVERZITET U SARAJEVU
INTERNACIONALNI BURCH UNIVERZITET U SARAJEVU
VANJSKOTRGOVINSKA KOMORA BOSNE I HERCEGOVINE
INTERNACIONALNO UDRUŽENJE ZA TEHNOLOŠKI RAZVOJ I INOVACIJE UKRAINA
TEHNOLOŠKI PARK “INTERA” U MOSTAR

BOOK OF ABSTRACTS
KNJIGA SAŽETAKA

”NT-2023“

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

Sarajevo, Bosnia and Herzegovina, 22nd-24th June 2023, NT-IX, Br-IX.
Sarajevo, Bosna i Hercegovina, 22-24. juna, 2023., NT-IX, Br-IX.

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

BOOK OF ABSTRACTS – KNJIGA SAŽETAKA

Organizer / Organizator:
SOCIETY FOR ROBOTICS OF B&H - Društvo za robotiku u Bosni i Hercegovini

Co-organizers / Suorganizatori:
UNIVERSITY "DŽEMAL BIJEDIĆ" OF MOSTAR / Univerzitet "Džemal Bijedić" u Mostaru
UNIVERSITY OF SARAJEVO/Univerzitet u Sarajevu
UNIVERSITY OF TUZLA/ Univerzitet u Tuzli
UNIVERSITY OF ZENICA/ Univerzitet u Zenici
SARAJEVO SCHOOL OF SCIENCE AND TECHNOLOGY/Sarajevska škola za nauku i tehnologiju
INTERNATIONAL UNIVERSTY OF SARAJEVO/Internacionalni Univerzitet u Sarajevu
INTERNATIONAL BURCH UNIVERSTY OF SARAJEVO/Internacionalni Burch Univerzitet u Sarajevu
FOREIGN TRADE CHAMBER OF BOSNIA AND HERZEGOVINA/Vanjskotrgovinska komora u BiH
INTERNATIONAL ASSOCIATION FOR TECHNOLOGICAL DEVELOPMENT AND INNOVATIONS UKRAINA/Internacionalno udruženje za tehnološki razvoj i inovacije Ukraina
TECHNOLOGY PARK "INTERA" OF MOSTAR / Tehnološki park "INTERA" u Mostaru

Sponsors / Pokrovitelj
ACADEMY OF SCIENCES AND ARTS OF BOSNIA AND HERZEGOVINA
AKADEMIJA NAUKA I UMJETNOSTI BOSNE I HERCEGOVINE

Address - Adresa:
SOCIETY FOR ROBOTICS OF B&H - Društvo za robotiku u Bosni i Hercegovini
St. Petog korpusa br.3
77000 BIHAĆ, BOSNIA and HERZEGOVINA
E-mail:ic.newtech@gmail.com
www.icnt.ba

Technical editors - Tehnički urednici:
Prof. Isak Karabegović, PhD
Prof. Mehmed Mahmić, PhD
Prof. Ermin Husak, PhD

ISSN: 2303-7512
Printed/Štamparija:
Fojnica d.o.o.
Printing/Tiraž: 180 primjeraka

Sarajevo, 22nd-24th June 2023 / Sarajevo, 22 - 24. juni 2023.

Sponsors/Pokrovitelji

MINISTARSTVO CIVILNIH POSLOVA
BOSNE I HERCEGOVINE

VLADA
FEDERACIJE BOSNE I HERCEGOVINE

AKADEMIJA NAUKA I UMJETNOSTI
BOSNE I HERCEGOVINE

FEDERALNO MINISTARSTVO OBRAZOVANJA I NAUKE
BOSNE I HERCEGOVINE

FEDERALNO MINISTARSTVO ENERGIJE,RUDARSTVA I
INDUSTRIJE BOSNE I HERCEGOVINE

VANJSKOTRGOVINSKA /SPOLJNOTRGOVINSKA KOMORA
BOSNE I HERCEGOVINE

PRIVREDNA-GOSPODARSKA KOMORA
FEDERACIJE BOSNE I HERCEGOVINE

GRAD BIHAĆ

NACIONALNI PARK UNA

BH TELEKOM

KULA GRADAČAC
INDUSTRIJA MODNE KONFEKCIJE

„RAUSK“ RAZVOJNA AGENCIJA USK

INTERA TEHNOLOŠKI PARK MOSTAR

INTERNACIONALNO UDRUŽENJE ZA TEHNOLOŠKI
RAZVOJ I INOVACIJE UKRAINA

ACADEMY OF SCIENCES AND ARTS OF BOSNIA AND HERZEGOVINA
AKADEMINA NAUKA I UMJETNOSTI BOSNE I HERCEGOVINE

SOCIETY FOR ROBOTICS OF BOSNIA AND HERZEGOVINA
DRUŠTVO ZA ROBOTIKU U BOSNI I HERCEGOVINI

UNIVERSITY OF MOSTAR “DŽEMAL BIJEDIĆ”
UNIVERZITET “DŽEMAL BIJEDIĆ” U MOSTARU

UNIVERSITY OF TUZLA
UNIVERZITET U TUZLI

UNIVERSITY OF SARAJEVO
UNIVERZITET U SARAJEVU

UNIVERSITY OF ZENICA
UNIVERZITET U ZENICI

SARAJEVO SCHOOL OF SCIENCE AND TECHNOLOGY
SARAJEVSKA ŠKOLA ZA NAUKU I TEHNOLOGIJU

INTERNATIONAL UNIVERSITY OF SARAJEVO
INTERNACIONALNI UNIVERZITET U SARAJEVU

INTERNATIONAL BURCH UNIVERSITY OF SARAJEVO
INTERNACIONALNI BURCH UNIVERZITET U SARAJEVU

FOREIGN TRADE CHAMBER OF BOSNIA AND HERZEGOVINA
VANJSKOTRGOVINSKA KOMORA BOSNE I HERCEGOVINE

INTERNATIONAL ASSOCIATION FOR TECHNOLOGICAL DEVELOPMENTAND INNOVATIONS UKRAINA
INTERNACIONALNO UDRUŽENJE ZA TEHNOLOŠKI RAZVOJ I INOVACIJE UKRAINA

TECHNOLOGY PARK “INTERA” OF MOSTAR
TEHNOLOŠKI PARK “INTERA” U MOSTARU

NEW TECHNOLOGIES - DEVELOPMENT AND APPLICATION „NT-2023“

Word of the organizers

We are aware of a different problems that the contamporary economy suffer. Research capacities are limited and infrastructure is poorly developed. Companies fall in using the contemporary knowledge and specialization, rarely promote innovation and commercialization, poorly manage research facilities and technology transfer. All this ultimately leads to their inadequate capacities to meet market demands, as well as lagging in a regional development and a low competitiveness. The organizers are going to prepare the series of free seminars, conferences and round tables for the economy, small and medium enterprises, with the goal to introduce new capacities and the possibilities of the technology development. Thus the organizers want to encourage technology transfer, development projects and innovative work, as well as develop awareness of the importance of intellectual property protection. In a product development, from concept to its production, a key element in achieving market success, is time. With ever stringent market requirements, the trends in increasing product individualization (personalization) become more obvious, and there are fewer products of mass consumption. Alternative solutions in production are increasingly being used to meet such conditions in the development and production. The organizers' intention is to introduce new methods and technologies to our market, as well as to inform the engineers, designers, contractors and investors about the possibilities and advantages of new methods and technologies, as well as products in their technical and financial form. The aim is to bring closer new 21st century technologies, that are in use in developed countries, to professional public in above mentioned conferences, seminars and round tables. With their development trends and achievements, new technologies can contribute to the development of both small and medium-sized enterprises and large companies, and thus to develop the local community in which they operate. The goals of conferences, seminars and round tables is that manufacturing companies as well as research and development institutions become more familiar with the latest technical and technological achievements in the field of new technologies used in the 21st century.

Sarajevo, 12th May 2023 *THE ORGANIZERS*

NOVE TEHNOLOGIJE - RAZVOJ I PRIMJENA „NT-2023“

Uvodna riječ organizatora

Uočili smo veliki problem današnjeg gospodarstva. Istraživački su kapaciteti ograničeni, infrastruktura slabo razvijena, kompanije zaostaju za suvremenim znanjem i specijalizacijama, rijetko promoviraju inovacije i komercijalizacije, slabo se upravlja istraživačkim kapacitetima i transferom tehnologija, što u konačnici dovodi do neadekvatnih kapaciteta kompanija za odgovor na zahtjeve tržišta, zaostajanja u regionalnom razvoju i niskoj konkurentnosti. Organizatori pripremaju seriju besplatnih seminara, konferencija i okruglih stolova za privredu, mala i srednja poduzeća, na kojima ih žele upoznati s novim kapacitetima i mogućnostima koje nude. Time također žele potaknuti transfer tehnologije, razvojne projekte, inovativni rad i razviti svijest o važnosti zaštite intelektualnog vlasništva. Pri razvoju proizvoda, od ideje do njegove proizvodnje, ključni element u postizanju uspjeha na tržištu je vrijeme. Uz sve oštrije zahtjeve tržišta, očitiji su i trendovi u porastu individualizacije (personalizacije) proizvoda, a sve je manje proizvoda masovne potrošnje. Kako bi se udovoljilo takvim uvjetima pri razvoju i proizvodnji, sve se više primjenjuju alternativna rješenja u proizvodnji. Namjera je organizatora približiti nove metode i tehnologije našem tržištu i upoznati inženjere, projektante, izvođače, te investitore o mogućnostima i prednostima novih metoda i tehnologija, kao i proizvoda u njihovom tehničkom i financijskom obliku. Stručnoj javnosti ovakvim konferencijama, seminarima i okruglim stolovima želimo približiti nove tehnologije 21. stoljeća koje su u upotrebi u razvijenim zemljama u svijetu. Nove tehnologije svojim trendovima razvoja i dostignućima mogu doprinijeti razvoju kako malih i srednjih poduzeća, tako i velikih kompanija, te na taj način razviti lokalnu zajednicu u kojoj djeluju. Ciljevi konferencija, seminara i okruglih stolova će biti takvi da proizvodnim tvrtkama i razvojno-istraživačkim institucijama približe najnovija tehničko-tehnološka dostignuća na području novih tehnologija koje se koriste u 21. stoljeću.

Sarajevo, 12. maj, 2023. god. *ORGANIZATORI*

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, 12th May 2023 *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, 12. maj, 2023.god. *ORGANIZATORI*

INTERNATIONAL ORGANIZIRING COMMITTEE
INTERNACIONALNI NAUČNI/ZNANSTVENI ODBOR

Ahmed Kovačević, City University London, United Kingdom, President
Zijo Pašić, *ANU BiH, BA*
Ejup Ganić*, ANU BiH,University of Sarajevo School of Science and Technology, BA*
Asif Šabanović*, ANU BiH*
Vitali Ivanov, *Sumy State University, UK*
Đorđe Jovanović*, University of Podgorica,MNE*
Miran Brezočnik*, University of Maribor, SI*
Mehmet Zeyrek*, Middle East Tecnical University Ankara, TR*
Sadko Mandžuka,*University of Zagreb, HR*
Vidmantas Nenorta*, University of Kaunas, LN*
Želimir Husnić*, The Boeing Company, USA*

SCIENTIFIC COMMITTEE
NAUČNI / ZNANSTVENI ODBOR

Sadko Mandžuka, University of Zagreb, HR, President
Pašić Z. (BA), Hanjalić K. (BA), Karabegović I. (BA), Muhamad M. Rafi (PAK), Pašić S. (BA), Kovačević A. (UK), Ćatović F. (BA), Jovanović Đ. (MNE), Dukić H. (BA), Brezočnik M. (SI), Rogić M. (BA), Bazaras Ž. (LN) ,Obad M.(BA),Gotlih K.(SI), Bajić D. (MNE), Daunuys M. (LN), Duket K.E. (USA), Voloder A. (BA), Isić S. (BA), Rezić S. (BA) ,Jecić S. (HR), Kahn R.A.(BAG), Jovanović O. (MNE), Nožić M. (BA), Čohodar M. (BA), Tiro D.(BA), Dašić P. (SRB), Galović A. (HR), Ekinović S. (BA), Karabegović E. (BA), Husak E. (BA), Muhić Š. (DK), Natraveli A. (USA), Vojić S. (BA), Mahmić M. (BA), Kulenović M. (BA), Bašić H. (BA), Stojkić Ž. (BA), Denjo D. (BA), Hajro I. (BA), Stefanović M. (SRB), Pašagić H. (HR), Vučina A. (BA), Avdaković S. (BA), Jelačić Z. (BA), Kothari V.K. (IND), Mićević D. (SRB), Niderer P. (SW), Vitez I. (HR), Vukojević D. (BA), Zhang D. (USA), Kecshkmethy A. (DE), Luximon A. (HK), Plančak M. (SRB), Stefanović M. (SRB), Krezić D. (BA), Singh R.P. (IN), Bekto E. (BA), Kovačević S. (HR), Balić J. (SI), Sokolović M. (SI), Zaimović-Uzunović N. (BA), Delalić Z. (BA), Alibabić V. (BA), Hadžikadić M. (USA), Hodžić E. (USA), Dizdar G. (USA), Srkalović G. (USA), Zlatar M. (BA), Žigić I. (BA), Golubović D. (BA), Salah.E.O. (SUD), Lee J.S. (KR), Sing R.P. (IN), Costa F.S. (PR), Zečić Dž. (BA), Badnjević A. (BA), Kevrić J. (BA), Jokić D. (BA), Havziefendić J. (BA), Halilbegović S. (BA), Čekić A. (BA), Calautit J.K. (UK), Mirjanić D. (BA), Tešnjak S. (HR), Brdarević S. (BA), Sprečić D. (BA), Jovanović J. (MNE), Yang X.J. (CN), Diby P. (SK), Tokić A. (BA), Veljović Z. (MNE), Jovanović A. (MNE), Rahul M. (USA), Džonlagić N. (BA), Waleed K.A. (UAE), Savičević S. (MNE), Posavljak S. (BA), Mirjanić-Markuš M. (MNE), Parwadi M. (ID), Amir Maher S.L. (UK), Milovanović M. (SRB), Nikolić V. (SRB), Erklig A. (TR), Tarek M. (CA), Kovač A. (MK), Širok B. (SI), Juraga I. (HR), S. Sheik M .(OMAN), Samardžić I. (HR), Ćosović-Bajić S. (HR), Kiss I. (RO), Subramoniau S. (MY), Doroslovački R. (SRB), Hrasnica M. (BA), Lovrić I. (BA), Knežević M. (MNE), Khan M.S. (PAK), Ali Sabea H. (IQ), Špago S. (BA), Wein P.S. (TW), Saridarg F.D. (TR), Jašarević S. (BA), Habibzadeh A. (IR), Safdar A. (SE), Xhaxhiu K. (AL), Damić M. (SRB), Ogurlu Y. (TR), Noman N. (KR), Ismail O. (SIR), Alagić I. (BA), Teerawong L. (TH), Yildirim A. (TR), Masi A. (IT), Kurtanović O. (BA), Athapaththu A. M. R. G (JP), Khan K. (BAN), Yadav K. (SA), Đukanović M. (MNE), Hadžiabdić M. (BA), Nukathati R.K. (CAN), Trišović N. (SRB), Uzunoglu M. (TR) , Jovanović J. (SRB), Nariman N.A. (DE), Nikolić D. (MNE), Šabanović A. (BA), Tankonogyi V.(UK), Mandžić E. (BA), Bischof S. (HR), Šarić T. (BA), Mišković A. (BA), Zeyrek M. (TR), Stanković S. (SRB), Božo J. (SRB), Molnar R.(SRB), Miljković Z. (SRB), Egrlić A. (BA), Džafić I. (BA), Banjanović-Mehmedović L. (BA), Jovanović M. (SRB), Jankes G. (SRB),Tabaković M. (BA), Husnić Ž.(USA), Kuzmanović I.(HR), Titu M. (RO), Kazani I. (AL), Klarić S.(BA), Svetlana S.(SRB), Ješić D.(SRB), Kovač P.(SRB), Domenico G.(IT), Šoput P.(HR), Raul T.(GE), Kovalov V.(UK), Koltovska-Nechosko D.(MK), Krzy M.(SI), Čurković S. (SRB), Popov G.(BG), Ivanov Vik. (UA),Ivanov Vit. (UA), Lemeš S. (BA), Bičo Ćar M. (BA), Stupar S. (BA), Bratovčič A. (BA), Ademović N. (BA), Demić M. (SRB), Mitrović D. (SRB), Majstorivić V. (SRB), Lovrec D. (SI)

ORGANIZIRING COMMITTEE
ORGANIZACIONI KOMITET

Isak Karabegović, Academy of Sciences and Arts, BA, President
***Sead Pašić**, „Džemal Bijedić“ University of Mostar, BA*
***Fuad Ćatović**, „Džemal Bijedić“ University of Mostar, BA*
***Sadko Mandžuka**, University of Zagreb, HR*
***Lejla Benjanović-Mehmedović,** Universit of Tuzla, BA*
***Safet Isić**, „Džemal Bijedić“ University of Mostar, BA*
***Edina Karabegović,** University of Bihać, BA*
***Mehmed Mahmić**, University of Bihać, BA*
***Samir Vojić**, University of Bihać, BA*
***Ermin Husak**, University of Bihać, BA*
***Amar Vuković**, B.Sc.,University of Wien*

Reviewers/Recezenti

Prof. Sead Pašić,PhD, PhD,Prof. Miran Brezočnik, PhD, Prof.Salah-Eldin Omer, PhD, Prof.Isak Karabegović,PhD, Prof.Himzo Đukić PhD, Prof.Fuad Ćatović,PhD, Prof.Avdo Voloder,PhD, Prof.Đorđe Jovanović, PhD, Prof.Safet Isić,PhD, Prof.Edina Karabegović,PhD, Prof.Mehmed Mahmić,PhD, Prof.Vojislav Trkulja,PhD., Prof.Suad Habaš,PhD, Prof.Husein Pašagić,PhD, Asst.prof.Maja Kazazić,PhD, Prof.Majda Srabović,PhD, Asst.prof.Melita Huremović,PhD, Prof.Samir Lemeš,PhD, Prof.Samir Vojić,PhD, Prof.Lejla Benjanović-Mehmedović,PhD, Prof.Ermin Husak,PhD, Asst.prof.Emir Nezirić,PhD, Prof.Abdel Đozić,PhD,Prof.Denisa Žujo-Zekić,PhD, Prof.Zoran Petrović,PhD, Prof.Dušan Mijin,PhD, Ass.prof.Azra Špago,PhD, Prof.Remzija Cvrk,PhD, Prof.Jasmina Aliman,PhD, Prof.Nermina Uzunović-Zaimović,PhD, Prof.Sandra S. Konstantinović,PhD, Prof.Ramo Šendelj,PhD, Prof.Tarik Zaimović,PhD, Prof.Tomaž Ambrožić,PhD, Prof.Dušan Kogaj,PhD, Prof.Jelena Marković,PhD, Prof.Mirko Gojić, PhD, Prof.Mirsda Oruč,PhD, Asst.prof.Ladislav Vasilišin,PhD, Prof.Amer Ćustović,PhD, Prof.Anesa Jerković-Mujkić,PhD, Prof.Asima Begić Akagić, PhD,Prof.Semina Hadžiabdić,PhD, Prof.Mirsad Kurtović,PhD,, Prof. Vladimir Medved, PhD, Prof.Dušan Golubović, PhD, Prof.Svetlana Stevović, PhD.,Prof.Ljilja Vukoć,PhD, Asst.prof.Indira Šestan,PhD, Prof.Zahida Ademović,PhD, Asst.prof.Besim Salkić,PhD, Prof.Elvira Hadžiahmetović Jurida,PhD, Asst.prof.Amra Selimović,PhD, Asst.prof.Zoran Petrović,PhD, Prof.Majda Srabović,PhD, Prof. Aida Šapčanin,PhD, Prof. Mirha Bićo Ćar,PhD, Prof. Irena Drmić Hofman,PhD, Prof.Amra Bratovčić,PhD, Prof. Sadko Mandžuka,PhD, Prof.Pero Škorput,PhD, Prof. Savo Stupar,PhD, Vijay Anant Athavele,PhD, Prof.Jasmin Bekteševič,PhD, Georgi Popov,PhD

Sponsors / Pokrovitelj

ACADEMY OF SCIENCES AND ARTS OF BOSNIA AND HERZEGOVINA
AKADEMIJA NAUKA I UMJETNOSTI BOSNE I HERCEGOVINE

Organizer / Organizator:

SOCIETY FOR ROBOTICS OF B&H - Društvo za robotiku u Bosni i Hercegovini

Co-organizers / Suorganizatori:

"DŽEMAL BIJEDIĆ" UNIVERSITY OF MOSTAR / "Džemal Bijedić" Univerzitet u Mostaru
UNIVERSITY OF SARAJEVO / Univerzitet u Sarajevu
UNIVERSITY OF TUZLA / Univerzitet u Tuzli
UNIVERSITY OF ZENICA / Univerzitet u Zenici
SARAJEVO SCHOOL OF SCIENCE AND TECHNOLOGY / Sarajevska škola za nauku i tehnologiju
INTERNATIONAL UNIVERSTY OF SARAJEVO / Internacionalni Univerzitet u Sarajevu
INTERNATIONAL BURCH UNIVERSTY OF SARAJEVO / Internacionalni Burch Univerzitet u Sarajevu
FOREIGN TRADE CHAMBER OF BOSNIA AND HERZEGOVINA / Vanjskotrgovinska komora u BiH
INTERNATIONAL ASSOCIATION FOR TECHNOLOGICAL DEVELOPMENTAND INNOVATIONS UKRAINA/Internacionalno udruženje za tehnološki razvoj i inovacije Ukraina
TECHNOLOGY PARK "INTERA" OF MOSTAR / Tehnološki park INTERA u Mostaru

ABSTRACTS / SAŽETCI

„NEW TECHNOLOGIES, DEVELPMENT AND APPLICATION“

„NOVE TEHNOLOGIJE, RAZVOJ I PRIMJENA“

NT-2023

Note / Opaska:

Svi radovi u knjizi sažetaka su recenzirani. Bez obzira na to, urednici i organizator ne odgovaraju za sadržaj prikazan u ovoj publikaciji. Sva prava pripadaju autorima, što znači da će daljnji uvjeti objave rada biti dogovoreni sa samim autorima. Nakon objave Zbornika sažetaka NT-2023 autori kao i druge osobe ili institucije koji žele objaviti reference ili na neki način koriste rad iz ove publikacije, se mole da navedu prethodnu objavu rada u Zborniku sažetaka NT- 2023.

All the papers presented in this publication have been reviewed. However the editors and the organizers are not responsible for thecontents presented within the papers. All the rights belong to the authors, meaning further publication conditions should be agreed upon with the authors. Upon the Book of the Proceedings Abstracts NT-2023 publication the authors, so as the other persons or institutions wishing topublish reference or in some other manner use the papers from this publication are kindly requested to explicitly identify priorpublication in the Book of the Proceedings Abstracts NT-2023.

Sarajevo, 22nd-24th June 2023 / Sarajevo, 22 - 24. juni 2023.god.

PLENARY SESSION

9th International Conference

"New Technologies, Development and Application“ NT-2023

Sarajevo, 22nd- 24th June 2023

ACADEMY OF SCIENCES AND ARTS OF BOSNIA AND HERZEGOVINA

Bryan Howell
Brigham Young University
USA

Topic: "LESSONS FROM TWELVE YEARS OF AN INTERDISCIPLINARY INNOVATION PROGRAM"

Biography:

Bryan Howell is an assistant professor of innovation and design history in the Department of Design and co-instructor in the Crocker Innovation course at the Marriott School of Business at Brigham Young University (BYU). He received his BFA in Industrial Design at BYU in 1987 and his MFA in Design at the University of Texas, Austin, in 2003. He has authored 60 journal and international conference publications on design teaching methods and sensory perception. He has conducted 11 international conference workshops and sponsored five conference tracks on entrepreneurship and visual papers. He has received 75K in corporate-funded student projects and was awarded the Abell Innovation Professorship for multi-disciplinary education. He co leads the Design Sketching SIG of the Design Society, which organizes workshops, research projects, conference tracks, and the upcoming 2024 design sketching conference. He consults as an expert witness in design-related legal issues for international technology companies, including Apple Computer,and mentors regional corporate R&D groups on design management and innovation process. Before his academic career, he was an industrial designer at frog design in Germany, a design manager in the Silicon Valley studio where he worked with Steve Jobs at NeXT computer, and finally, the design leader in the frog Singapore office. He next workedat Dell Computer, where he directed a nine-million-dollar annual design budget, testing and developing over fifty products a year. In 2003 he founded Pure Design Labs, a product, brand, and packaging design consultancy serving clients in North America and Southeast Asia.

Christopher A. Mattson
Brigham Young University
USA

Topic: "LESSONS FROM TWELVE YEARS OF AN INTERDISCIPLINARY INNOVATION PROGRAM"

Biography:

Christopher A. Mattson is a Professor of Mechanical Engineering at Brigham Young University (BYU) in Provo Utah. Prof. Mattson has strong interests in product development, engineering design, multidisciplinary design and optimization, and designing for global development. He teaches engineering design and innovation at the undergraduate and graduate levels, including cross-disciplinary innovation and international study abroad. Prof. Mattson earned a PhD in mechanical engineering from Rensselaer Polytechnic Institute in New York (2003), where his area of research was multiobjective optimization. He was a mechanical design engineer (1996-2000), and global director of engineering (2004-2006) at ATL Technology. A highlight of his time at ATL was starting and managing ATL's 25-person Chinese design center in Guangzhou (2004-2005). He is an NSF CAREER awardee, and was given a Presidential Early Career Award for Scientist and Engineers (PECASE) from Barak Obama in 2012. He was a Fulbright Fellow from 2014-2015 where he was a visiting scholar at the Loughborough Design School in England. He holds multiple US patents, and he is the recipient of ASME's 2015 Ben C. Sparks award for his educational work in building a strong senior design experience for BYU students. He is a past associate editor for Structural and Multidisciplinary Optimization, and for the ASME Journal of Mechanical Design. He is the co-Chair of ASME's Engineering for Global Development Committee, and an ASME Fellow.

Curtis Anderson
Brigham Young University
USA

Topic: "LESSONS FROM TWELVE YEARS OF AN INTERDISCIPLINARY INNOVATION PROGRAM"

Biography:

Curtis Anderson is a Professor of Law at the Brigham Young University Law School. He teaches transactional skills courses in the areas of corporate formation and governance, mergers and acquisitions, securities and e-commerce, and supervises the BYU Law and Entrepreneurship Clinic. He is also a faculty member of the BYU Crocker Innovation Fellowship Program, which is an interdisciplinary, one-year innovation experience for undergraduate students from any major and where he teaches with faculty from the School of Business, College of Engineering, and Department of Design. Before coming to BYU Law, Professor Anderson was a Senior Vice President and the General Counsel of the Match Group. Prior to joining the Match Group, Professor Anderson was a partner at Baker Botts in Dallas. While in private practice, he advised public and private companies, as well as venture capital funds. He represented clients in complex mergers and acquisitions, public and private financings (debt and equity) and general corporate matters. His clients were typically technology, real estate or energy companies.

Nile W. Hatch
Brigham Young University
USA

Topic: "LESSONS FROM TWELVE YEARS OF AN INTERDISCIPLINARY INNOVATION PROGRAM"

Biography:

Nile W. Hatch is an associate professor of Entrepreneurship and Strategy and is the Farr research fellow at the Marriott School of Business at Brigham Young University. He joined the Marriott School faculty in 2000 in strategic management and joined the entrepreneurship group in 2007 when it was created. He teaches entrepreneurship, innovation, and the economics of strategy. He earned a Ph.D. from the University of California, Berkeley and M.S. and B.S. degrees from Brigham Young University. Before coming to the Marriott School, he taught strategy at the University of Illinois. His research focuses innovation as a learning process to resolve uncertainty, find the unknown and unmet needs of customers, how they innovate to solve them, and how they compete with rivals once they enter. He addresses this process of innovating through learning through the lenses of learning curves, disruptive innovation, the social value of innovation, cognition in innovation, entry timing, competition, and trust as learning through repeated interaction. His research has appeared in the Journal of Business Ethics, Journal of Business Venturing, Harvard Business Review, Management Science, Journal of Mechanical Design, Sloan Management Review, and the Strategic Management Journal.

Carlos Conceição António
University of Porto
POR

Topic: " OPTIMIZATION OF MECHANICAL SYSTEMS"

Biography:

Carlos Conceição António finished the Ph.D. degree in Mechanical Engineering in 1995. He obtained the "Habilitation" as Professor of Mechanical Engineering in 2005 from University of Porto where is a Full Professor and coordinator of Mathematics group of Mechanical Engineering Department of Faculty of Engineering. He is a member of Research Unit LAETA - Associated Laboratory for Energy, Transports and Aeronautics (INEGI) and coordinator of the numerical methods group. He has published four books, around 100 SCI/SCOPUS-indexed papers in international peer-reviewed journals and 260 papers/oral presentations in international congresses. His current research interests include Process Simulation, Composite Structures, Bioengineering, Reliability-based-Design, Optimal Design, Evolutionary Algorithms and Artificial Neural Networks.

Munib Karavdic
University of New South Wales
AU

Topic: "DIGITAL INNOVATION NEEDS TO START WITH PEOPLE, NOT TECHNOLOGY BIO''

Biography:

Dr. Munib Karavdic is an expert in innovation and design. He helps leaders and their organisations to innovate and drive change with confidence from strategy to implementation. This is achieved by building innovation capabilities underpinned by human-centred design as a critical driver of growth and customer-centric strategy. As Conjoint Professor in Design and Innovation at AGSM/UNSW, he is involved in research and supports MBA students by sharing his insights and practical expertise from his industry work. His subject, Design thinking, is taught in the executive MBA program, and Intrapreneurship is taught at MBAX. Both are highly rated and very popular among students and the business community. In his venture, WAVE Design, he brings a sharp commercial edge and reliability through a scalable, repeatable methodology to innovation through human-centred design (HCD). He helps companies design strategies, business models, products and services that help organisations unlock their potential.

Edhem-Eddie Ćustović
La Trobe University
AU

Topic: " THE ROLE OF YOUNG RESEARCHERS FROM BOSNIA AND HERZEGOVINA IN THE DEVELOPMENT AND IMPLEMENTATION OF NEW TECHNOLOGIES''

Biography:

Edhem 'Eddie' Custovic by day is an engineering academic at La Trobe University, Australia and the founder/director of the La Trobe Innovation & Entrepreneurship Foundry (LIEF). He received B.Eng (Electronics) from La Trobe University, a MSc (Entrepreneurship & Innovation) from Swinburne University and attained his Ph.D. from La Trobe University (Electronics, Digital Radar Systems and Ionospheric Physics). Heis a business owner & entrepreneur, having founded and co-founded numerous companies including Scientific Instruments Australia. He is also thought leader, mentor, philanthropist and a global citizen. Eddie was born in Tuzla, Bosnia & Herzegovina and lived for extended periods in Switzerland before migrating to Australia. Since then, he has given guest lectures and conducted business in over 100 countries. His multicultural background, multilingualism and approach to work enable me to take a politically and culturally sensitive perspective on life, volunteer roles, and professional career. In 2015, with the culmination of first-hand experiences and passion to help those in need, he founded the Bosnia & Herzegovina Futures Foundation. Custovic was the Engineering Project Coordinator for the Learn, Access, Experience Professions (LEAP) program which was funded by the Australian Federal Government to accelerate the participation of regional, low SES and minority participation in STEM higher education. Under his leadership the program excelled, reaching more than 10,000 students in over 200 state schools. He wholeheartedly has a deep commitment to making positive change for the world. For Custovic, the intersection between scientific innovation and human empowerment is where we can really "disrupt the future". His life motivation is to use the powers of engineering, education, networking, entrepreneurial mindset and the spirit of positive change to empower individuals and grow local economies while delivering the scientific advancements of our finest minds for the benefit of future generations. Custovic is an active contributor to Online & Print Media globally, TV & Radio. Custovic is the recipient of the 2022 IEEE Theodore W. Hissey Outstanding Young Professional Award for "For leadership in the empowerment and development of technology professionals globally"

CONTENTS – SADRŽAJ

KINESTHETIC TRAJECTORY LEARNING OF A COLLABORATIVE ROBOT UR 10e WITH APLC S7-1500
Rok Belšak, Janez Gotlih, Lucijano Berus, Timi Karner ***1***

STUDENT EDUCATIONAL EXPERIENCES IN A 12-MONTH INTERDISCIPLINARY INNOVATION & COMMERCIALIZATION COURSE
Alyssa Bagoyo, Grace Kilbourn-Barber, Spencer Egbert, Isaac Murri, Meghan Sarles, Ethan Ritchie, Bryan Howell ***2***

ANALYSIS AND DEVELOPMENT OF A ROBOTIC ARM FOR SPACE APPLICATIONS
Carmela Franco, Rosario La Regina, Carmine Maria Pappalardo ***3***

ROBOT-ASSISTED 3D SCANNING LASER SURFACE HARDENING OF MEDIUM-CARBON STEEL: SURFACE ROUGHNESS PARAMETERS AND HARDNESS
Dmytro Lesyk, Matej Hruska, Bohdan Mordyuk, Pawel Kochmanski, Bartosz Powalka ***4***

NONLINEAR CONTROL OF A ROBOTIC ARM IN THE ELECTROMECHANICAL DOMAIN
Rosario La Regina, Maria Curcio, Carmine Maria Pappalardo ***5***

A NEW HYBRID PSO-JAYA ALGORITHM FOR FUNCTION OPTIMIZATION
Lucijano Berus, Jernej Hernavs, Tadej Peršak, David Potočnik, Simon Klančnik, Janez Gotlih, Timi Karner, Mirko Ficko ***6***

COMPARISON OF THE MAIN PARAMETERS OF THE STEEL AND CARBON-FIBER-REINFORCED PLASTIC BAND TRACTION UNITS FOR LONG-STROKE OIL WELL PUMPS
Bogdan Kopei, Ihor Kopei, Volodymyr Kopei, Oleh Onysko, Vasyl Mykhailiuk ***7***

TOOL WEAR IN THE PROCESS OF DRILL-STRING CONNECTOR THREAD LATHE MACHINING
Oleh Onysko, Volodymyr Kopei, Yaroslav Kusyi, Lolita Pituley, Iryna Taras ***8***

SIMULATION OF THE STRUCTURE AND FORMATION KINETICS OF A METASTABLE MODIFICATION OF CERIUM UPON QUENCHING FROM A LIQUID STATE
Oleksandr Lysenko, Tetiana Kalinina, Iryna Zagorulko, Predrag Dašić, Popil Oleg ***9***

RESEARCH OF THE SURFACE OIL ABSORPTION PROCESSED BY VIBRATION ROLLING AND DEFORMING BROACHING
Ihor Shepelenko, Evhen Solovykh, Oleh Bevz, Stanislav Katerynych, Andrey Solovuch ***10***

DESIGN AND MANUFACTURING OF CONFORMAL COOLING CHANNELS FOR INJECTION MOLDING: A REVIEW
Gotlih Janez, Karner Timi, Belšak Rok, Ficko Mirko, Berus Lucijano, Brajlih Tomaž, Pal Snehashis, Brezočnik Miran ***11***

MIND MAPS FORKEY POINTS OF A REVERSE ENGINEERING PROJECT
Ivanova Svitlana, Dimitrov Lubomir, Ivanov Viktor, Urum Galyna, Olefir Olena .. ***12***

HEURISTIC SEARCH FOR THE DESIGN OF SILENT CHAIN TRANSMISSIONS USING GRAPHS
Svitlana Ivanova, Lubomir Dimitrov, Viktor Ivanov, Anatolii Konoplov, Natalia Cheredarchuk ***13***

CONTINUOUS IMPROVEMENT AND PERFORMANCE ASSESSMENT IN KNOWLEDGE-BASED ORGANIZATIONS
Aurel Mihail Țîțu, Andreea Maria Ungureanu, Florin-Alexandru Lungu ***14***

IMPROVEMENT OF THE TECHNIQUE OF OPTIMAL TECHNOLOGICAL ROUTES PLANNING FOR MACHINING OF THE MACHINE PARTS SURFACES
Yaroslav Kusyi, Oleh Onysko, Andrii Kuk, Olha Kostiuk, Bohdan Solohub ***15***

ANOMALY DETECTION AND CLASSIFICATION IN AGRICULTURAL PRODUCE USING IMAGE PROCESSING AND CNN ASSISTED BY A ROBOTIC ARM
Varsha Viswanathan, Supraajha Murali, Venkatakrishnan Veeraraghavan ***16***

GAUSS-BASED HONEY BADGER ALGORITHM FOR STEP-CONE PULLEY OPTIMIZATION PROBLEM
Mića Đurđev, Mijodrag Milošević, Dejan Lukić, Aco Antić, Borivoj Novaković, Luka Đorđević ***17***

GENETIC ALGORITHAMS MODELING OF CUTTING FORCES DURING TURNING HARD STEEL FOR ECONOMIC SUSTANABLE PRODUCTION
Pavel Kovač, Mirfad Tarić, Borislav Savković, Dušan Ješić, Branislav Dudić ***18***

ANALYSIS OF SOME PARAMETERS IN EXPLOSIVE FORMING
Darko Šunjić, Stipo Buljan, Eduarda Gomes ***19***

PRODUCT LIFE CYCLE IN AUTOMOTIVE INDUSTRY
Adrian Bogorin-Predescu, Stefan Țîțu, Aurel Mihail Țîțu ***20***

APPLICATION OF THE PFMEA METHODOLOGY IN A PRODUCTION FLOW WITH COLLABORATIVE ROBOTS
Aurel Mihail Țîțu, CristianVasile Doicin, Nicolae Ionescu, Vasile Gusan ***21***

DIMENSIONAL AND POSITIONAL CONTROL OF INDUSTRIAL WORKPIECE USING CMM AND OPTICAL 3D SCANNER
Kenan Varda, Almira Softić, Nermina Zaimović-Uzunović, Sabina Serdarević-Kadić ***22***

USING FRACTAL DIMENSIONS IN MODELING COMPLEX SYSTEMS IN ENGINEERING
Maryna Holofieieva, Volodymyr Tonkonogyi, Iraida Stanovska, Andrii Pavlyshko, Sergii Klimov ***23***

VIBRATION INFRARED THERMAL METHOD OF DEFECTOSCOPY OF NON-METALLIC HETEROGENEOUS MATERIALS
Volodymyr Tonkonogyi, Oleksandr Stanovskyi, Maryna Holofieieva, Oleksandr Levynskyi, Sergii Klimov ***24***

MULTIBODY MODELING OF A SERIAL MANIPULATOR FOR IN-SPACE APPLICATIONS
Salvio Veneziano, Marco Claudio De Simone ***25***

DESIGN OF AN INSTRUMENTED RAIL SEAT TEST-RIG FOR CONTINUOUS VEHICLE MONITORING
Giampiero Celenta, Tony Luigi Leopoldo Lenza, Marco Claudio De Simone ***26***

ANALYSIS AND DESIGN OF TEST-RIGS FOR LABORATORY TESTS UNDER MICROGRAVITY CONDITIONS
Salvio Veneziano, Giampiero Celenta, Marco Claudio De Simone ***27***

CONTRIBUTIONS REGARDING THE IMPLEMENTATION OF THE DIGITAL ARCHIVING PROCESS IN A PUBLIC ORGANIZATION
Constantin Dorin Olteanu, Cristian Vasile Doicin, Nicolae Ionescu, Aurel Mihail Țîțu ***28***

LOKAL DYNAMICS AND GLOBAL BEHAVIOR OF CERTAIN SECOND ORDER NONLINEAR DIFFERENCE EQUATION
Midhat Mehuljić, Jasmin Bektešević, Vahidin Hadžiabdić, Sadjit Metović, Adnan Mašić ***29***

PERFORMANCE COMPARISON OF THE SIMSCAPE MULTIBODY SOLVERS FOR ARTICULATED MECHANICAL SYSTEMS
Ömer Ekim Genel, Rosario La Regina, Carmine Maria Pappalardo ***30***

VIRTUAL PROTOTYPING OF A DYNAMIC VIBRATION ABSORBER FOR THE VIBRATION CONTROL OF A FRAME STRUCTURE
Giuseppe Isola, Rosario La Regina, Carmine Maria Pappalardo, Valentino Paolo Berardi ***31***

SYSTEM IDENTIFICATION OF A NONLINEAR ONE-DEGREE-OF-FREEDOM VIBRATING SYSTEM
Şefika İpek Lök, Carmine Maria Pappalardo, Rosario La Regina, Levent Malgaca ***32***

ROBOTIC TECHNOLOGY AS THE BASIS OF IMPLEMENTATION OF INDUSTRY 4.0 IN PRODUCTION PROCESSES IN CHINA
Isak Karabegović, Ermin Husak, Edina Karabegović, Mehmed Mahmić ***33***

CHARACTERISATION OF 17-7PH STEEL OF MODIFIED STATE RH 950 WITH MODIFIED CHEMICAL COMPOSITION
Belma Fakić, Diana Ćubela ***34***

DESIGNING THE OPTIMAL GEOMETRY OF MULTI-STAGE TOOLS
Mirna Nožić, Himzo Đukić ***35***

COGNITIVE CYBER-PHYSICAL PRODUCTION SYSTEMS: A NEW CONCEPT OF MANUFACTURING SYSTEMS ON THE ROUTE TO INDUSTRY 5.0
Elvis Hozdić, Zoran Jurković ***36***

3D PRINTED SOUVENIR WITH MECHANICAL IRIS
Alma Žiga, Josip Kačmarčik, Ismir Behadarević ***37***

MULTI-RESPONSE OPTIMIZATION OF FDM PROCESS PARAMETERS USING TAGUCHI BASED GREY RELATIONAL ANALYSIS METHOD
Kenan Muhamedagic, Ahmet Cekic, Derzija Begic-Hajdarevic, Amina Ramljak ***38***

THE INFLUENCE OF TECHNOLOGICAL PARAMETERS ON THE GEOMETRIC PRODUCT SPECIFICATION OF THE PARTS MANUFACTURED BY THE FUSED DEPOSITION MODELING
Vladimir Blanuša, Dejan Movrin, Branko Štrbac, Miodrag Hadžistević, Miloš Ranisavljev ***39***

3D PRINTED TOYS FOR CHILDREN WITH DISABILITIES – STUDY CASE IN MONTENEGRO
Mihailo Jovanovic, Milena Djukanovic, Anita Maric, Andrea Medin ***40***

CALIBRATION OF TEST AND MEASURING EQUIPMENT IN PANDEMIC CONDITIONS
Belma Fakić, Samir Lemeš, Branka Muminović, Omer Beganović, Mustafa Hadžalić, Kenan Varda ***41***

NUMERICAL SIMULATION OF VISCOELASTIC FLUID FLOW IN A CHANNEL
Almin Halač, Ejub Džaferović ***42***

THE POSSIBILITY OF APPLYING ChatGPT (AI) FOR CALCULATIONS IN MECHANICAL ENGINEERING
Dragi Tiro ***43***

INDUSTRY 4.0 READINESS ASSESMENT: HUMAN RESOURCE READINESS AND ACTIVE ROLE OF GOVERNMENT ADMINISTRATION FOR TRANSITIONAL CONTEXT OF BOSNIA AND HERZEGOVINA
Isak Karabegović, Mirha Bičo Ćar, Savo Stupar, Munira Šestić ***44***

STRATEGIES FOR REDUCING EXCESS AND OBSOLETE INVENTORY
Emir Halilović, Hadis Bajrić, Kristian Melin, Ermin Neimarlija ***45***

ASSEMBLY AND MAINTENANCE OF HIGH BAY WAREHOUSES ON A PRACTICAL EXAMPLE OF A METAL STRUCTURE INSTALLATION PROJECT
Ismar Alagić ***46***

AN APPROACH TO DYNAMIC MODELLING OF INDUSTRIAL ROBOTS BASED ON 3D CAD TECHNIQUE
Maida Cohodar Husic, Mirko Ficko, Derzija Begic-Hajdarevic, Tadej Persak, Ahmet Cekic, Simon Klancnik ***47***

CONSTRUCTION OF AN AUTOMATED DOOR AS A SMART DEVICE
Mehmed Čobo, Alma Žiga, Malik Čabaravdić ***48***

FPGA BASED LOGISTICS SERVICE ROBOT CONTROL IN E-COMMERCE WAREHOUSE SYSTEM
Lejla Banjanović-Mehmedović, Lejla Husić, Anel Husaković, Nermin Sarajlić ***49***

AN OVERVIEW OF MAINTENANCE STRATEGIES USING PETRI NET MODELS
Ilija Hristoski, Tome Dimovski ***50***

DIGITAL TWINS DATA VISUALIZATION METHODS. PROBLEMS OF HUMAN INTERACTION: A REVIEW
Yevhen Palazhchenko, Vira Shendryk, Sergii Shendryk ***51***

MACHINE LEARNING MODEL FOR STUDENT DROP-UT PREDICTION BASED ON STUDENT ENGAGEMENT
Lucija Brezočnik, Giacomo Nalli, Renato De Leone, Sonia Val, Vili Podgorelec, Sašo Karakatič ***52***

PROTOTYPING IoT TECHNOLOGY SOLUTIONS USING LORAWAN INFRASTRUCTURE
Amir Hajdar, Samim Konjicija ***53***

A REVIEW OF RESEARCH PROGRESS AND APPLICATION OF WAVELET NEURAL NETWORKS
Wang Tonghao, Vincenzo Guercio, Piercarlo Cattani, Francesco Villecco ***54***

MOTION SYNCHRONIZATION FOR BILATERAL CONTROL SYSTEMS
Šejla Džakmić, Nađa Viteškić, Amel Ramdedović, Mohammad Adnan Diab Alrefaee ***55***

EDGE DETECTION ALGORITHM FOR BIOLOGICAL SLICE IMAGES BASED ON EMPIRICAL WAVELET TRANSFORM AND MORPHOLOGY
Yafei Liu, Vincenzo Guercio, Piercarlo Cattani, Francesco Villecco ***56***

CYBERSECURITY CHALLENGES IN MODERN SUPPLY CHAIN
Gordana Zeba, Mirjana Čičak ***57***

THE EFFECT OF ONLINE LEARNING SETTING ON MOTIVATION, INTENDED EFFORT, EMOTIONAL ENGAGEMENT, AND LANGUAGE LEARNING STRATEGIES AMONG NON-ENGLISH MAJORS IN CROATIA- A PILOT STUDY
Zrinka Fišer ***58***

CYBER VIOLENCE FORM OF DOMESTIC VIOLENCE
Petrică Tertereanu, Mihai Dragomir, Aurel Mihail Țîțu ***59***

ON THE OPTIMAL DESIGN OF A SCALE-FREE SUPPLY NETWORK
Piercarlo Cattani, Francesco Villecco ***60***

REMOTE LIQUID LEVEL MONITORING BASED ON IOT TECHNOLOGY
Vito Tič ***61***

INTERNET OF THINGS IN THE CONSTRUCTION INDUSTRY: A GENERAL OVERVIEW
Angelo Lorusso, Giampiero Celenta ***62***

CHALLENGES AND BENEFITS OF USING DIGITAL TWIN TECHNOLOGY
Savo Stupar, Mirha Bičo Ćar, Munira Šestić ***63***

APPLICATION OF LOAD CELL SENSOR DATA COLLECTION FOR STRENGTH TRAINING AND MUSCULOSKELETAL REHABILITATION
Amir Hajdar, Ensar Abazović, Armin Paravlić ***64***

MOBILE APPLICATION MSCHEDULER
Suad Sućeska ***65***

SIMULATION PLATFORM FOR THE ANALYSIS OF MOTORWAY TRAFFIC SAFETY MANAGEMENT SYSTEMS
Sadko Mandžuka, Luka Dedić, Goran Kos, Krešimir Vidović ***66***

VIRTUAL URBAN CONSOLIDATION CENTER
Reinhold Schodl, Sandra Eitler ***67***

IMPLEMENTATION OF SMART ROAD TECHNOLOGIES IN THE FUNCTION OF ROAD TRAFFIC SAFETY MANAGEMENT
Osman Lindov, Adnan Omerhodžić ***68***

SUSTAINABLE MOBILITY: CONCEPTUAL ASPECTS OF DEVELOPMENT AND MANAGEMENT
Natalya Shramenko, Christoph Hupfer ***69***

APPLICATION OF INNOVATIVE TECHNOLOGIES TO IMPROVE URBAN DELIVERY IN THE CITY OF SARAJEVO
Ermin Muharemović, Amel Kosovac, Belma Memić, Elma Avdagić-Golub ***70***

APPLICATION OF INTELLIGENT TRANSPORT SYSTEMS IN ROAD TRAFFIC: A REVIEW
Nadica Stojanovic, Ivan Grujic, Bojana Boskovic ***71***

CREATING ONTOLOGIES CONCEPT IN TRANSPORT AND TRAFFICRESEARCH ENVIRONMENT
Pero Škorput, Krešimir Vidović ***72***

ESTIMATING URBAN AIR QUALITY ACCORDING TO SUSTAINABLE DEVELOPMENT GOAL 11
Belma Memić, Elma Avdagić-Golub, Amel Kosovac, Ermin Muharemović ***73***

APPLICATION OF THE ITS SYSTEM IN LIMITING THE ACCESS OF ROAD VEHICLES TO PARTS OF URBAN ZONES IN SARAJEVO
Mirzet Sarajlić, Drago Ezgeta, Ajdin Džananović ***74***

THE POSSIBILITY OF USING DRONES IN THE PROCESS OF DELIVERY IN THE AREA OF THE CITY OF SARAJEVO
Amel Kosovac, Adisa Medić, Muharem Šulić, Haris Mehičić ***75***

SELECTION OF ENVIRONMENTALLY SUSTAINABLE MEANS OF URBAN MOBILITY DURING DAILY POPULATION MIGRATION IN ORDER TO SATISFY THE NEED FOR TRANSPORTATION USING METHODS OF MULTICRITERIA ANALYSIS
Mirzet Sarajlić, Adnan Omerhodžić, Ajdin Džananović, Adnan Tatarević ***76***

ADVANCED TRAFFIC MANAGEMENT SYSTEM IN THE FUNCTION OF IMPROVING MOBILITY IN THE CITY OF SARAJEVO
Nedim Kamenjašević, Mustafa Mehanović, Mirzet Sarajlić ***77***

CHALLENGES OF PHYSICAL AND DIGITAL INTEGRATION OF TRANSPORT INFRASTRUCTURE IN BOSNIA AND HERZEGOVINA
Drago Ezgeta, Samir Čaušević, Mustafa Mehanović ***78***

DYNAMIC TRAFFIC FLOW ASSIGNMENT ON PARALLEL NETWORKS
Armen Bagdasaryan, Antonios Kalampakas, Mansur Saburov ***79***

MODEL OF OPTIMIZATION OF CARGO SPACE VOLUME UTILIZATION IN DELIVERY VEHICLES
Maida Eljazović, Ermin Muharemović ***80***

MOBILITY-AS-A-SERVICE AND THE FUTURE OF URBAN MOBILITY: A HUMAN-CENTERED APPROACH TO MULTIMODAL JOURNEY PLANNING
Bia Mandžuka, Marinko Jurčević, Krešimir Vidović ***81***

POSSIBILITIES OF QUEUING SYSTEM AT POSTAL OPERATORS
Mladenka Blagojević, Dragana Šarac, Amel Kosovac, Ermin Muharemović ***82***

DEVELOPMENT AND DESIGN OF AIR PURIFIER DEVICE PROTOTYPE
Vedad Saletović, Adis J. Muminović, Isad Šarić, Nedim Pervan ***83***

CONDITIONS FOR AMORPHIZATION OF Ce-Ag ALLOYS DURING QUENCHING FROM A LIQUID STATE
Tetiana Kalinina, Oleksandr Lysenko, Vladeta Jevremović, Anton Khlebnikov, Tetiana Dorozhka ***84***

INTEROPERABILITY, SCALABILITY, AND AVAILABILITY OF ENERGY TYPES IN HYBRID HEATING SYSTEMS
Vira Shendryk, Reza Malekian, Paul Davidsson ***85***

ENERGY EFFICIENCY OF INDUSTRIAL DRYING MACHINE AND EFFECTS TO NATURAL GAS CONSUMPTION AND CARBON FOOTPRINT
Mesud Ramić, Maximilian Pleitz, Ejub Džaferović, Amra Hasečić ***86***

RENEWABLE ENERGY SOURCES PHOTOVOLTAIC POWER PLANTS AND CONSTRUCTIVE SOLUTIONS RELATED TO LOCALITY AND CLIMATE
Miron Torlo, Tarik Balić, Damir Špago ***87***

ANALYSIS AND CHOICE OF GAS TURBINE BLADE
Muharem Šabić, Edvin Šimić, Said Šabić ***88***

MACHINE LEARNING OPTIMIZATION OF AIR HEATING TIME IN THE HEATING CONTROL SYSTEM OF A SMART HOUSE
Valeriy Sydorenk, Andriy Perekrest, Vira Shendryk, Sergii Shendryk ***89***

QUALITATIVE ANALYSIS OF THE STRUCTURE OF NOx EMISSIONS DURING COMBUSTION OF PULVERIZED COAL AND BIOMASS AND STAGED AIR SUPPLY CONDITIONS IN FURNACE
Nihad Hodzic, Anes Kazagic, Kenan Kadic ***90***

OPTIMIZATION OF PHOTOVOLTAIC SYSTEMS FOR TWO DIFFERENT REGIONS IN BOSNIA AND HERZEGOVINA COVERING ELECTRICITY DEMAND OF A TYPICAL HOUSEHOLD
Azrudin Husika, Damir Špago, Halima Hadžiahmetović, Safet Isić ***91***

NUMERICAL SIMULATIONS OF HYDRAULIC TRANSIENTS IN HYDROPOWER SYSTEM WITH A SURGE TANK
Hata Milišić, Emina Hadžić ***92***

MODELING OF THERMAL PROTECTION OF PIPELINES FROM DESTRUCTION IN TECHNOLOGICAL CORRIDORS
Oleg M. Mandryk, Lubomur S. Shlapak, Oleh M. Tuts, Iryna L. Bodnaruk ***93***

RESEARCH OF PULSE COMBUSTION WITH INTENTION OF APPLICATION IN HIGH POWER BOILERS
Nihad Hodzic, Kenan Kadic ***94***

SUSTAINABLE MOBILITY: CHANGING MINDSETS AND RETHINKING PARADIGMS
Christoph Hupfer, Natalya Shramenko ***95***

FLUE GAS EMISSIONS ON THE OXYGEN-ENRICHED COMBUSTION OF BROWN COAL AND WOODY BIOMASS
Kenan Kadić, Nihad Hodžić ***96***

GLOBAL DYNAMICS OF A CERTAIN NONLINEAR SYSTEM OF DIFFERENTIAL EQUATIONS WITH THE APPEARANCE OF HOPF BIFURCATION
Vahidin Hadžiabdić, Midhat Mehuljić, Jasmin Bektešević, Adnan Mašić, Nedim Pervan ***97***

THE GLOBAL BEHAVIOR OF A CERTAIN GENERAL DIFFERENCE POLYNOMIAL EQUATION
Jasmin Bektešević, Vahidin Hadžiabdić, Midhat Mehuljić, Adnan Mašić, Fatih Destović ***98***

BIOMEDICAL APPLICATION OF NANOCOMPOSITES BASED ON FULLERENES-C60
Amra Bratovcic ***99***

CHEMICAL ANALYSIS OF POMEGRANATE FRUITS TAKEN FROM DIFFERENT LOCATIONS IN HERZEGOVINA (BOSNIA AND HERZEGOVINA)
Alma Mičijević, Aida Šukalić, Alma Leto, Sanela Nazdrajić ***100***

THE RELATIONSHIP BETWEEN FOLIC ACID AND HEALTHY REPRODUCTION
Jia Lijun, Andrea Formato, Giampiero Celenta, Raffaele Romano ***101***

EFFECT OF BAKING CONDITIONS AND RECIPES ON THE QUALITY OF COOKIES
Zhou Shuai, Raffaele Romano, Giampiero Celenta, Andrea Formato ***102***

TECHNOLOGIES AND TECHNOLOGICAL PROCESS OF FOREST UTILIZATION– CASE STUDY „SARAJEVO ŠUME“
Velid Halilović, Jusuf Musić, Jelena Knežević, Elmin Hodžić ***103***

SIMULATION MODELING OF MULTIDIMENSIONAL MASS FLOTATION SEPARATORY PROCESSES CONSIDERING THE DISTRIBUTION OF PARAMETERS
Sergii Tymchuk, Ivan Abramenko, Vira Shendryk, Yuliia Nechitailo, Viktor Zhyla ***104***

REVIEW OF PARASITIC NEMATODES OF FISH FROM THE UNA RIVER (BOSNIA AND HERZEGOVINA)
Isat Skenderović, Edina Hajdarević, Alen Bajrić, Subha Avdić ***105***

AN INVESTIGATION OF THE ANTHROPOGENIC IMPACT ON CHEMISTRY, QUALITY INDICATORS AND CONCENTRATIONS OF SELECTED CHEMICAL ELEMENTS OF THE RIVER BREGAVA
Dalila Ivanković, Almir Šestan ***106***

INVENTORY OF URBAN GREENERY USING GIS APPLICATIONS
Admir Avdagić, Besim Balić, Dino Hadžidervišagić, Nejla Kalača ***107***

MODELS TO ESTIMATE A QUALITY AND STRUCTURE OF WOOD ASSORTMENT OF STANDING TREES OF BEECH (Fagus sylvatica L.) IN BOSNIA AND HERZEGOVINA
Admir Avdagić, Besim Balić, Ahmet Lojo, Jusuf Musić ***108***

EVALUATION OF PROPERTIES OF MATERIALS FOR FUNCTIONAL FOOTBALL SPORTSWEAR
Ivana Salopek Čubrić, Goran Čubrić, Antonija Petrov, Tomislav Rolich ***109***

TECHNOLOGIES FOR REMEDIATION OF POLLUTED ENVIRONMENT: BETWEEN CLASSIC PROCESSES AND THE CHALLENGES OF NEW APPROACHES
Miroslav Vrvić ***110***

NITRATES AND NITRITES IN DRINKING WATER WITH A HUMAN HEALTH RISK ASSESSMENT IN THE CITY OF MOSTAR
Aida Šukalić, Alma Leto, Alma Mičijević, Lamija Torlo ***111***

COMPARATIVE ASSESSMENT OF THE QUALITY OF APPLE JUICE PRODUCED BY ECOLOGICAL AND TEHNOLOGICAL PROCESS
Fatima Muhamedagić, Edina Šertović, Mehmed Cero ***112***

THE QUANTUM-CHEMICAL PREDICTION FOR SOME NMR SPECTRAL PARAMETERS IN SYSTEMS BASED ON AROMATIC POLYAMIDES
Andrey Tokar, Olga Chihvintseva, Milan Milosavljević ***113***

CONTRIBUTION TO THE KNOWLEDGE OF GRAPEVINE PRODUCTION IN SOUTEASTERN EUROPE – CASE STUDY OF MONTENEGRO
Dejan Zejak, Branislav Dudic, Gabriela Pajtinková Bartáková, Katarína Gubíniová ***114***

STRUCTURAL DYNAMICS OF STEEL FRAMES WITH THE APPLICATION OF FRICTION ISOLATORS
Angelo Lorusso, Giampieto Celenta ***115***

FIRE RESISTANCE OF STEEL GIRDERS
Sanin Dzidic, Amir Ademovic, Ahmed El Sayed ***116***

CONTRIBUTION TO REASONS FOR THE SEISMIC RISK RE-EVALUATION FOR STRUCTURAL DESIGN OF HIGH-RISE BUILDINGS IN BOSNIA AND HERZEGOVINA
Sanin Dzidic, Faruk Avdic, Ahmed El Sayed, Amir Causevic ***117***

ASPHALT MIXTURES FOR M17.3 MAIN ROAD NEUM-STOLAC IN B&H
Merima Šahinagić-Isović, Marko Ćećez, Kenan Mostarlić, Fuad Ćatović ***118***

3D DIGITAL RECONSTRUCTION OF HERITAGE BUILDINGS BY USING OLD 2D PLANS
Nedim Tuno, Admir Mulahusić, Gojko Jugović, Dušan Kogoj ***119***

SUSTAINABLE MODEL OF PRESCHOOL EDUCATION FACILITIES
Nerma Smajlović Orman, Adnan Novalić, Maja Popovac, Ahmed El Sayed ***120***

IN-DEPTH ANALYSIS OF CURRENT LEGISLATION ON ARCHITECTURAL STANDARDS AND NORMS OF PRESCHOOL EDUCATION FACILITIES IN BOSNIA AND HERZEGOVINA
Nerma Smajlović Orman, Adnan Novalić, Maja Popovac, Ahmed El Sayed ***121***

OVERVIEW OF OPTIMIZATION TOOLS FOR READY-MIXED CONCRETE DISPATCHING PROBLEM BASED ON MIXED-INTEGER LINEAR PROGRAMMING
Mateja Držečnik, Uroš Klanšek ***122***

DESIGN AND TECHNOLOGY OF CONSTRUCTION OF REINFORCED SOIL STRUCTURES
Danija Đonko, Azra Špago ***123***

AIRPORT PAVEMENT MAINTENANCE AND REPAIR
Muharem Šabić, Edvin Šimić, Džubur Damir ***124***

ANALYSIS OF GLULAM BEAMS STRENGTHENED WITH FRP STRIPES
Azra Mahinić Vrce, Žana Džubur, Merima Salčin, Mirsad Tarić ***125***

EVOLUTION OF THE CONCEPT OF HEALTH AND WELLBEING THROUGH THE INTERNATIONAL SUSTAINABILITY RATING SYSTEMS OF BUILDINGS
Kosara Kujundžić, Slavica Stamatović Vučković ***126***

THE ADAPTIVE REUSE OF HISTORIC BUILINGS - CASE STUDY THE WHITE FORTRESS IN SARAJEVO
Yousef Zaarir ***127***

SUSTAINABILITY OF THE STRUCTURAL CONSTRUCTION MATERIALS OF FAMILY HOUSES IN BOSNIA AND HERZEGOVINA, POSSIBLE ALTERNATIVES UP TO SUSTAINABLE CONSTRUCTION PRINCIPLES
Yousef Zaarir ***128***

DETERMINATION OF THERMAL TRANSMITTANCE (U)OF A GROUND COMPOSITE FLOOR STRUCTURE WITH AND WITHOUT VERTICAL EDGE INSULATION
Jovana Jovanovic ***129***

THERMAL BRIDGES - EFFECTS AND SOLUTIONS IN THE ENERGY RENOVATION OF BUILDINGS
Emina Japić, Aida Husetić ***130***

THE ROLE OF HEAT PUMPS IN THE ENERGY EFFICIENCY OF BUILDINGS: REVIEW
Aida Husetić, Redžo Salkić ***131***

THE INFLUENCE OF THE QUALITY OF ELECTRONIC LEARNING PLATFORMS ON IMPROVING THE COMPETENCES AND PERFORMANCE OF EMPLOYEES
Haris Palalija, Elvir Čizmić, Zijada Rahimić, Munira Šestić ***132***

PERCEPTION DIFFERENCES OF ELECTRONIC LEARNING QUALITY AND CONTENT IN SERVICE BUSINESSES
Elvir Čizmić, Haris Palalija, Senad Softić, Munira Šestić ***133***

JOB ANALYSIS IMPACT IN SATISFACTION AND PERFORMANCE OF EMPLOYEE WITHIN DIGITALIZATION CONTEXT CHALLENGES
Elvir Čizmić, Đevad Šašić, Venan Hadžiselimović, Adil Trgo ***134***

NEW TECHNOLOGIES AND UPDATING OF HIGHER EDUCATION
Darko Lovrec ***135***

MICRO-CREDENTIALS AS AN EFFECTIVE WAY OF ACQUIRING NECESSARY MODERN SKILLS
Darko Lovrec, Vito Tič ***136***

RESILIENCE IN REMOTE WORKING IN FOUR COUNTRIES OF THE WESTERN BALKANS
Irena Petrušić, Borislav Đukanović ***137***

IMPACT OF E-GOVERNANCE REGULATIONS ON THE BUSINESS ENVIRONMENT IN BOSNIA AND HERZEGOVINA
Đevad Šašić, Merima Tanović, Amel Delić, Amar Kozadra ***138***

FROM NEGATIVNE INTEREST RATES TOWARD OLD NORMALITY
Milorad Katnić, Ivana Katnic, Anđela Jakšić-Stojanović ***139***

CONCEPTUAL FOUNDATIONS FOR THE FORMATION OF THE PARADIGM OF NEO-INDUSTRIALIZATION IN MODERN CONDITIONS
Yuri Doroshenko, Irina Malykhina, Olga Leonova ***140***

DEVELOPMENT OF THE RAW MATERIAL SECTOR OF THE RUSSIAN INDUSTRY IN THE POST-COVID AND SANCTIONS PERIOD
Riapukhina Viktoriia ***141***

THE POTENTIAL OF SOCIAL ENTREPRENEURSHIP FOR REGIONAL DEVELOPMENT AND IMPROVEMENT THE POSITION OF MARGINALIZED CATEGORIES OF THE POPULATION
Aleksandar Djordjevic, Aleksandra Djordjevic ***142***

THE CONCEPT OF VALUE IN KNOWLEDGE-BASED ORGANIZATIONS
Aurel Mihail Țîțu, Madalina Maria Pana, Constantin Oprean ***143***

HOW DO WE USE OUR SOCIAL NETWORKS? A STUDY FROM BOSNIA AND HERZEGOVINA
Amra Kožo, Suada Peštek ***144***

AVATAR CONSUMPTION IN VIDEO GAMES: A SYSTEMATIC LITERATURE REVIEW
Denis Berberović, Adi Alić, Merima Činjarević, Benjamin Mešanović ***145***

ASSESSMENT OF THE READINESS OF COMPANIES FOR THE APPLICATION OF INDUSTRY 4.0 WITH THE HELP OF AN EXPERT SYSTEM
Mirha Bičo Ćar, Savo Stupar, Munira Šestić, Isak Karabegović ***146***

THE IMPACT OF DIGITALIZATION AND DIGITAL CONSUMPTION ON SOCIAL DEVELOPMENT
Ilda Kashami, Arjan Çuri ***147***

KINESTHETIC TRAJECTORY LEARNING OF A COLABORATIVE ROBOT UR 10e WITH A PLC S7-1500

Rok Belšak[1], Janez Gotlih[2], Lucijano Berus[3], Timi Karner[4]
[1,2,3,4]University of Maribor, Faculty of Mechanical Engineering,2000 Maribor, Slovenia


Rok Belšak


Janez Gotlih


Lucijano Berus


Timi Karner

ABSTRACT:
Collaborative robots are gaining in popularity in various applications. Their practicality to be able to work without additional safety requirements in specific tasks and cooperate with humans has a great potential. Programming a collaborative robot is intended to be easier from programming a classical industrial robot. However, some basic knowledge of programming is required. In order to simplify the teaching process for a collaborative robot a kinesthetic learning is introduced and implemented into the Universal Robot UR10e with the external PLC S7-1500 controller. It has been shown that with the help of kinesthetic learning the trajectory can be easily modified where programming knowledge for robots is not required.

Keywords: *collaborative robot, UR, PLC, Siemens, kinesthetic learning*

STUDENT EDUCATIONAL EXPERIENCES IN A 12-MONTH INTERDISCIPLINARY IOT INNOVATION AND COMMERCIALIZATION COURSE

Alyssa Bagoyo[1], Grace Kilbourn-Barber[1], Meghan Sarles[1],Spencer Egbert[1],
Ethan Ritchie[1],Isaac Murri[1], and Bryan Howell[1]
[1] Brigham Young University, Provo, Utah 84602, USA







Bryan Howell | *Alyssa Bagoyo* | *Grace Kilbourn-Barber* | *Spencer Egbert* | *Isaac Murri* | *Meghan Sarles* | *Ethan Ritchie*

ABSTRACT:
The XYZ Innovation Fellowship Program is a transformative, interdisciplinary, one-year innovation experience for undergraduate students at ABC University from any major. Teams of students study and practice the principles of entrepreneurial innovation, drawing on ideas from design thinking, entrepreneurship, product development, and agile software. Four instructors lead the course from Entrepreneurship, Design, Engineering and Law. In this paper, we will feature the experience of one of the teams, including six students: one from chemical engineering, mechanical engineering, entrepreneurial management, information systems, and two from industrial design. We will share details of our transformative educational experience surrounding our new product, Plant Au Pair, a smart IoT (Internet of Things) plant health device. Plant Au Pair uses variable product lighting and notifications sent to your cell phone via an app, to alert indoor plant owners when and how much to water their plants based on their specific plant species. Precise care depends on the plant's species, home temperature, and humidity — parameters that can be specified using the mobile app. A series of explanations and demonstrations through the app allows customers to understand these variables and give suggestions on how to effectively grow theirplants. Finally, to create a more immersive experience, the system allows owners to create plant personas for each plant, creating names, birth dates and personalities.
...
In this paper, we will share the basics of the unique course structure including customer validation, data collection, sponsorship, legal contracts, student stipends, prototyping budgets, trade show expectations, intellectual property transfer, IoT product requirements, research domains, bi-weekly sprint reviews, assessment assumptions, and investor pitches.
This class ensures that students develop technical skills and a deep conceptual understanding from concept ideation to commercialization. Our educational experience through the XYZ Innovation Fellowship Program has given our team the opportunity-while still in university, to flourish in a fast-paced environment that stimulates collaboration with students of other disciplines while gaining a real-world understanding of building a company from the ground up.

Keywords: *multi-disciplinary education, student start-up, product design, educational collaborations, design-driven innovation, entrepreneurship*

ANALYSIS AND DEVELOPMENT OF A ROBOTIC ARM FOR SPACE APPLICATIONS

Carmela Franco[1],Rosario La Regina[2], Carmine Maria Pappalardo[3]
[1,2,3]University of Salerno, 84084 Fisciano, Italy


Carmela Franco


Rosario La Regina

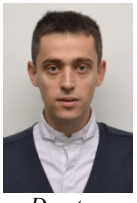

Carmine Maria Pappalardo

ABSTRACT:
The present paper focuses on the design of a robotic arm for space applications, virtually prototyped using software such as SOLIDWORKS, MATLAB, and SIMSCAPE. More than sixty years have passed since the first space launch in orbit around the Earth. Since then, numerous missions have been conducted in the meantime, making space launches way more accessible. Nonetheless, if launching satellites into space is now something so approachable, not much has been done to deliver it back. As a result, space pollution has become a problem. Therefore, it is essential to try to reduce the risk of collision and loss of satellites. Moreover, it is fundamental to equip the new satellite with a self-destruct system to prevent the occurrence of the so-called "Kessler Syndrome" scenario. This paper illustrates and analyses the design phases, the choice of the kinematics, the static verification, and the modal analysis in different setups of a robotic arm attached to a minisatellite. For this purpose, the propulsion system was carefully chosen, whereas control systems for the arm movement were developed and a feedback controller was chosen. The arm under study was designed to fit a minisatellite, be resistant during orbit, and be able to stabilize the attitude of the robot in orbit. The paper presents the analysis of the results of the virtual prototyping process developed in this work by using a multibody approach.

Keywords: *virtual prototyping, computer simulations, robotic arm, serial kinematics, multibody dynamics, satellite attitude control*

ROBOT-ASSISTED 3D LASER SURFACE HARDENING OF MEDIUM-CARBON STEEL: SURFACE ROUGHNESS PARAMETERS AND HARDNESS

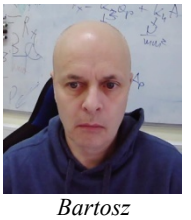
Dmytro Lesyk[1,3,4], Matej Hruska[2], Bohdan Mordyuk[3], Pawel Kochmanski[4], Bartosz Powalka[4]
[1]Laser Systems and Advanced Technologies Department, National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", 03056 Kyiv, Ukraine
[2]New Technologies Research Centre, University of West Bohemia, 30100 Pilsen, Czech Republic
[3]Principles for Surface Engineering Department, G.V. Kurdyumov Institute for Metal Physics of the NAS of Ukraine, 03680 Kyiv, Ukraine
[4]Mechanical Engineering and Mechatronics Department, West Pomeranian University of Technology, 70310 Szczecin, Poland


Dmytro Lesyk


Matej Hruska


Bohdan Mordyuk


Pawel Kochmanski


Bartosz Powalka

ABSTRACT:
To improve the surface properties of the steel products, the robot-based 3D laser surface hardening system was applied. AISI 1045 steel flat parts were selectively hardened by a laser heat treatment (LHT) method using a high-power disc laser. The laser hardening tests were performed using a constant power strategy. The single-pass laser-based phase transformation hardening processes were performed. The main influential laser processing parameters, such as laser power (1.35–2.55 kW) and scanning speed (9.0–15.0 mm/s), were selected and studied using a design of experiments. The statistical models were developed using a response surface method (RSM). The LHT parameters were also examined using the analysis of variance (ANOVA). The results showed that the optimized single-pass LHT treatment provided more than 200% increase in surface hardness due to transformation hardening.

Keywords: *AISI 1045 carbon steel, laser surface hardening, robot-assisted 3D scanning system, hardening intensity, hardness, roughness parameters*

NONLINEAR CONTROL OF A ROBOTIC ARM IN THE ELECTROMECHANICAL DOMAIN

Rosario La Regina[1], Maria Curcio[2],Carmine Maria Pappalardo[3]
[1,2,3]University of Salerno, 84084 Fisciano, Italy

Rosario La Regina

Maria Curcio

Carmine Maria Pappalardo

ABSTRACT:
A growing number of industries are paying attention to research in robotics. Precision and speed of execution are necessary features that must not be underestimated during the design phase. In this context, the choice of actuators to be used and the control policy play a key role. In this paper, a prototype of a robotic arm is proposed together with its dynamic analysis. In particular, the problem at hand was studied in a multi-domain environment using two MATLAB toolboxes, namely SIMSCAPE MULTIBODY and SIMSCAPE ELECTRICAL. By combining multibody dynamics and electrical dynamics, the developed model of the robotic system is as close to reality as possible. The control architecture chosen is a proportional-derivative controller, which is widely used in industry for mechanical systems of this type. Consequently, from a software-in-the-loop perspective, the design and calibration of the controller yield more accurate results for subsequent hardware-in-the-loop and control prototyping phases.

Keywords: *robotic arm, nonlinear control, direct current motor, SIMSCAPE MULTIBODY, SIMSCAPE ELECTRICAL, Robotics System Toolbox*

A NEW HYBRID PSO-JAYA ALGORITHM FOR FUNCTION OPTIMIZATION

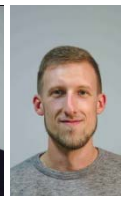
Lucijano Berus[1], Jernej Hernavs[2], Tadej Peršak[3], David Potočnik[4], Simon Klančnik[5], Janez Gotlih[6], Timi Karner[7], Mirko Ficko[8]

[1,2,3,4,5,6,7,8]University of Maribor, Faculty of Mechanical Engineering, Production Engineering Institute, Smetanovaulica 17, 2000 Maribor, Slovenia


Lucijano Berus


Jernej Hernavs


Tadej Peršak


David Potočnik


Simon Klančnik


Janez Gotlih


Timi Karner


Mirko Ficko

ABSTRACT:
A simple yet powerful population based algorithm (PSO-JAYA) is proposed with the combination of Particle Swarm Optimization (PSO) and JAYA optimization algorithms. The idea is to synthesize the exploration abilities of PSO and JAYA into hybrid PSO-JAYA, which incorporates both algorithms' strengths. Benchmark test functions are used to compare PSO-JAYA with other well-known optimization algorithms.

Keywords: *Particle swarm optimization, Function optimization, Jaya optimization, Constrained benchmark problems*

COMPARISON OF THE MAIN PARAMETERS OF THE STEEL AND CARBON-FIBER-REINFORCED PLASTIC BAND TRACTION UNITS FOR LONG-STROKE OIL WELL PUMPS

Bogdan Kopei[1], Ihor Kopei[2], Volodymyr Kopei[3], Oleh Onysko[4], Vasyl Mykhailiuk[5]
[1,2,3,4,5]Ivano-Frankivsk National Technical University of Oil and Gas, 15 Karpatska st., Ivano-Frankivsk, 76019, Ukraine


Bogdan Kopei


Ihor Kopei


Volodymyr Kopei


Oleh Onysko


Vasyl Mykhailiuk

ABSTRACT:
Sucker rod well pump installations are the most common for the mechanized method of oil production. They use a beam-balanced pumping unit as a surface drive, and a sucker rod string is a flexible link connecting the drive with a plunger well pump. The disadvantage of a beam-balanced pumping unit is the cyclic nature of operation with a short cycle period and a large asymmetry of loads. In this regard, the use of long-stroke pumping units with a band traction unit is promising. The problem of increasing the inter-repair period of a long-stroke pumping unit is associated with the creation of a long-sized, high-strength and durable band traction unit. The authors proposed to use carbon-fiber-reinforced plastic instead of steel. Carbon-fiber plastic is characterized by high strength, low density and corrosion resistance. The optimal values of the geometric parameters of the carbon-fiber band traction unit are determined and compared with the steel one: the thickness of the band is 2-3 mm (4-5 mm for steel); the width of the band depends on the diameter of the tubing and is 35–90 mm; band length is 1000–3000 m (1500–4500 m for steel). The carbon-fiber band traction unit of a long-stroke pumping unit has a significant margin of endurance in comparison with steel bands.

Keywords: *oil production, long-stroke pumping unit, band traction unit, carbon fiber, endurance limit.*

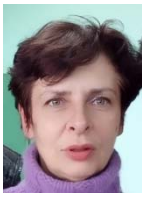
TOOL WEAR IN THE PROCESS OF DRILL-STRING CONNECTOR THREAD LATHE MACHINING

Oleh Onysko[1], Volodymyr Kopei[2], Yaroslav Kusyi[3], Lolita Pituley[4] and Iryna Taras[5]
[1,2,3,4,5]Ivano-Frankivsk National Technical University of Oil and Gas, Ukraine


Oleh Onysko


Volodymyr Kopei


Yaroslav Kusyi


Lolita Pituley


Iryna Taras

ABSTRACT:
The oil and gas industry is still the main and largest supplier of energy today. Extraction of hydrocarbons is a complex, science-intensive process that strongly affects the ecological state of the environment. The quality of drill strings, and especially their threaded connectors, determine the efficiency of oil and gas production and, at the same time, the environmental friendliness of the drilling process for years to come. Among the factors that contribute to this are the processes of thread-forming and appropriate tool-cutters. Lathe tools are the most widely used in the process of manufacturing drill-string threads. Well-known global trends offer such threading tools exclusively with a zero value of the rake angle. This, of course, ensures that a thread profile as close as possible to the theoretical one is obtained. However, this approach does not improve the efficiency of the threading process and does not allow these cutters to thread on alloyed, difficult-to-machine parts. The authors of this article developed a tool and methods of determining of the cutter wear resistance ability and show it on the example of the production of the 4 ½ Reg thread from chrome-nickel hardened steel. The result shows that the relative wear stability of the cutter proposed by the authors with a negative front angle is greater by more than 30% compared to the conventional.

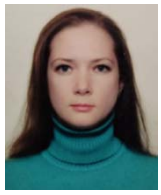
Keywords: *lathe tool, rake angle, tool-jointtapered thread, carbide insert wearing, thread profile accuracy.*

SIMULATION OF THE STRUCTURE AND FORMATION KINETICS OF A METASTABLE MODIFICATION OF CERIUM UPON QUENCHING FROM A LIQUID STATE

Oleksandr Lysenko[1], Kalinina Tetiana[2], Iryna Zagorulko[3], Predrag Dašić[4], Oleg Popil[5]
[1,2,5]Dniprovsk State Technical University, Faculty of metallurgy, 51918 Kamianske, Ukraine
[3]G.V. Kurdyumov Institute for Metal Physics of the N.A.S. of Ukraine, 03142 Kyiv, Ukraine
[4]Academy of Professional Studies Šumadija – Department in Trstenik, 37240 Trstenik, Serbia


Oleksandr Lysenko


Tetiana Kalinina


Iryna Zagorulko


Predrag Dašić


Oleg Popil

ABSTRACT:
In this paper is given the results of a complex computational analysis of the structure, mechanism and kinetics of crystallization of the metastable modification of cerium, which is fixed in the products of quenching from a liquid state with a thickness of less than 80 μm, are presented. The given are results of model calculations of parameters characterizing the kinetics of competitive crystallization of Ce for layers of different thicknesses and influence of the melt layers thickness on the rate of the process of QLS and the magnitude of supercooling corresponding to different stages of crystallization of the equilibrium δ- and γ-modifications of cerium. A correlation of simulation results with the corresponding experimental data has been achieved.

Keywords: *superfast quenching, cerium, metastable polytype, mathematical simulation, structure, formation mechanism and kinetics*

RESEARCH OF THE SURFACE OIL ABSORPTION PROCESSED BY VIBRATION ROLLING AND DEFORMING BROACHING

Ihor Shepelenko[1], Evhen Solovykh[2], Oleh Bevz[3], Stanislav Katerynych[4], Andrey Solovuch[5]
[1,2,3,4,5]Central Ukrainian National Technical University, 7 Universytetskyi Avenue, Kropyvnytskyi 25006, Ukraine


Ihor Shepelenko


Evhen Solovykh


Oleh Bevz


Stanislav Katerynych


Andrey Solovuch

ABSTRACT:
A technique for studying the oil absorption of a surface with a regular microreliefis proposed, which has been successfully tested in experimental studies. The main regularities of changes in the oil absorption of the surface processed by vibration rolling are established, and a comparison of theoretical and experimental data is carried out. The possibility of changing the oil absorption value of the surface and obtaining its optimal value for various operating conditions of movable conjugations by varying the processing modes is shown. The expediency of using deforming broaching to increase the supporting surface of a regular microrelief while maintaining an increased oil absorption is proved.

Keywords: *regular microrelief, surface oil absorption, vibration rolling, supporting surface, deforming broaching.*

DESIGN AND MANUFACTURING OF CONFORMAL COOLING CHANNELS FOR INJECTION MOLDING: A REVIEW

DESIGN AND MANUFACTURING OF CONFORMAL COOLING CHANNELS FOR INJECTION MOLDING: A REVIEW

Gotlih Janez[1], Karner Timi[2], Belšak Rok[3], Ficko Mirko[4], Berus Lucijano[5], Brajlih Tomaž[6], Pal Snehashis[7], Brezočnik Miran[8]
[1,2,3,4,5,6,7,8]University of Maribor, Faculty of Mechanical Engineering, Maribor, Slovenia








Janez Gotlih	*Timi Karner*	*Rok Belšak*	*Mirko Ficko*	*Lucijano Berus*	*Tomaž Brajlih*	*Snehashis Pal*	*Miran Brezočnik*

ABSTRACT:
It has been shown that conformal cooling in injection molding has the potential to replace conventional cooling due to its many advantages. The overall quality of the injection molding process is closely related to heat removal from the product and the mold, which is most uniform and efficient with conformal cooling. The disadvantages of conformal cooling are mainly in the manufacture of the mold, which is more expensive and time-consuming, which also affects the production of spare parts. To examine the current state of conformal cooling, an overview is given, organized according to the life cycle of the injection molding process. The main topics covered are process simulation, mold design and optimization, mold manufacturing, injection molding process control, and final quality evaluation based on product quality and financial benefits. Finally, the most promising solutions and their limitations are presented.
Keywords: *conformal cooling, injection molding, tool design, tool manufacturing, simulation, optimization*

ABSTRACT:
It has been shown that conformal cooling in injection molding has the potential to replace conventional cooling due to its many advantages. The overall quality of the injection molding process is closely related to heat removal from the product and the mold, which is most uniform and efficient with conformal cooling. The disadvantages of conformal cooling are mainly in the manufacture of the mold, which is more expensive and time-consuming, which also affects the production of spare parts. To examine the current state of conformal cooling, an overview is given, organized according to the life cycle of the injection molding process. The main topics covered are process simulation, mold design and optimization, mold manufacturing, injection molding process control, and final quality evaluation based on product quality and financial benefits. Finally, the most promising solutions and their limitations are presented.
Keywords: *conformal cooling, injection molding, tool design, tool manufacturing, simulation, optimization*

MIND MAPS FOR KEY POINTS OF A REVERSE ENGINEERING PROJECT

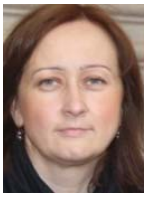
Ivanova Svitlana[1], Dimitrov Lubomir[2], Ivanov Viktor[3], Urum Galyna[4], Olefir Olena[5]
[1,4,5]South Ukrainian National Pedagogical University named after K.D. Ushynsky, 65020 Odesa, Ukraine
[2]Technical University of Sofia, 1000 Sofia, Bulgaria
[3]Odesa National Maritime University, 65029 Odesa, Ukraine


Svitlana Ivanova


Lubomir Dimitrov


Viktor Ivanov


Galyna Urum


Olena Olefir

ABSTRACT:
The choice of the option of further use of damaged equipment - replacement or repair, is always a difficult task. Rapid technological advances have made it imperative to explore the redesign option. The movement towards a circular economy has added the option of repurposing. It is proposed to compare these options using the diagram Damage - Cost - Functionality - Time. In this diagram, each of the options corresponds to a geometric figure. The Decision Rule for choosing the type of project comes down to choosing a geometric figure. The proposed diagram can be viewed as a mind map. Another key point of a reverse engineering project is the assessment of the degree of equipment damage. The combined use of the DSM matrix and the morphological matrix of damage made it possible to visualize the search for the cause of damage and the degree of damage.

Keywords: *reverse engineering, redesign, repurposing, mind map, DSM matrix, morphological map of damage*

HEURISTIC SEARCH FOR THE DESIGN OF SILENT CHAIN TRANSMISSIONS USING GRAPHS

Ivanova Svitlana[1], Dimitrov Lubomir[2], Ivanov Viktor[3], Konoplov Anatolii[4], Cheredarchuk Natalia[5]
[1]South Ukrainian National Pedagogical University named after K.D. Ushynsky, 65020Odesa, Ukraine
[2]Technical University of Sofia, 1000 Sofia, Bulgaria
[3,4,5]Odesa National Maritime University, 65029Odesa, Ukraine


Svitlana Ivanova


Lubomir Dimitrov


Viktor Ivanov


Anatolii Konoplov


Natalia Cheredarchuk

ABSTRACT:
The problem of “rectangling” or “polygonal action” has not been solved for chain drives, either bush roller chains or toothed chains. The search for a fundamentally new chain design was carried out using the heuristic method of enhancement creative activity. It is shown how, using the heuristic techniques that make up the method, the designer comes step by step to a new design. In the proposed six design options, the “rectangling” effect is completely eliminated. The design with the location of the drive sprocket on a straight chain section is considered. In this case, the following types of gearings can be used: pin sprocket – cycloidal rack, involute sprocket – gear rack, involute sprocket – pin rack. A design option is possible, in which the sprocket engages in the section where the chain wraps the tension roller. The chain, when wraps the tension roller, forms a compound gear wheel. In this case, the following types of gearings can be used: pin gear – cycloidal sprocket, cycloidal gear – pin sprocket, involute gear – involute sprocket and cycloidal gear – cycloidal sprocket. A significant reduction in the dynamic loads acting on the chain has been achieved.

Keywords: *silent chain, problem rectangling, heuristic method, graph interaction network*

CONTINUOUS IMPROVEMENT AND PERFORMANCE ASSESSMENT IN KNOWLEDGE-BASED ORGANIZATIONS

Aurel Mihail Titu[1],Andreea Maria Ungureanu[2], Florin-Alexandru Lungu[3,4]
[1]"Lucian Blaga" University of Sibiu, 10 Victoriei Street, Sibiu, Romania
[1]University POLITEHNICA of Bucharest, Faculty of Industrial Engineering and Robotics, 313 Splaiul Independenţei, 6th District, Bucharest, Romania
[2]University Politehnica of Bucharest, Faculty of Industrial Engineering and Robotics, 313 Splaiul Independenţei, 6th District, Bucharest, Romania,
[3]National Research and Development Institute for Cryogenics and Isotopic Technologies—ICSI, Uzinei Street No. 4, 240050 Rmmnicu Valcea, Romania,
[4]Faculty of Power Engineering, Politehnica University of Bucharest, 060042 Bucharest, Romania

Aurel Mihail Titu

Andreea Maria Ungureanu

Florin-Alexandru Lungu

ABSTRACT:
Ever since the emergence of the economic environment, there have been concerns about the quality of products and services provided. This concept has evolved over time, reaching very high levels and quality requirements becoming very rigorous. Thus, quality management is a permanent issue in a continuously changing society. To have an effective and efficient quality management system, organizations must demonstrate that they have the ability to consistently deliver products and services that meet legal, customer and regulatory requirements. But this is not enough, companies having to demonstrate performance and improvement. In this scientific paper will be analyzed modern management models in organizations, performance evaluation methods and the close connection between key performance indicators (KPI) and continuous improvement.

Keywords: *Management, Knowledge, Continuous improvement, KPI, Quality Management*

IMPROVEMENT OF THE TECHNIQUE OF OPTIMAL TECHNOLOGICAL ROUTES PLANNING FOR MACHINING OF THE MACHINE PARTS SURFACES

Yaroslav Kusyi[1], Oleh Onysko[2], Andrii Kuk[1], Olha Kostiuk[3], Bohdan Solohub[4]
[1] Lviv Polytechnic National University – Department “Robotics and Integrated Mechanical Engineering Technologies”, Ukraine – 79013, Lviv
[2] Ivano-Frankivsk National Technical University of Oil and Gas – Department “Computerized Mechanical Engineering”, Ukraine – 76019 Ivano-Frankivsk
[3] Lviv Polytechnic National University – Department of the Marketing and Logistics, Ukraine – 79013, Lviv
[4] Lviv Polytechnic National University – Department of Technical Mechanics and Dynamics of Machines, Ukraine – 79013, Lviv


Yaroslav Kusyi


Oleh Onysko


Andrii Kuk


Olha Kostiuk


Bohdan Solohub

ABSTRACT:
Increasing important requirements for quality parameters of mechanical engineering products and changing the criteria for evaluating the efficiency of technological systems: machine-clamping device-tool-workpiece requires the correction of the technological preparation of production at the Development and Manufacturing stage of Parts in their Life Cycles. Traditional methods of designing technological routes for processing machine parts do not ensure the fulfilment of the set technological tasks. The developed technique of technological routes planning for the treatment of the parts surfaces by machining allows to analyse of the degree of their material degradation using the LM-hardness method and is realized during the manufacturing of the drum's shaft of the belt conveyor. The values of the coefficients of variation during the machining of the shaft decrease from 10.10-18.80 % (for blank) to 0.33-0.57 % (after various types of grinding) in the technological chain "blank-final detail", which indicates the increase in the homogeneity of the material for functional surfaces of the shaft and the reduction of its susceptibility to damageability.

Keywords: *technological process, technological inheritability, LM-hardness method, homogeneity, object-oriented technology, functionally-oriented technology*

ANOMALY DETECTION AND CLASSIFICATION IN AGRICULTURAL PRODUCE USING IMAGE PROCESSING AND CNN ASSISTED BY A ROBOTIC ARM

Varsha Viswanathan, Supraajha Murali, Venkatakrishnan Veeraraghavan
Department of Computer science and Engineering
Easwari Engineering College,
162, Bharathi Salai, Ramapuram, Chennai, India


Varsha V


Supraajha M


Venkatakrishnan V

ABSTRACT:
The Global Hunger Crisis has long been one of the most pressing problems of the modern world. Surveys have shown that globally, around 14 percent of food produced is wasted between harvest and retail. This project aims to develop a mechanism that uses image processing and deep learning to classify agricultural produce and perform anomaly detection. The system performs two kinds of evaluations; a mass-evaluation and a singular evaluation. The mass evaluation of produce is done by angling a camera at an angle theta (θ), that is pre calculated through an optimal angle calculation algorithm. In addition, the system provides controls to a supervisor to specifically evaluate individual items based on the factor of "intuitive inquiry". In this process, a robotic arm picks the target item and takes it to the camera physically for end-to-end coverage. The data obtained from both mass analysis and individual analysis is fed into a program containing metrics for evaluation. Based on the degree of adherence/divergence from standards, the system also recommends a further progression by classifying the item into sets—i.e., if the item is anomaly-free, if it is fully defective and must be discarded, if it can be corrected through further processing, or if it has been under processed. With each iteration of item evaluation, the system intelligently learns from its decisions for improved accuracy and speed.

Keywords: *Computer Vision, Image Processing, Convolutional Neural Networks, Deep Learning*

GAUSS-BASED HONEY BADGER ALGORITHM FOR STEP-CONE PULLEY OPTIMIZATION PROBLEM

PRIMJENA ALGORITMA MEDOJEDNOG JAZAVCA BAZIRANOG NA GAUSOVIM MAPAMA ZA OPTIMIZACIJU PROBLEMA STEPENASTE REMENICE

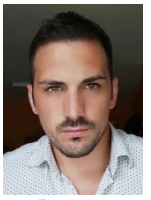
Đurđev Mića[1], Milošević Mijodrag[2],Lukić Dejan[3], Antić Aco[4], Novaković Borivoj[5], Đorđević Luka[6]
[1,5,6]University of Novi Sad, Technical Faculty “Mihajlo Pupin”, Zrenjanin, Serbia
[2,3,4]University of Novi Sad, Faculty of Technical Sciences, Novi Sad, Serbia

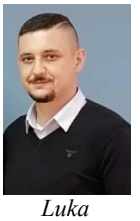

Mića Đurđev


Mijodrag Milošević


Dejan Lukić


Aco Antić


Borivoj Novaković


Luka Đorđević

ABSTRACT:
This study considers the application of the improved Gauss-based Honey badger algorithm (Gauss-based HBA) to deal with the popular constrained optimization problem regarding the minimization of the weight of the step-cone pulley. The concept of the proposed swarm intelligence algorithm is described, and the mathematical formulation is detailed. Afterward, the step-cone pulley optimization is presented graphically with the mathematical model regarding objective function and eleven constraints. The comparative study was performed to validate the performances of the Gauss-based HBA that proved to be efficient for this optimization problem.

Keywords: *honey badger algorithm, optimization, step-cone pulley problem*

REZIME:
Ova studija razmatra primjenu poboljšanog algoritma medojednog jazavca zasnovanog na Gauss-ovim haotičnim mapama (Gauss-based HBA) za rješavanje popularnog problema uslovne optimizacije koji se odnosi na minimizaciju težine stepenaste remenice. Opisan je koncept predloženog algoritma iz oblasti inteligencije rojeva, uz detaljan prikaz matematičkih izraza. Nakon toga je grafički predstavljena optimizacija stepenaste remenice sa matematičkim modelom koji pokriva funkciju cilja i jedanaest ograničenja. Uporedna studija je sprovedena sa ciljem da se validiraju performanse Gauss-baziranog HBA koji se pokazao efikasnim za rješavanje ovog problema optimizacije.

Ključne riječi: *algoritam medojednog jazavca, optimizacija, problem stepenaste remenice*

GENETIC ALGORITHAMS MODELING OF CUTTING FORCES DURING TURNING HARD STEEL FOR ECONOMIC SUSTANABLE PRODUCTION

MODELOVANJE SILA REZANJA POMOĆU GENETSKIH ALGORITAMA PRI STRUGANJU KALJENOG ČELIKA ZA EKONOMSKU ODRŽIVU PROIZVODNJU

Pavel Kovač[1], Mirfad Tarić [2], Borislav Savković[3], Dušan Ješić [4], Branislav Dudić[5,6]
[1,3]University of Novi Sad, Faculty of Technical Sciences, 21000 Novi Sad, Serbia
[2] Srednja škola metalskih zanimanja, Sarajevo, Bosnia and Hercegovina
[4]International Technology and Management Academy – MTMA, Novi Sad, Serbia
[5] Comenius University in Bratislava, Faculty of Management, 820 05 Bratislava, Slovakia
[6]University Business Academy, Faculty of Economics and Engineering Management, 21000 Novi Sad, Serbia


Pavel Kovač


Mirfad Tarić


Borislav Savković


Dušan Ješić


Branislav Dudić

ABSTRACT:
This paper presents the modeling of the main cutting resistance when turning hardened steel using artificial intelligence, i.e. genetic algorithms. Given that the main cutting forces during machining are of great importance, the application of genetic algorithms tries to reduce human intervention in the selection of optimal cutting tools and process parameters for metal cutting. In the work, the processing of hardened material is carried out, which until now was processed by grinding, but now one operation can be skipped and the processing is finished by turning. In material removal processes such as turning, the choice of cutting tools and optimal process parameters play a decisive role in improving quality and reducing production costs.

Keywords: *Cutting force, turning, hardened steel, artificial intelligence, genetic algorithms*

REZIME:
U ovom radu prikazano je modeliranje glavnog otpora rezanja pri struganju kaljenog čelika primenom veštačke inteligencije tj.genetskih algoritama. S obzirom na to, da su sile rezanja pri struganju od velikog značaja, primenom genetskih algoritama se pokušava smanjiti ljudska intervencija u odabiru optimalnih reznih alata i parametara procesa za rezanje metala. U radu se vrši obrada kaljenog materijala koji se dosad obrađivao brušenjem a sada može da se jedna operacija preskoči i da se obrada završi struganjem. U procesu skidanja materijala pri obradi kao što je struganje, izbor alata za rezanje i optimalni procesni parametri igraju odlučujuću ulogu u poboljšanju kvaliteta i smanjenju troškova proizvodnje.

Ključne reči: *Sila rezanja, struganje, kaljeni čelik, veštačka inteligencija, genetski algoritm*

ANALYSIS OF SOME PARAMETERS IN EXPLOSIVE FORMING

ANALIZA ODREĐENIH PARAMETARA KOD EKSPLOZIVNOG OBLIKOVANJA

Šunjić Darko[1], Buljan Stipo[2],Gomez Eduarda[3]
[1]University of Mostar, Faculty of Mechanical Engineering, Computing and Electrical Engineering, 88000 Mostar, BiH
[2]Federal Ministryof Energy, Miningand Industry, 88000 Mostar, Bosnia and Herzegovina
[3]proMetheus-Unit of Research in Materials, Energy and Environment for Sustainability, Instituto Politécnico de Viana do Castelo,4900-348 Viana do Castelo, Portugal


Darko Šunjić


Stipo Buljan


Eduarda Gomez

ABSTRACT:
High-speed forming technologies include explosive forming, electromagnetic forming, and electrohydraulic forming. Explosive forming was most developed in the 50s of the 20th century for the needs of the development of the aviation industry and the space industry. Since that these technologies are still relatively unexplored, it is interesting to analyze certain parameters, and in this paper the emphasis is on the techniques of measuring detonation speed, deformations and pressure during explosive forming.

Keywords: *explosive forming, metal forming, technologies, parameters, pressure, deformation*

REZIME:
Visokobrzinske tehnologije obrade deformiranjem ubrajaju obradu eksplozijom, elektromagnetno oblikovanje i elektrohidrauličko oblikovanje. Obrada eksplozijom najviše se razvijala 50-ih godina 20. stoljeća i to za potrebe razvoja avio-industrije i svemirske industrije. S obzirom da su ove tehnologije relativno još neistražene zanimljivo je analizirati određene parametre, a u ovome je radu akcent na tehnikama mjerenja brzine detonacije, mjerenja deformacija i mjerenju tlaka kod obrade eksplozijom.

Ključne riječi: *obrada eksplozijom, obrada deformiranjem, tehnologije, parametri, tlak, deformacije*

PRODUCT LIFE CYCLE IN AUTOMOTIVE INDUSTRY

Adrian Bogorin-Predescu[1], Stefan Titu[2] and Aurel Mihail Titu[3]
[1]University POLITEHNICA of Bucharest, 313 Splaiul Independenței, București
[2]Iuliu Hațieganu University of Medicine and Pharmacy, 8Victor Babes Street, Cluj Napoca
[3]Lucian Blaga University of Sibiu, 10 Victoriei Street, Sibiu, România

Adrian Bogorin-Predescu

Stefan Titu

Aurel Mihail Titu

ABSTRACT:
This paper presents a unique point of view regarding the description of engineering processes in the automotive industry, from concept and development, to series production and end of product life. The phases of these engineering processes describe the Product Life Cycle (PLC), requirement gates and authorizations for synchronizing the underlying processes. The product life cycle runs from the earliest stages of a product idea to the end of a product delivery obligation. The PLC describes all of a product's Phases and Gates as timing milestones for the underlying processes, prompting a status review and leading to release for the successive phase. The PLC is the basis for process managers to define consistent value-added processes.In the last part, the points of view of the authors and the conclusions that emerge from this study are highlighted.

Keywords: *Product Life Cycle, process, gates, management, release, series production, development, concept, phase*

APPLICATION OF THE PFMEA METHODOLOGY IN A PRODUCTION FLOW WITH COLLABORATIVE ROBOTS

Aurel Mihail Țițu[1,2], Cristian Vasile Doicin[3], Nicolae Ionescu[4] and Vasile Gusan[5]
[1]Lucian Blaga University of Sibiu, 10 Victoriei Street, Sibiu, România
[2]The AcademyofRomanianScientists, 54 SplaiulIndependenței, Bucharest, Romania
[3]University Politehnica of Bucharest, Faculty of Industrial Engineering andRobotics, Splaiul Independenței nr. 313, 6th District, Bucharest, Romania
[4]University Politehnica of Bucharest, Faculty of Industrial Engineering and Robotics, Splaiul Independenței nr. 313, 6th District, Bucharest, Romania
[5]University POLITEHNICA of Bucharest, Faculty of Industrial Engineering and Robotics, SplaiulIndependenței no. 313, 6th District, Bucharest, Romania


Aurel Mihail Țițu


Cristian Vasile Doicin


Nicolae Ionescu


Vasile Gusan

ABSTRACT:
The implementation of collaborative robots can often be a challenging aspect. Depending on how collaborative robots have been integrated, various negative effects can occur that can affect the final quality of the product. The authors believe that this aspect could be prevented by identifying potential defects, their effects and causes using the PFMEA methodology. In this scientific work, the PFMEA Methodology will be applied in a serial manufacturing flow with collaborative robots, focusing on the potential defects arising due to the functions operated by the collaborative robots. The individual identification of potential causes will make it possible to treat and prevent them. By punctually treating the causes that generate the appearance of negative effects in a process, their appearance in the long term can be significantly reduced, and thus the quality, efficiency and effectiveness of the manufacturing flow with collaborative robots will be increased.

Keywords: *collaborative robot, PFMEA, cause-effect, quality assurance, manufacturing*

DIMENSIONAL AND POSITIONAL CONTROL OF INDUSTRIAL WORKPIECE USING CMM AND OPTICAL 3D SCANNER

KONTROLA DIMENZIJA I POZICIJA NA INDUSTRIJSKOM KOMADU KORISTEĆI CMM I 3D SKENER

Kenan Varda[1], Almira Softić [2], Nermina Zaimović-Uzunović[1], Sabina Serdarević-Kadić[2]
[1]University of Zenica
[2]University of Sarajevo


Kenan Varda


Almira Softić


Nermina Zaimović-Uzunović


Sabina Serdarević-Kadić

ABSTRACT:
In the process of dimensional and positional control of workpieces of large series, it is necessary to establish fast and reliable product quality control. This paper presents an example of dimensional and positional control of a machine workpiece, using a coordinate measuring machine Carl Zeiss Contura G2 and an optical 3D scanner RangeVision PRO. Using the manual mode of operation, the VAST XT probe detected and roughly determined the surfaces of interest. Automatic strategies for CNC measurement were created.
The obtained measurement results on the CMM were compared with the results obtained by 3D scanning. 3D model is created and virtually measured in the GOM Inspect software.
Keywords: *CMM,3D scanning, metrology, measurement, GOM, Rangevision, control*

REZIME:
U procesu kontrole dimenzija i pozicija radnih komada velikih serija, potrebno je uspostaviti brzu i pouzdanu kontrolu kvalitete proizvoda. U ovom radu je prezentovan primjer kontrole dimenzija i pozicija mašinskog radnog komada, koristeći koordinatnu mjernu mašinu Carl Zeiss Contura G2 i optički 3D skener RangeVision PRO. Koristeći manuelni režim rada, VAST XT sondom su detektovane i grubo određene površine od interesa. Kreirane su automatske strategije za CNC mjerenje.
Dobijeni rezultati mjerenja na CMM su upoređeni sa rezultatima dobijenim 3D skeniranjem. Kreiran je 3D model i virtuelno izmjeren u softveru GOM Inspect. Prikazani su poređeni rezultati.

Ključne riječi: *CMM, 3D skeniranje, metrologija, mjerenje, GOM, RangeVision, kontrola*

USING FRACTAL DIMENSIONS IN MODELING COMPLEX SYSTEMS IN ENGINEERING

Maryna Holofieieva[1], Volodymyr Tonkonogyi[2], Iraida Stanovska[3], Andrii Pavlyshko[4], Sergii Klimov[5]
[1,2,3,4,5]Odessa National Polytechnic University, Odessa, Ukraine


Maryna Holofieieva


Volodymyr Tonkonogyi


Iraida Stanovska


Andrii Pavlyshko


Sergii Klimov

ABSTRACT:
The article is devoted to the development and implementation of elements of express methods for designing heterogeneous objects. The method "of express-selection from the results of reverse calculation on the direct model - RCDM" is proposed. It allows you to dramatically speed up the creation of a direct computer model of an object, testing it and making a decision on its compliance with the specified operating conditions of the object. In the case of a negative answer, the original direct model is corrected, followed by a retest. The method consists in using the fractal dimension when modeling complex systems. Heterogeneous objects consist of at least two elements, between which there is a boundary. This boundary has a fractal dimension, and deliberate distortion (crumpling) of the original object leads to a change in the fractal dimension of the boundaries. The latter makes it possible to bring the distortion of the object to the extent that the boundaries reach the surface of the object and to numerically estimate the fractal dimension of the boundaries after crushing on the model. As a result, we get a number that allows us to measure the initial fractal dimension of this boundary, and therefore, to measure its state.

Keywords: *r complex objects, express design, transfer models, intensive parameter, fractal dimension*

VIBRATION INFRARED THERMAL METHOD OF DEFECTOSCOPY OF NON-METALLIC HETEROGENEOUS MATERIALS

Volodymyr Tonkonogyi[1], Oleksandr Stanovskyi[2], Maryna Holofieieva[3], Oleksandr Levynskyi[4], Sergii Klimov[5]
[1,2,3,4,5]Odessa National Polytechnic University, Odessa, Ukraine


Volodymyr Tonkonogyi


Oleksandr Stanovskiy


Maryna Holofieieva


Oleksandr Levynskyi


Sergii Klimov

ABSTRACT:
Effective using of non-metallic heterogeneous materials and constructions from them requires accurate determination of parameter values characterizing the internal processes that occur in them throughout the entire life cycle. Particular attention should be paid to reliable, operational measurement that could be performed outside the research laboratory. The complexity of the structure, special physical and mechanical properties, the presence of various defects, as well as complex internal processes, which neglecting leads to significant measurement errors and, accordingly, to incorrect decisions regarding their application. That is, classical measurement methods cannot be used to study heterogeneous structures. It is proposed to use the vibrational infrared thermal method of detecting defects of non-metallic heterogeneous materials, which is based on the phenomenon of thermal energy release in their locations under the influence of mechanical vibrations. This method of thermal energy generation has advantages over classical methods, primarily because it does not lead temperature changes in defect-free zones. This increases the accuracy of detecting the location of the defect. In addition, the signal-to-noise ratio increases. A general system designed for flaw detection of non-metallic heterogeneous materials with the help of infrared technology devices with vibrationally excited thermal energy is proposed.

Keywords: *non-metallic heterogeneous materials, internal processes, flaw detection, vibration infrared thermal method, infrared thermometry*

MULTIBODY MODELING OF A SERIAL MANIPULATOR FOR IN-SPACE APPLICATIONS

Salvio Veneziano[1], Marco Claudio De Simone[2]
[1](MEID4 Academic Spin-Off of the University of Salerno, Via Giovanni Paolo II, 132, Fisciano, 84084, Italy)
[2](Department of Industrial Engineering, University of Salerno, Via Giovanni Paolo II, 132, Fisciano, 84084, Italy)


Salvio Veneziano


Marco Claudio De Simone

ABSTRACT:
Launching satellites into orbit presents insurmountable constraints related to the cost directly proportional to the weight of the cargo and the volume it occupies. In-orbit assembly or in-space fabrication (ISM) itself is a possible solution to these problems, involving the production of artifacts in low Earth orbit (LEO) through various manufacturing processes suited to microgravity conditions. A small robotic island would reduce the problem of sending the necessary instrumentation and raw materials for production. This makes it possible to manufacture various products from small satellites to large structures. One possible configuration is the combination of additive manufacturing and robotics, using a 3D printer for the production of semi-finished products and a robotic arm for their handling and assembly, respectively.
The present work focuses on the preliminary study of a serial manipulator for use within a robotic platform for in-orbit assembly of CubeSat nanosatellites. The objective is to model the robotic island in a multi-body SimScape environment and analyze the kinematic and dynamic behavior of the manipulator by planning trajectories for the main steps of the fabrication process.

Keywords: *multi-body, serial manipulator, SimScape, dynamic, motion laws*

DESIGN OF AN INSTRUMENTED RAIL SEAT TEST-RIG FOR CONTINUOUS VEHICLE MONITORING

Giampiero Celenta[1], Tony Luigi Leopoldo Lenza[2], Marco Claudio De Simone[2]
[1](MEID4 Academic Spin-Off of the University of Salerno, Via Giovanni Paolo II, 132, Fisciano, 84084, Italy)
[2](Department of Industrial Engineering, University of Salerno, Via Giovanni Paolo II, 132, Fisciano, 84084, Italy)

Giampiero Celenta

Tony Luigi Leopoldo Lenza

Marco Claudio De Simone

ABSTRACT:
The need for constantly efficient machines or systems and the increased costs associated with maintaining such efficiency has gradually changed the way in which maintenance of machines or devices is carried out. Such activities are, in fact, increasingly dependent on technologically advanced systems capable of predicting component deterioration over the course of regular use. In order to optimize maintenance interventions, therefore, the need arises to be able to predict the behavior of artifacts by monitoring the wear status of the component under operating conditions. This aspect is particularly felt in cases where the variables that determine deterioration are difficult to predict in their frequency while knowing the type of external actions that lead to deterioration. Current monitoring technologies rely primarily on the use of sensors, coupled with the relative ease of being able to manage data and share it in real time on the cloud, which is increasingly leading companies to equip their devices with sensor networks capable of recording a wide range of signals to monitor the health of the device itself. This paper reports on the preliminary development phase of a fatigue testing machine for testing instrumented seats using a Cartesian manipulator.

Keywords: *multi-body, test-rig, SimScape, experimental apparatus, railway maintenance*

ANALYSIS AND DESIGN OF TEST-RIGS FOR LABORATORY TESTS UNDER MICROGRAVITY CONDITIONS

Salvio Veneziano[1],Giampiero Celenta[1], Marco Claudio De Simone[2]
[1](MEID4 Academic Spin-Off of the University of Salerno, Via Giovanni Paolo II, 132, Fisciano, 84084, Italy)
[2](Department of Industrial Engineering, University of Salerno, Via Giovanni Paolo II, 132, Fisciano, 84084, Italy)


Salvio Veneziano


Giampiero Celenta


Marco Claudio De Simone

ABSTRACT:
The restrictions imposed by the pandemic have severely affected the aerospace sector. To cope with this deepening crisis, therefore, the aerospace industry should use its know-how in the implementation of disruptive and highly innovative projects that would lead it, in the medium to long term, to cope with the current post-pandemic economic crisis. This is the context of the collaboration between the Italian Space Agency (ASI) and the European Space Agency (ESA) in connection with the European Advanced Generation Carrier (Vega). Such launchers simultaneously put into orbit about 50 small, lightweight satellites that will be used for a variety of applications-including earth observation, telecommunications, science, technology, and education. Given the growing interest of companies in this field, it was hypothesized to create a test rig for testing under microgravity conditions.
The following work presents the design of a parallel manipulator capable of simulating flight conditions and performing vibration tests specifically for this type of minisatellite.
The 3D model of the manipulator and CubeSat was developed in Solidworks while the rigid/flexible multibody model was modeled in Mathworks' Simscape multidomain environment.

Keywords: *multi-body, parallel manipulator, SimScape, Solidworks, dynamisc, micro-gravity*

CONTRIBUTIONS REGARDING THE IMPLEMENTATION OF THE DIGITAL ARCHIVING PROCESS IN A PUBLIC ORGANIZATION

Constantin Dorin OLTEANU[1], CristianVasile Doicin[2], Nicolae Ionescu[3], Aurel Mihail TITU[4]
[1]University Politehnica of Bucharest, Faculty of Industrial Engineering andRobotics, Splaiul Independenţei nr. 313, 6th District, Bucharest, Romania,
[2]University Politehnica of Bucharest, Faculty of Industrial Engineering andRobotics, Splaiul Independenţei nr. 313, 6th District, Bucharest, Romania,
[3]University Politehnica of Bucharest, Faculty of Industrial Engineering andRobotics, Splaiul Independenţei nr. 313, 6th District, Bucharest, Romania,
[4]Lucian Blaga University of Sibiu, 10 Victoriei Street, Sibiu, România


Constantin Dorin Olteanu


Cristian Vasile Doicin


Nicolae Ionescu


Aurel Mihail Titu

ABSTRACT:
The scientific paper presents original research on implementing the digital archiving process within a public organization. Current archiving is mainly done in physical format, which is not beneficial. Physical archiving involves using significant material resources, physical space resources, time resources, and additional human resources. The research proposed by the authors follows the orientation of the current society towards the digitization of the activities of a public organization and the implementation of digital archiving, considerably reducing the resources used for physical archiving and, finally, the quality of the services offered to citizens can increase significantly. In this scientific paper, we have proposed mathematical modeling that respects a dedicated research methodology and is carried out with experimental data analysis software. Later I processed and interpreted the experimental data. More, an estimate was made for 20 years of the number of files that should be archived. The digital capacity required for the digital archiving of the scanned documents, the estimation of the time needed for the scanning documents, and the estimation of the energy consumption required for the scanning documents for archiving were also estimated. At the end of the paper, the conclusions that emerge from this essential and helpful research to be effectively implemented are presented.

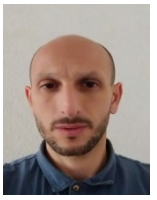
Keywords: *digital archiving, mathematical modeling, experimental research, digitization of activities, public organization.*

LOKAL DYNAMICS AND GLOBAL BEHAVIOR OF CERTAIN SECOND ORDER NONLINEAR DIFFERENCE EQUATION

LOKALNA DINAMIKA I GLOBALNO PONAŠANJE ODREĐENE NELINEARNE DIFERENTNE JEDNADŽBE DRUGOG REDA

Midhat Mehuljić[1], Jasmin Bekteševi[1], Vahidin Hadžiabdić[1], Sadjit Metović[1], Adnan Mašić[1]
[1]University of Sarajevo- Faculty of Mechanical Engineering, Sarajevo, Bosnia and Herzegovina


Midhat Mehuljić


Jasmin Bekteševi


Vahidin Hadžiabdić


Sadjit Metović


Adnan Mašić

ABSTRACT:
In this paper we observed a certain rational differece equation of the second order with quadratic terms. The local stability of this equation was fully tested and the absence of periodic solutions of period-two was proven. The stability of the zero equilibrium has been proven for all values of positive parameters, while depending on the positive parameters, two, one or no equilibria may occur. The equation is bounded on both sides. Four conjectures are given for the remaining parameter values for which the global dynamics were not examined. Their reason is the simulations that were made and listed in the paper.

Keywords: *boundness, equilibrium, period-two solutions, local stability, global stability.*

REZIME:
U ovom radu posmatrali smo određenu racionalnu diferentnu jednadžbu drugog reda sa kvadratnim članovima. Lokalna stabilnost ove jednadžbe je u potpunosti ispitana i dokazano je nepostojanje periodičnih rješenja perioda dva. Stabilnost nulte tačke ekvilibrijuma je dokazana za sve vrijednosti pozitivnih parametara, dok u zavisnosti od pozitivnih parametara može doći do dvije, jedne ili nijedne tačke ekvilibrijuma. Jednadžba je ograničena sa obje strane. Za preostale vrijednosti parametara za koje nije ispitivana globalna dinamika date su četiri konjekture. Razlog za njih su simulacije koje su urađene i navedene u radu.

Ključne riječi: *ograničenost, ekvilibrijum, periodičko rješenje perioda dva, lokalna stabilnost, globalna stabilnost.*

PERFORMANCE COMPARISON OF THE SIMSCAPE MULTIBODY SOLVERS FOR ARTICULATED MECHANICAL SYSTEMS

Ömer Ekim Genel[1], RosarioLa Regina[2],Carmine Maria Pappalardo[3*]
[1]Istanbul Technical University, 34437Istanbul, Turkey
[2,3]University of Salerno, 84084 Fisciano, Italy

Ömer Ekim Genel

Rosario La Regina

Carmine Maria Pappalardo

ABSTRACT:
SIMSCAPE MULTIBODY is considered an efficient simulation tool for the dynamic analysis of articulated mechanical systems due to the ease of modeling complex mechanical systems, the CAD import feature, and allowing for the implementation of advanced control techniques. Therefore, the objective of this study is to evaluate the performances of seven solvers implemented in SIMSCAPE MULTIBODY in terms of the error and the total elapsed simulation time. As the benchmark problem, a physical pendulum under three different load scenarios is considered, namely dynamic torque, no torque, and static torque. Computed angular position and angular velocity values at the final time step are compared with those obtained from the SIMULINK model. In addition to comparing the total elapsed simulation times in the SIMSCAPE MULTIBODY environment, the total elapsed simulation times are also compared with those obtained from SIMULINK simulations. The numerical results found in this study show a good agreement between the effectiveness of the solvers analyzed and appreciable differences in their efficiency.

Keywords: *dynamical simulations, SIMSCAPE MULTIBODY, performance evaluation, equations of motion solvers, articulated mechanical systems*

VIRTUAL PROTOTYPING OF A DYNAMIC VIBRATION ABSORBER FOR THE VIBRATION CONTROL OF A FRAME STRUCTURE

Giuseppe Isola[1], Rosario La Regina[2], Carmine Maria Pappalardo[3], Valentino Paolo Berardi[4]
[1,2,3,4]University of Salerno, 84084 Fisciano, Italy


Giuseppe Isola


Rosario La Regina


Carmine Maria Pappalardo


Valentino Paolo Berardi

ABSTRACT:
The control of structural vibrations in the mechanical, aerospace, and civil fields is becoming increasingly important in recent years. A fundamental problem in the design of civil and industrial structures is the high vibratory level that characterizes them due to environmental factors, such as high windiness or high sensitivity to seismic phenomena of the areas in which the structures are located. Particular attention is paid to non-dissipative systems, known as dynamic absorbers, used to modify the behavior of buildings in seismic territories or in areas with high winds. The purpose of these devices is to absorb a portion of the incoming mechanical energy in order to decrease the demand for energy that the structure must dissipate, thereby reducing its damage. The aim of this paper is, therefore, to analyze different types and design methodologies of dynamic absorbers and any fields of their application in order to highlight their contribution to dynamic dampening of mechanical vibrations.

Keywords: *mechanical vibrations, structural control, dynamic vibration absorbers*

SYSTEM IDENTIFICATION OF A NONLINEAR ONE-DEGREE-OF-FREEDOM VIBRATING SYSTEM

Şefika İpek Lök[1], Carmine Maria Pappalardo[2], Rosario La Regina[3], Levent Malgaca[4]
[1,4]DokuzEylul University, 35220 Konak, Turkey
[2,3]University of Salerno, 84084 Fisciano, Italy




Şefika İpek Lök | *Carmine Maria Pappalardo* | *Rosario La Regina* | *Levent Malgaca*

ABSTRACT:
In this paper, the modeling of a nonlinear one-degree-of-freedom mechanical system is investigated with nonlinear system identification methods. To this end, a nonlinear mechanical system with a cubic law for its stiffness characteristics is formulated using MATLAB/SIMULINK software. To identify the nonlinear properties of the mechanical system at hand, the Nonlinear ARX model is studied as the identification method. The nonlinear ARX model consists of linear and nonlinear output functions. More specifically, Feed Forward Network and Sigmoid Network functions are studied as nonlinear output functions of the Nonlinear ARX model to investigate the nonlinear dynamics of the mechanical system of interest. Numerical experiments show that the nonlinear mathematical models of the mechanical system are identified successfully.

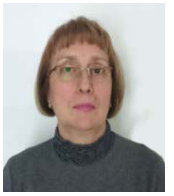
Keywords: *nonlinear mechanical system, system identification, nonlinear ARX model*

ROBOTIC TECHNOLOGY AS THE BASIS OF IMPLEMENTATION OF INDUSTRY 4.0 IN PRODUCTION PROCESSES IN CHINA

[1]Isak Karabegović, [2]Ermin Husak, [2]Edina Karabegović, [2]Mehmed Mahmić
[1]Academy of Sciences and Arts of Bosnia and Herzegovina,
Bistrik 7, 71000 Sarajevo, Bosnia and Herzegovina,
[2]Univesity of Bihać, Technical faculty Bihać, Ul.Irfana Ljubijankića bb,
77000 Bihać, Bosnia and Herzegovina


Isak Karabegović


Ermin Husak


Edina Karabegović


Mehmed Mahmić

ABSTRACT:
The implementation of Industry 4.0 has been intensively present in the surrounding countries in the last five to six years. However, its concept is not widespread enough in production processes in the world. Its implementation will improve many aspects of human life in all segments of society. The business paradigm and production models will change at all levels of production processes, including the supply chain. Major changes have taken place in the recent years, such as the transformation of production systems, consumption, delivery, logistics, etc., all due to the implementation of the latest technological discoveries such as: robotics, automation, 3D printing, Internet of Things (IoT), smart sensors, Big Data, Cloud Computing, Radio Frequency Identification (RFID), Virtual and Augmented Reality (AR), Artificial Intelligence (AI), Cyber-Physical Systems (CPS), etc. The implementation strategy of Industry 4.0 consists of adapting industrial production to complete smart automation, which means introducing methods of self-automation, self-configuration, self-diagnosis and elimination of problems, knowledge, and intelligent decision-making. By implementing the ‘’Made in China 2025’’ strategy, China has become the first country in the world in terms of robot implementation and vehicle production. The paper provides an analysis of Industry 4.0 patent applications and the trend of robot implementation in the last ten years with the aim of presenting the implementation of Industry 4.0.

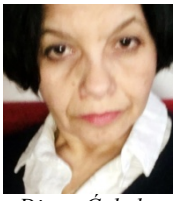
Keywords*: robot, Industry 4.0, production process, automation, China*

CHARACTERISATION OF 17-7PH STEEL OF MODIFIED STATE RH 950 WITH MODIFIED CHEMICAL COMPOSITION

KARAKTERIZACIJA ČELIKA 17-7PH MODIFIKOVANOG HEMIJSKOG SASTAVAU MODIFIKOVANOM STANJU RH950

Belma Fakić[1], Diana Ćubela[2]
[1]University of Zenica, Institute “Kemal Kapetanović” in Zenica,72000 Zenica, B&H
[2]Metallurgical and technological faculty,72000 Zenica, B&H


Belma Fakić


Diana Ćubela

ABSTRACT:
Precipitation hardening at low temperature is a heat treatment in which the material is hardened by precipitation of secondary phases from a solid solution. The first degree of hardening of steel 17-7PH is the transformation of austenite into martensite. Cryogenic heat treatment of this material offers the possibility of obtaining a suitable combination of martensite and austenite. The proportion of microstructural constituents martensite, austenite and delta ferrite was determined using an optical light microscope and the Feritoscope. The mechanical properties were determined at room and high temperature. Fire resistance testing of 17-7PH steel with high chromium and nickel content to show that it retains its high strength at high temperatures.

Keywords: *PH steel, microstructure, hardness, mechanical properties, fire resistance, heat treatment*

REZIME:
Precipitaciono ojačavanje na niskoj temperaturi je termička obrada u kojoj se materijal ojačava taloženjem sekundarnih faza iz čvrstog rastvora. Prvi stepen ojačavanja čelika 17-7PH je transformacija austenita u martenzit. Kriogena termička obrada ovog materijala pruža mogućnost dobijanja odgovarajuće kombinacije martenzita i austenita. Udio mikrostrukturnih sastojaka martenzita, austenita i delta ferita određeni su pomoću optičkog svjetlosnog mikroskopa i Feritoskopa. Mehanička svojstva su određena na sobnoj i visokoj temperaturi. Ispitivanje vatrootpornosti čelika 17-7PH s visokim sadržajem kroma i nikla kako bi se pokazalo da zadržava svoju visoku čvrstoću na visokim temperaturama.

Ključne riječi: *PH čelik, mikrostruktura, tvrdoća, mehanička svojstva, vatrootpornost, termički tretman*

DESIGNING THE OPTIMAL GEOMETRY OF MULTI-STAGE TOOLS

DIZAJNIRANJE OPTIMALNE GEOMETRIJE VIŠESTEPENIH ALATA

Mirna Nožić[1], Himzo Đukić[2]
[1]University “Džemal Bijedić” of Mostar, Faculty of Mehanical Engineering, Mostar, BiH
[2]University of Mostar FSRE, Mostar, BiH


Mirna Nožić


Himzo Đukić

ABSTRACT:
The paper provides a theoretical analysis of influencing parameters on the optimal geometry of multi-stage drawing tools with reduced wall thickness. It has been shown that the greatest influence on the geometry of the tool has: the dimensions of the diameter of the rings in the multi-stage tool, the angles of the rings in the tool, the height of the ironing zone, the height of the rings, the total height of all rings. The influence of the method of sizing rings in a multi-stage tool on the design of the optimal geometry of the tool was experimentally investigated.

Keywords:*multi-stage tools, optimal geometry, deep drawing with reduction, wall thicknesses, designing the optimal tool*

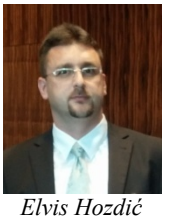
REZIME:
U radu je data teoretska analiza uticajnih parametara na optimalnu geometriju višestepenih alata za izvlačenje sa redukcijom debljine zida. Pokazano je da najveći uticaj na geometriju alata imaju: dimenzije prečnika prstenova u višestepenom alatu, uglovi prstenova u alatu, visine zone glačanja, visine prstenova, ukupna visina svih prstenova. Eksperimentalno je istražen uticaj načina dimenzionisanja prstenova u višestepenom alatu na dizajniranje optimalne geometrije alata.

Ključne riječi: *višestepeni alati, optimalna geometrija, duboko izvlačenje sa redukcijom debljine zida, dizajniranje optimalnog alata*

COGNITIVE CYBER-PHYSICAL PRODUCTION SYSTEMS: A NEW CONCEPT OF MANUFACTURING SYSTEMS ON THE ROUTE TO INDUSTRY 5.0

KOGNITIVNI KIBERNETSKO-FIZIČKI PROIZVODNI SISTEMI: NOVI KONCEPT PROIZVODNIH SISTEMA NA PUTU PREMA INDUSTRIJI 5.0

Elvis Hozdić[1], Zoran Jurković[2]
[1]University of Novo mesto, Faculty of Mechanical Engineering, Novo mesto, Slovenia
[2]University of Rijeka, Faculty of Engineering, Rijeka, Croatia


Elvis Hozdić


Zoran Jurković

ABSTRACT:
The European Commission has announced a new production philosophy for a sustainable, human-centric and resilient European industry. It has recently emerged under the name Industry 5.0 and opens up new perspectives for the development of advanced manufacturing systems. The concept of Industry 5.0 brings forth a new paradigm in the field of manufacturing systems, the so-called adaptive cognitive manufacturing systems (ACMS) paradigm. A fundamental building block of ACMS is the new generation of manufacturing systems called cognitive cyber-physical production systems (C-CPPS). This paper presents the development of a new production system. Its development stems from earlier work on a generic conceptual model of a cyber-physical production system (CPPS). The conceptual model of the C-CPPS incorporates the key technologies of Industry 4.0 for the development, adaptation and implementation of a CPPS and the advanced cognitive technologies of Industry 5.0 for the symbiosis of humans and automation.

Keywords: *cognitive cyber-physical production systems, enabling technologies, human-centric, Industry 5.0, resilient, sustainable*

REZIME:
Europska komisija je objavila novu proizvodnu filozofiju za održivu, na ljude usmjerenu i otpornu europsku industriju. Pojavila se je pod imenom Industrija 5.0 i otvara nove perspektive za razvoj naprednih proizvodnih sistema. Koncept Industrije 5.0 donosi novu paradigmu u oblasti proizvodnih sistema, takozvanu paradigmu adaptivnih kognitivnih proizvodnih sistema (ACMS). Osnovni gradbeni element ACMS-a je nova generacija proizvodnih sistema koji se nazivaju kognitivni kibernetsko-fizički proizvodni sistemi (C-CPPS). Ovaj rad predstavlja razvoj novog proizvodnog sistema. Njegov razvoj proizlazi iz ranijeg istraživačkog rada na generičkom konceptualnom modelu kibernetsko-fizičkog proizvodnog sistema (CPPS). Konceptualni model C-CPPS inkorporira ključne tehnologije Industrije 4.0 za razvoj, adaptaciju i implementaciju CPPS-a i napredne kognitivne tehnologije Industrije 5.0 za simbiozu ljudi i automatizacije.

Ključne riječi: *kognitivni kibernetsko-fizički proizvodni sistemi, omogućavajuće tehnologije, usmjereni na čovjeka, Industrija 5.0, otporni, održivi*

3D PRINTED SOUVENIR WITH MECHANICAL IRIS

SUVENIR S IRIS MEHANIZMOM DOBIVEN 3D PRINTANJEM

Žiga Alma[1], Kačmarčik Josip[2], Behadarević Ismir[3]
[1,2,3]University of Zenica, Faculty of Mechanical Engineering, 72000 Zenica, B&H


Žiga Alma


Kačmarčik Josip


Behadarević Ismir

ABSTRACT:
The paper presents the design and 3D printing of the souvenir for the Archaeological park "Ravne 2" in Visoko. The souvenir has the shape of a hexagon box, since most of the buildings in the park have a hexagonal base. On the top of the box is a mechanical iris lid consisting of six equilateral triangles that move and make on opening by turning the hexagon base. An analytical and numerical method for determining the bending stress of columns in a rotating base has been given, since they are the most loaded part of the assembly. The method of 3D printing of the box has been described and practical advices have been given for the design of the mechanical models made by 3D printing.

Keywords: *souvenir, hexagon box, mechanical iris, 3D printing*

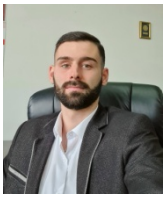
REZIME:
U radu je prikazan dizajn i 3D printanje suvenira za Arheološki park "Ravne 2" u Visokom. Suvenir je oblika heksagonalne kutije pošto je većina objekata u parku izgrađena sa heksagonalnom osnovom. Na vrhu kutije je poklopac napravljan kao iris mehanizam koji se sastoji od 6 jednakostraničnih trouglova koji se, okretanjem baze kutije, pokreću i prave otvor. Prikazan je analitički i numerički metod određivanja napona savijanja u stubićima rotirajuće baze, poštosu oni najopterećeniji dio sklopa. Opisan je metod 3D pritanja kutije i dati su praktični savjeti za dizajniranje mehaničkih modela koji će se izrađivati 3D printanjem.

Ključne riječi: *souvenir, heksagonalnakutija, iris mehanizam, 3D printanje*

MULTI-RESPONSE OPTIMIZATION OF FDM PROCESS PARAMETERS USING TAGUCHI BASED GREY RELATIONAL ANALYSIS METHOD

VIŠEKRITERIJSKA OPTIMIZACIJA FDM PROCESNIH PARAMETARA PRIMJENOM GREY RELACIJSKE ANALIZE ZASNOVANE NA TAGUCHI METODI

Kenan Muhamedagic[1], Ahmet Cekic[1], Derzija Begic-Hajdarevic[1], Amina Ramljak[1]
[1] University of Sarajevo - Faculty of Mechanical Engineering, BiH - 71000 Sarajevo


Kenan Muhamedagic


Ahmet Cekic


Derzija Begic-Hajdarevic


Amina Ramljak

ABSTRACT
Fused Deposition Modelling (FDM) is on the mostly used of Additive Manufacturing (AM) process to produce the polymer parts of simple to complex shapes. This study focuses on the optimisation of FDM process parameters to obtain the optimal parametric combination that provides the maximal flexural strength and the maximal compressive strength. The experiment was conducted by FDM process for printing Polylactic Acid (PLA) parts. Data from Taguchi design of experiments were analysed with Grey Relational Analysis (GRA). Layer thickness, printing temperature and raster angle are the parameters used for experimentation. It was found that 0.1 mm layer thickness, 220 °C printing temperature and 90° raster angle presented the optimal parametric combination by used multi-response optimisation method. Analysis of variance (ANOVA) at a 95 % confidence level was used to determine the most significant parameters.

Keywords: *FDM process, Polylactic Acid (PLA), GRA, ANOVA, flexural strength, compressive strength*

SAŽETAK:
Modeliranje topljenim depozitima (FDM) je najčešće korišteni prostupak aditivne proizvodnje (AM) koji se koristi za izradu polimernih dijelova od jednostavnih do složenih oblika. Ova studija se fokusira na optimizaciju FDM procesnih parametara kako bi se odredila optimalna kombinacija parametara koja osigurava maksimalnu čvrstoću na savijanje i maksimalnu čvrstoću na pritisak. Eksperiment je proveden FDM postupkom printanja dijelova od polimaida (PLA). Podaci su analizirani Grey Relacijskom Analizom (GRA) zasnovanom na dizajnu eksperimenta urađenom prema Tahuchi metodu. Parametri korišteni za provedbu eksperimenta bili su debljina sloja, temperatura printanja i ugao rastera. Primjenom metode višekriterijske optimizacije je utvrđeno da, debljina sloja od 0.1 mm, temperatura printanja od 220 °C i ugao rastera od 90° predstavljaja optimalnu kombinaciju parametara. Za određivanje najznačajnijih parametara korištena je analiza varijanse (ANOVA) na nivou pouzdanosti od 95%.

Ključne riječi: *FDM postupak, Poliamid (PLA), GRA, ANOVA, čvrstoća na savijanje, čvrstoća na pritisak*

THE INFLUENCE OF TECHNOLOGICAL PARAMETERS ON THE GEOMETRIC PRODUCT SPECIFICATION OF THE PARTS MANUFACTURED BY THE FUSED DEPOSITION MODELING

UTICAJ TEHNOLOŠKIH PARAMETARA NA GEOMETRIJSKU SPECIFIKACIJU PROIZVODA DELOVA PROIZVEDENIHDEPONOVANJEM ISTOPLJENOG FILAMENTA

Vladimir Blanuša[1], Dejan Movrin[2], Branko Štrbac[3],Miodrag Hadžistević[4], Miloš Ranisavljev[5]
[1]The Higher Education Technical School of Professional Education, Novi Sad, Serbia
[2,3,4,5]Faculty of Technical Sciences-Novi Sad, Serbia


Vladimir Blanuša


Dejan Movrin


Branko Štrbac


Miodrag Hadžistević


Miloš Ranisavljev

ABSTRACT:
The production of functional parts by additive manufacturing is becoming an increasingly common practice in today's manufacturing environment. Currently, there are a large number of methods that fall into the domain of additive manufacturing, and one of the most popular is Fused Deposition Modeling. Functionality, dimensional and geometric accuracy, and surface roughness are the key quality characteristics of every manufactured product. With the workpiece obtained by the FDM method, these characteristics directly depend on the choice of technological parameters. In this paper, the effects of the filling percentage, quality, and layer thickness on the mentioned quality output characteristics were analyzed. Based on the results, obtained by analysis of variance (ANOVA), it can be concluded that the selected factors and their levels have statistical significance on the quality output characteristics.

Keywords: *Fused Deposition Modeling, Technological parameters, Optimization*

REZIME:
Proizvodnja funkcionalnih delova aditivnim tehnologijama postaje sve češća praksa u današnjem proizvodnom okruženju. Trenutno postoji veliki broj metoda koje spadaju u domen aditivne proizvodnje, a jedna od najpopularnijih je deponovanje istopljenog filamena. Funkcionalnost, dimenziona i geometrijska tačnost i hrapavost površine su ključne karakteristike kvaliteta svakog proizvedenog proizvoda. Kod radnog predmeta dobijenog metodom FDM, ove karakteristike direktno zavise od izbora tehnoloških parametara. U ovom radu analizirani su uticaji procenta ispunjenosti, kvaliteta i debljine sloja na pomenute izlazne karakteristike kvaliteta. Na osnovu rezultata, dobijenih analizom varijanse (ANOVA), može se zaključiti da odabrani faktori i njihovi nivoi imaju statističku značajnost na karakteristike izlaznog kvaliteta.

Ključne reči: *Deponovanje istopljenog filamena, tehnološki parametri, optimizacija*

3D PRINTED TOYS FOR CHILDREN WITH DISABILITIES – STUDY CASE IN MONTENEGRO

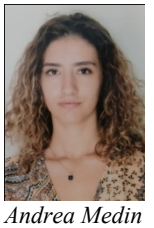
3D ŠTAMPANE IGRAČKE ZA DJECU SA SMETNJAMA U RAZVOJU – STUDIJA SLUČAJA CRNE GORE

Mihailo Jovanovic[1], Milena Djukanovic[2], Anita Maric[3], Andrea Medin[4]
[1]Adriatik University, Faculty of Management Herceg Novi
[2]University of Montenegro, Faculty of Electrical Engineering
[3]Government of Montenegro, Bureau for Education Services
[4]University of Montenegro, Faculty of Mechanical Engineering


Mihailo Jovanovic


Milena Djukanovic


Anita Maric


Andrea Medin

ABSTRACT:
Around 15% of the population has some kind of disability, of which 240 million are children. They are a part of every community, and the way society approaches and embraces them defines children's ability to participate and develop. Toys have a huge impact on children's cognitive development, senses, and creativity, as well as teaching them about themselves and their surroundings. Actually, kids build skills naturally through play. 3D printing as a fast-growing technology has also found its use in education, and it is especially beneficial for printing toys for children with disabilities because the materials used are recyclable and eco-friendly and can be created in accordance with their needs.

Keywords: *3D printing, children, education, toys, software, PLA filaments, Montenegro*

REZIME:
Oko 15% stanovništva ima neku vrstu invaliditeta, od čega su 240 miliona djeca. Oni su dio svake zajednice, a način na koji im društvo pristupa i prihvata ih definiše sposobnost djece da učestvuju i razvijaju se. Igračke imaju ogroman uticaj na dječiji kognitivni razvoj, čula i kreativnost, kao i na učenje o sebi i svom okruženju. U stvari, djeca razvijaju vještine prirodno kroz igru. 3D štampa kao brzorastuća tehnologija našla je svoju primjenu i u obrazovanju, a posebno je korisna za štampanje igračaka za djecu sa smetnjama u razvoju jer se koriste reciklirajući i ekološki materijali i mogu se kreirati u skladu sa njihovim potrebama.

Ključne riječi: *3D štampa, djeca, obrazovanje, igračke, softver, PLA filamenti, Crna Gora*

CALIBRATION OF TEST AND MEASURING EQUIPMENT IN PANDEMIC CONDITIONS

KALIBRACIJA ISPITNE I MJERNE OPREME U USLOVIMA PANDEMIJE

Belma Fakić, Samir Lemeš, Branka Muminović,
Omer Beganović, Mustafa Hadžalić, Kenan Varda
University of Zenica
Bosnia and Herzegovina


Belma Fakić


Samir Lemeš


Branka Muminović


Omer Beganović


Mustafa Hadžalić


Kenan Varda

ABSTRACT:
In order to meet the requirements of product standards, accreditation and certification bodies, normal operation during production requires regular calibration of test and measuring equipment, providing the validity of testing and measurement results. If regular, standard-prescribed calibration is not performed, the results of tests and measurements become questionable. This paper analyses how the COVID-19 pandemic influenced regular calibrations of testing and measuring equipment by accredited laboratories. The companies from Bosnia and Herzegovina participated in a survey to estimate the existing capacity of the national quality infrastructure under extraordinary conditions.

Keywords: *Calibration, Measuring equipment, Pandemic conditions, Accredited laboratories, Maintenance*

REZIME:
Da bi se ispunili zahtjevi standarda za proizvode, tijela za akreditaciju i certifikaciju, normalan rad u toku proizvodnje zahtijeva redovnu kalibraciju ispitne i mjerne opreme, obezbjeđujući validnost rezultata ispitivanja i mjerenja. Ako se ne izvrši redovna, standardom propisana kalibracija, rezultati ispitivanja i mjerenja postaju upitni. Ovaj rad analizira kako je pandemija COVID-19 utjecala na redovne kalibracije opreme za ispitivanje i mjerenje od strane akreditiranih laboratorija. Kompanije iz Bosne i Hercegovine učestvovale su u istraživanju za procjenu postojećeg kapaciteta nacionalne infrastrukture kvaliteta u vanrednim uslovima.

Ključne riječi: *Kalibracija, mjerna oprema, uslovi pandemije, akreditirane laboratorije, održavanje*

NUMERICAL SIMULATION OF VISCOELASTIC FLUID FLOW IN A CHANNEL

NUMERIČKA SIMULACIJA VISKOELASTIČNOG TOKA FLUIDA U KANALU

Halač Almin[1], Džaferović Ejub[2]
[1,2] University of Sarajevo – Faculty of Mechanical Engineering Vilsonovo šetalište 9, 71000 Sarajevo, Bosnia and Herzegovina

Almin Halač

Ejub Džaferović

ABSTRACT:
This paper describes a method and results of the numerical simulation of viscoelastic fluid flow in a two-dimensional channel. The governing equations are solved by a finite volume method, and a segregated solution procedure based on the SIMPLE algorithm is used. The rheological behaviour of the viscoelastic fluid is described by the upper-convected Maxwell model (UCM). After calculating the cell-centre stresses from the constitutive equations, the cell-face stresses must be calculated. However, linear interpolation can lead to decoupling between velocity and stress, resulting in an oscillating (checkerboard) velocity field, even for the correct stress values. To overcome this problem, a method for the calculation of the cell-face stresses based on the Rhie and Chow interpolation is developed. The developed method is tested on the flow in a two-dimensional channel. Although the discussion is limited to the channel flow, observations and conclusions presented in the paper should also be relevant for viscoelastic fluid flows in general.

Keywords*: Viscoelastic flow, stress-velocity coupling, numerical simulation, channel flow, upper-convected Maxwell model*

REZIME:
Ovaj rad opisuje metod i rezultate numeričke simulacije viskoelastičnog toka fluida u dvodimenzionalnom kanalu. Osnovne jednačine su riješene koristeći metodu konačnih zapremina, te proceduri baziranoj na SIMPLE algoritmu. Reološko ponašanje viskoelastičnog fluida je opisano pomoću upper-convected Maxwellovog modela (UCM). Nakon izračuna napona u centrima kontrolne ćelije koristeći konstitutivnu jednačinu, naponi na stranici kontrolne ćelije trebaju biti izračunati. Međutim, linearna interpolacija napona može dovesti do dekuplovanja između brzine i napona, što kao rezultat daje oscilatorno polju brzine, čak iako je polje napona tačno izračunato. Da bi se riješio ovaj problem, metoda za izračun napona na stranici kontrolne ćelije bazirana na Rhie i Chow interpolaciji je razvijena. Metoda je testirana na toku u dvodimenzionalnom kanalu. Iako je diskusija ograničen na tok u kanalu, zapažanja i zaključci dati u radu bi trebali biti relevantni za sve viskoelastične tokove.

Ključne riječi: *Viskoelastičan tok, kuplovanje napona i brzine, numerička simulacija, tok u kanalu, upper-convected Maxwellov model*

THE POSSIBILITY OF APPLYING ChatGPT (AI) FOR CALCULATIONS IN MECHANICAL ENGINEERING

MOGUĆNOST PRIMJENE ChatGPT (AI) ZA PRORAČUNE U MAŠINSTVU

Dragi Tiro
University “Džemal Bijedić”, Faculty of Mechanical Engineering,
88000 Mostar, Bosnia and Herzegovina

Dragi Tiro

ABSTRACT:
The research started from the assumption that using a modern artificial intelligence chatbot “ChatGPT” can significantly facilitate the job of a mechanical engineer when calculating in practice. The intention was to apply AI in many different tasks in the field of mechanical engineering, and to come to conclusions by statistical processing of the results. However, using ChatGPT in several examples of calculations we obtained incorrect results or wrong formulas and the like. Therefore, the application of ChatGPT on a large number of examples was abandoned and several of them are presented in this paper. It was concluded that for now, the use of ChatGPT in solving the problem of machine calculations is not desirable, it is even dangerous because of obtaining the wrong solutions.

Keywords: *AI, ChatGPT, Mechanical Engineering, Calculations*

REZIME:
Istraživanje je krenulo od pretpostavke da se korištenjem savremenogchatbota umjetne inteligencije chatGPT može značajno olakšati posao mašinskom inžinjeru prilikom proračuna u praksi. Namjera je bila da se u mnogo različitih zadataka iz domena mašinstva primjeni AI, te da se statističkom obradom rezultata dođe do zaključaka. Međutim, korištenjem chatGPT u nekoliko primjera proračuna dobijeni se netačni rezultati ili pogrešne formule i slično. Zbog toga se odustalo od primjene chatGPT na velikom broju primjera i u ovom radu je prikazano nekoliko njih. Zaključeno je kako za sada primjena chatGPT u rješavanju problema mašinskih proračuna nije poželjna, čak je i opasna zbog dobijanja pogrešnih rješenja.

Ključne riječi: *vještačka inteligencija, ChatGPT, mašinstvo, proračun*

INDUSTRY 4.0 READINESS ASSESMENT: HUMAN RESOURCE READINESS AND ACTIVE ROLE OF GOVERNMENT ADMINISTRATION FOR TRANSITIONAL CONTEXT OF BOSNIA AND HERZEGOVINA

PROCJENA SPREMNOSTI ZA INDUSTRIJU 4.0: SPREMNOST LJUDSKIH RESURSA I AKTIVNA ULOGA DRŽAVNE ADMINISTRACIJE ZA TRANZICIONI KONTEKST BOSNE I HERCEGOVINE

Isak Karabegović[1], Mirha Bičo Ćar[2], Savo Stupar[2], Munira Šestić[2]
[1]Academy of Sciences and Arts of Bosnia and Herzegovina, Sarajevo, Bosnia and Herzegovina
[2]University of Sarajevo, School of Economics and Business, Bosnia and Herzegovina


Isak Karabegović


Mirha Bičo Ćar


Savo Stupar


Munira Šestić

ABSTRACT:
For developing countries it is particularly important to create appropriate policies for industrial development in the new context of Industry 4.0. However, as a starting point for strategic determination, it is not enough to just assess the readiness of entreprises towards I4.0, knowing that the special challenges of developing countries in promoting and implementing I4.0 are related to human resources (poverty, lack of skills and digital differences), and significantly less state participation in affirmation of I4.0 in relation to developed countries. In this regard, a special challenge is creation of a I4.0 Readiness Assessment Tool for developing countries that would comprehensively assess not only the readiness of entreprises for I4.0, ... This paper offers possible proposal for complementing all the mentioned research questions with the aim of determining not only the readiness of enterprises, but also human resources, as well as the desired active role of the state administration through the perception of business actors, all for the transitional context of Bosnia and Herzegovina as a developing country.
Keywords: *Industry 4.0, Industry 4.0 Readiness Assessment Tool, Industry 4.0 Human Resources Readiness, Developing country*

SAŽETAK:
Za zemlje u razvoju posebno je važno kreirati odgovarajuće politike za industrijski razvoj u novom kontekstu Industrije 4.0. Međutim, kao polaznu osnovu za strateško opredeljenje, nije dovoljno samo procijeniti spremnost preduzeća za I4.0, znajući da su posebni izazovi zemalja u razvoju u promovisanju i implementaciji I4.0 vezani za ljudske resurse (siromaštvo, nedostatak veština i digitalne razlike), te značajno manje učešće države u afirmaciji I4.0 u odnosu na razvijene zemlje. U tom smislu, poseban izazov predstavlja stvaranje alata za procjenu spremnosti I4.0 za zemlje u razvoju,. ... Ovaj rad nudi mogući prijedlog za sva navedena istraživačka pitanja s ciljem utvrđivanja ne samo spremnosti preduzeća, već i ljudskih resursa, kao i željene aktivne uloge državne uprave, sve kroz percepciju poslovnih aktera, u tranzicijskom kontekstu Bosne i Hercegovine kao zemlje u razvoju.
Ključne riječi: *Industrija 4.0, Alat za procjenu spremnosti za I4.0, Spremnost ljudskih resursa za I 4.0, Zemlja u razvoju*

STRATEGIES FOR REDUCING EXCESS AND OBSOLETE INVENTORY

STRATEGIJE ZA SMANJENJENJE VIŠKA I ZASTARJELIH ZALIHA

Emir Halilović[1], Hadis Bajrić[2], Kristian Melin[3], Ermin Neimarlija[4]
[1,2]Faculty of Mechanical Engineering,University of Sarajevo, Sarajevo, Bosnia and Herzegovina
[3]Lut University Lahti Campus, Mukkulankatu 19,15210 Lahti, Finland
[4]Neimax d.o.o., Radinovići bb, 71300 Visoko, Bosna i Hercegovina


Emir Halilović


Hadis Bajrić


Kristian Melin


Ermin Neimarlija

ABSTRACT
The research and assessment of the state of obsolete stocks in companies from Bosnia and Herzegovina with a focus on the process industry, the wood industry, the pulp and paper industry, and the metal industry were carried out in the paper. Overview of obsolete stocks in companies from Bosnia and Herzegovina was done through a questionnaire. The research provides an overview and a list of the key reasons that lead to inventory obsolescence, which were identified through research in surveyed companies and a case study.
For one production company, a system was developed for the prevention of excessive and obsolete stocks, identification and qualification of obsolete stocks, a strategy for dealing with obsolete stocks was defined and an evaluation of the effect of the implemented strategy was made. Developed inventory management policy and strategies to prevent the creation of obsolete inventory were resulted in a 50% reduction in obsolete inventory.

Keywords: *excess inventory; obsolete inventory; disposal of excess and obsolete inventory; strategies for dealing with obsolete inventory; preventing the occurrence of excessive stocks.*

SAŽETAK
U radu je izvršeno istraživanje i procjena stanja zastarjelih zaliha u preduzećima iz Bosne i Hercegovine sa fokusom na procesnu industriju, drvnu industriju, industriju celuloze i papira, te metalnu industriju. Pregled zastarjelih zaliha u kompanijama iz Bosne i Hercegovine urađen je putem upitnika. U radu je dat pregled i lista ključnih razloga koji dovode do zastarjelosti zaliha, a koji su utvrđeni istraživanjem u anketiranim kompanijama i u kompaniji u kojoj se radio studij.
Za jednu proizvodnu kompaniju razvijen je sistem za prevenciju prekomjernih i zastarjelih zaliha, identifikaciju i kvalifikaciju zastarjelih zaliha, definisana je strategija postupanja sa zastarjelim zalihama i urađena procjena efekta sprovedene strategije. Razvijena politika upravljanja zalihama i strategije za sprečavanje stvaranja zastarjelih zaliha rezultirale su smanjenjem zastarjelih zaliha za 50%.

Ključne riječi: *višak zaliha; zastarjele zalihe; zbrinjavanje viška i zastarjelih zaliha; strategije za postupanje sa zastarjelim inventarom; sprečavanje nastanka prekomjernih zaliha.*

ASSEMBLY AND MAINTENANCE OF HIGH BAY WAREHOUSES ON A PRACTICAL EXAMPLE OF A METAL STRUCTURE INSTALLATION PROJECT

[1,2]Ismar Alagić
[1]International University of Sarajevo, Hrasnička cesta 15, 71230 Ilidža, Bosnia and Herzegovina
[2]University of Zenica, Faculty of Mechanical Engineering, Fakultetska 1, 72000 Zenica, Bosnia and Herzegovina

Ismar Alagić

ABSTRACT:
In this paper, the author will point out the determinants of assembly and maintenance of high-bay warehouses on the concrete example of a project for the assembly of metal structures for the needs of a renowned global company.
This paper is a modest attempt by the author to address an area that is insufficiently addressed from the standpoint of the existence of adequate professional literature, which would help spread scientific thought about the assembly of machine structures, assembly of high-bay warehouses, assembly of panels, assembly of rails and robots, assembly of conveyors, etc.
In this paper, the author will give numerous examples of the phases of the assembly of automated and robotic high-bay warehouses in the case of a specific project and specific working conditions.

Key words: *assembly, maintenance, high-bay warehouse (HBW), metal structure, installation.*

AN APPROACH TO DYNAMIC MODELLING OF INDUSTRIAL ROBOTS BASED ON 3D CAD TECHNIQUE

PRISTUP MODELIRANJU DINAMIČKIH SISTEMA INDUSTRIJSKIH ROBOTA TEMELJENOM NA 3D CAD TEHNIKE

Maida CohodarHusic[1], Mirko Ficko[2], Derzija Begic-Hajdarevic[3], Tadej Persak[4], Ahmet Cekic[5], Simon Klancnik[6]
[1,3,5] University of Sarajevo – Faculty of Mechanical Engineering, 71000 Sarajevo, B&H
[2,4,6] University of Maribor – Faculty of Mechanical Engineering, 2000 Maribor, Slovenia


Maida Cohodar Husic


Mirko Ficko


Derzija Begic-Hajdarevic


Tadej Persak


Ahmet Cekic


Simon Klancnik

ABSTRACT:
With the development of 3D CAD technology, new possibilities for performing experiments with virtual models have opened up. The paper proposes the development of a virtual model of a robotic manipulator based on its dynamics in the Simscape/Multibody programming environment. Such a model can serve as a research platform for optimizing system performances. This has demonstrated in the paper using the example of the ABB SCARA robot.

Keywords: *robot, dynamic model, 3D CAD, path planning, simulation*

REZIME:
Sa razvojem 3D CAD tehnologije, otvaraju se nove mogućnosti provođenja eksperimenata primjenom virtuelnih modela. Ovaj rad predlaže razvoj virtuelnog modela robotskog manipulatora temeljenog na njegovom dinamičkom modelu u programskom okruženju Simscape/Multibody. Takav model može poslužiti kao istraživačka platforma za optimiranje performansi sistema. Predložena ideja je demonstrirana na primjeru industrijskog robota ABB SCARA.

Ključne riječi: *robot, dinamički model, 3D CAD, planiranje putanje, simulacija*

CONSTRUCTION OF AN AUTOMATED DOOR AS A SMART DEVICE

KONSTRUKCIJA AUTOMATSKIH VRATA KAO JEDNOG PAMETNOG UREĐAJA

Mehmed Čobo, Alma Žiga, Malik Čabaravdić
University of Zenica, Faculty of Mechanical Engineering,Zenica, Bosnia & Herzegovina


Mehmed Čobo


Alma Žiga


Malik Čabaravdić

ABSTRACT:
In the paper, a smart device is being made, where the goal is to control the door via the web interface of any device with an Internet connection. The key components of the door are servo motor and levers which link shaft of servo motor to the door. The major part of the paper is devoted to the construction of the servo motor which is the drive element of the door, whose construction process is divided into two parts: the software part and mechanical part. The software part consists of a PID controller and a web server, and the mechanical part consists of the electric motor and electronic components. The mechanical relationship between the motor and the door was analyzed and the solution, which supports the local mode of operation of the door and control via the web interface at the same time, was chosen. ESP32 microcontroller and an Arduino platform for implementing code were chosen for data processing and motor movement control.

Keywords: *home automation, Arduino, automated door, ESP32, servo motor*

REZIME:
U radu se konstruiše jedan pametni uređaj, gdje je cilj upravljati vratima putem web interfejsa bilo kojeg uređaja sa internet vezom. Sastavni dijelovi koji omogućavaju upravljanje vratima su servo motor i veza vrata sa servo motorom putem poluga. Fokus je na izradi servo motora koji je pogonski element vrata, a čiji je proces konstruisanja podijeljen na dva dijela i to softverski i mehanički dio. Softverski dio čine PID kontroler i web server, a mehanički dio motor i elektroničke komponente. Analizirana je mehanička veza motora sa vratima i izabran je način priključivanja kojim sepodržava lokalni modus rada vrata i kontrolisanje putem web interfejsaistovremeno.Za procesuiranje podataka i kontrolisanje kretanja motora izabran je ESP32 mikrokontroler i Arduino platforma za implementaciju programskog koda.

Ključne riječi: *kućna automatizacija, Arduino, pokretna vrata, ESP32, servo motor*

FPGA BASED LOGISTICS SERVICE ROBOT CONTROL IN E-COMMERCE WAREHOUSE SYSTEM

UPRAVLJANJE LOGISTIČKIM SERVISNIM ROBOTOM BAZIRANOM NA FPGA HARDVERU U E-SKLADIŠNOM SISTEMU

Lejla Banjanovic-Mehmedović[1], Lejla Husić[2], Anel Husaković[3], Nermin Sarajlić[4]
[1,2,4]University of Tuzla, Faculty of Electrical Engineering, Tuzla, Bosnia and Herzegovina,
[3]University of Zenica, Faculty of Mechanical Engineering, Zenica, Bosnia and Herzegovina

Lejla Banjanović-Mehmedović

Lejla Husić

Anel Husaković

Nermin Sarajlić

ABSTRACT:
Logistic 4.0 requires the integration of different types of technologies, such as robotics, internet of Things (IoT), advanced data analytics, artificial intelligence (AI), which results in a powerful smart supply chain management system with the possibility of being used in different application. The wireless capability, path tracking and speed/position controllers have become important in the design of mobile robots since they are extensively applied in industrial and service fields. In this paper, we propose ane-commerce warehousing management concept based on the service mobile robot with a controller implemented on the Altera FPGA Cyclone IV board and Android application for remote control.According to the latest trends in RFID localization, the proposed navigation algorithm is implemented in the RFID based environment, using the FPGA based control platform. The perspectives of cyber security in the framework of the communication system and embedded application in the e-commerce warehouse are also presented. ...

Keywords: *FPGA, Industry 4.0, logistic, service robots, e-commerce warehouse, cybersecurity*

REZIME:
Logistika 4.0 zahtijeva integraciju različitih vrsta tehnologija, poput robotike, interneta stvari (IoT), napredne analitike podataka, vještačke inteligencije (VI), što rezultira moćnim pametnim sistemom upravljanja opskrbnim lancem u različitim primjenama. Mogućnost bežične veze, praćenje putanje i upravljanje brzinom/pozicijom postali su važni elementi u dizajnu mobilnih robota, s obzirom da se mobilni roboti intenzivno koriste u industrijskim i uslužnim aplikacijama. U ovom radu, predlažemo koncept upravljanja e-skladištem, baziran na servisnom mobilnom robotu s kontrolerom implementiranim na Altera FPGA Cyclone IV ploči i Android aplikaciji za daljinsko upravljanje. U skladu s najnovijim trendovima u RFID lokalizaciji, predloženi navigacijski algoritam implementiran je u RFID baziranom okruženju, koristeći FPGA upravljačku platformu. Prikazane su i perspektive kibernetičke sigurnosti u okviru komunikacijskog sistema i ugradbenih platformi u e-skladištu. ...

Ključne riječi: *FPGA, Industrija 4.0, logistika, servisni roboti, e-komerc skladište, cyber-sigurnost*

AN OVERVIEW OF MAINTENANCE STRATEGIES USING PETRI NET MODELS

PREGLED STRATEGIJA ODRŽAVANJA KORIŠTENJEM PETRI NET MODELA

Ilija Hristoski [1]***, Tome Dimovski*** [2]
[1]*Faculty of Economics - Prilep*
[2]*Faculty of Information and Communication Technologies - Bitola*
“St. Kliment Ohridski” University, Bitola, North Macedonia


Ilija Hristoski


Tome Dimovski

ABSTRACT:
The accelerated change in technology, industries, and social patterns and processes, caused by ubiquitous digitalization, increased interconnectedness, and smart automation, commonly referred to as Industry 4.0 revolution, has posed greater challenges to system maintenance issues than ever before. By describing various cost-effective practices to keep systems' equipment operational, and therefore highly available, maintenance remains the cornerstone set of activities that prevent equipment or facility from failing, keeping it in a good work condition, which is a key premise to carry out its mission. The paper aims to provide an overview of various maintenance strategies, supported by proposed Petri Net models. Such simulation models are suitable for carrying out performance and availability analysis of the strategies, based on a plethora of input parameters. The suggested Petri Net models provide solid frameworks for investigating the effectiveness of various maintenance strategies applied to a wide gamut of systems.

Keywords: *maintenance strategies, modeling, stochastic Petri Nets*

SAŽETAK:
Ubrzana promjena u tehnologiji, industrijama i društvenim obrascima i procesima, uzrokovana sveprisutnom digitalizacijom, povećanom međupovezanošću i pametnom automatizacijom, koja se obično naziva Industrijska revolucija 4.0, postavila je veće izazove za pitanja održavanja sistema nego ikada prije. Opisujući različite isplative prakse za održavanje opreme sistema operativnom, a samim tim i visoko dostupnom, održavanje ostaje kamen-temeljac skupa aktivnosti koje sprečavaju kvar opreme ili sistema, održavajući ih u dobrom radnom stanju, što je ključna pretpostavka za izvođenje njihove misije. Rad ima za cilj da pruži pregled različitih strategija održavanja, podržanih predloženim Petri Net modelima. Takvi simulacijski modeli su pogodni za izvođenje analize strategija u pogledu performansi i dostupnosti sistema, na osnovu mnoštva ulaznih parametara. Predloženi Petri Net modeli pružaju solidne okvire za istraživanje efikasnosti različitih strategija održavanja primenjenih na širok spektar sistema.

Ključne riječi: *strategije održavanja, modeliranje, stohastičke Petrijeve mreže*

DIGITAL TWINS DATA VISUALIZATION METHODS. PROBLEMS OF HUMAN INTERACTION: A REVIEW

Palazhchenko Yevhen[1], Shendryk Vira[2], Shendryk Sergii[3]

[1]Sumy State University Sumy, 40007 Sumy, Ukraine
[2]Sumy State University Sumy, 40007 Sumy, Ukraine
[3]Sumy National Agrarian University, 40000 Sumy, Ukraine

Yevhen Palazhchenko

Vira Shendryk

Sergii Shendryk

ABSTRACT:
Digital Twins (DT) are used in various industries. In particular, when working with robotic systems, the data from Digital Twins allows you to identify problems in the product and modernize it. In addition, Digital Twins technology can be used to train operators to prevent dangerous incidents.
Specially developed software or artificial intelligence can analyze the Digital Twins data immediately by a pre-programmed algorithm. On the other hand, a human is not capable of processing such arrays of numerical data and perceives information with the help of the five senses (touch, sight, hearing, smell, and taste). For complete immersion in the process and Digital Twins data processing, we can use a maximum of three of them (touch, sight, and hearing).
This work is devoted to the review of data visualization methods of Digital Twins of robot manipulators and the human ability to perceive and use the received data. The paper provides an overview of research in the direction of human-machine interaction and an overview of multimedia technologies used for data visualization. The work carried out will help systematize knowledge for future researchers..

Keywords: *Digital Twins, human-machine interaction, multimedia technologies, data visualization.*

MACHINE LEARNING MODEL FOR STUDENT DROP-OUT PREDICTION BASED ON STUDENT ENGAGEMENT

Lucija Brezočnik[1], Giacomo Nalli[2], Renato De Leone[2], Sonia Val[3], Vili Podgorelec[1], Sašo Karakatič[1]
[1]Intelligent Systems Laboratory, Facultyof Electrical Engineeringand Computer Science, University of Maribor, Slovenia
[2]School of Science and Technology, University of Camerino, Italy
[3]School of Engineering and Architecture, University of Zaragoza, Spain


Lucija Brezočnik


Giacomo Nalli


Renato De Leone


Sonia Val


Vili Podgorelec


Sašo Karakatič

ABSTRACT:
Nowadays, the issue of student drop-out is addressed not only through the prism of pedagogy, but also by technological practices. In this paper, we demonstrate how a student drop-out could be predicted through a student's performance using different Machine Learning techniques, i.e., supervised learning and unsupervised learning. The results show that various types of student engagement are essential factors in predicting drop-out and the final ECTS points achievements.

Keywords: *Machine Learning, Student Drop-out, Academic Drop-out, Student Engagement, Student Drop-out Prediction*

PROTOTYPING IoT TECHNOLOGY SOLUTIONS USING LORAWAN INFRASTRUCTURE

IZRADA PROTOTIPOVA IoT RJEŠENJA KORISTEĆI LORAWAN INFRASTRUKTURU

Amir Hajdar[1], Samim Konjicija[2]
[1]University of Sarajevo, Institute of Geodesy and Geoinformatics
[2]University of Sarajevo, Faculty of Electrical Engineering


Amir Hajdar


Samim Konjicija

ABSTRACT:
IoT solutions are rapidly finding ways into our lives. They are gaining popularity not only for small scale home applications, but also for large scale industrial applications. We generally have a problem of managing and monitoring multiple devices so we have to automate our processes. This is especially true for large scale industrial applications.
In order to learn how this automation can benefit us as well as find potential failures and bottle-necks, we often have to develop prototypes. These prototypes help us analyze potential problems and further improve our final, most efficient, solutions.
The purpose of this paper is to present a prototype developed utilizing Long Range Wide Area Network (LoRaWAN) to communicate with IoT devices that can be used for many different types of home and industrial applications. Typical LoRaWAN architecture will be presented, and use of data collected from a water meter device and a prototype device for measuring air temperature will be demonstrated.

Keywords: *IoT, LoRaWAN, prototype, MQTT, TTN, InfluxDB, networking*

REZIME:
IoT rješenja sve brže pronalaze put u našu svakodnevnicu. Ova rješenja postaju sve popularnija ne samo za male kućne projekte nego i za velike industrijske sisteme. Općenito imamo problem s upravljanjem i nadzorom više uređaja, pa moramo automatizirati naše procese. To posebno vrijedi za velike industrijske sisteme.
Kako bismo stekli znanja kako nam ova automatizacija može koristiti, kao i identifikovali potencijalne probleme, često moramo razviti prototipove. Ovi prototipovi nam pomažu analizirati potencijalne problem i dodatno poboljšati naša konačna optimalna rješenja.
Svrha ovog rada je predstaviti prototipove razvijene korištenjem infrastructure LoRaWAN mreže za komunikaciju s IoT uređajima koji se mogu koristiti za mnoge različite vrste kućnih i industrijskih aplikacija. Prikazat će se tipična LoRaWAN arhitektura, te demonstrirati korištenje podataka prikupljenih s vodomjernog uređaja i prototip auređaja za mjerenje temperature zraka.

Ključne riječi: *IoT, LoRaWAN, prototip, MQTT, TTN, InfluxDB, mreže*

A REVIEW OF RESEARCH PROGRESS AND APPLICATION OF WAVELET NEURAL NETWORKS

Wang Tonghao[1], Vincenzo Guercio[2], Piercarlo Cattani[3] and Francesco Villecco[4]
[1]College of Information and Electrical Engineering, China Agricultural University, No. 17 Tsinghua East Road, Haidian District, Beijing 100083, China
[2]Engineering School, Deim, University of Tuscia, Largo dell'Università, 01100 Viterbo, Italy
[3]Department of Computer, Control and Management Engineering, University of Rome "La Sapienza", via Ariosto 25, 00185 Roma, Italy
[4]Department of Industrial Engineering, University of Salerno, via Giovanni Paolo II 132, 84084 Fisciano, Italy


Wang Tonghao


Vincenzo Guercio


Piercarlo Cattani


Francesco Villecco

ABSTRACT:
Artificial Neural Network (ANN) has been used extensively and constantly developed. The combination of wavelet transform theory and the neural network has become an important branch to explore the optimization of neural network structure, and Wavelet Neural Network (WNN), a special network structure, was born. This paper reviews WNN's development and summarizes the system structure and algorithm implementation and presents derivative models and cutting-edge applications with obvious characteristics. The sorting and analysis of the above contents show that the combination of wavelet theory and neural network algorithm can make the network model have the advantages of fast convergence speed and high model accuracy, and has a rapid development trend in many fields such as audio signal and image processing. The work of this paper is intended to provide a reference for potential applications based on WNN and new network model design ideas.

Keywords: *Wavelet Transform, Wavelet Neural Network*

MOTION SYNCHRONIZATION FOR BILATERAL CONTROL SYSTEMS

SINHRONIZACIJA KRETANJA ZA UPRAVLJANJE BILATERALNIH SISTEMA

Džakmić Šejla[1], Viteškić Nađa[2], Ramdedović Amel[3], Alrefaee Mohammad Adnan Diab[4]
[1,2,3,4]International University of Sarajevo, Sarajevo, Bosnia and Herzegovina


Šejla Džakmić


Nađa Viteškić


Amel Ramdedović


Mohammad Adnan Diab Alrefaee

ABSTRACT:
This paper describes motion synchronization as essential problem in bilateral control systems. Two functionally related systems have synchronized behavior if they are controlled such that the slave device follows master's movement.. The proposed motion synchronization method is defined as a constrained motion in which generalized control errors are function of position and velocity of synchronized systems. Park's transformation from operation to configuration space is applied to define the generalized error such that it constraints the output of closed loop system by desired dynamics. Local controllers are implemented to ensure the stability of the system and enforce desired convergence rate with short time response. The obtained results prove fast response and fully synchronized motion control. The application of the proposed system is described in detail and evaluated by simulation and experiments. The experimental results will serve as a basis for the next stage of research, which is Cyber Physical Systems and teleoperations.

Keywords: *Bilateral control, synchronization, motion control*

REZIME:
Ovaj rad opisuje sinhronizaciju kretanja kao suštinskog problema u upravljanju bilateralnim sistemima. Dva funkcionalno povezana sistema imaju sinhronizovano ponašanje ako se njima upravlja tako što podređeni (slave) uređaj slijedi kretanje master uređaja. Predložena metoda sinhronizacije definisana je kao ograničenje kretanja u kojem su generalizovane greške upravljanja funkcije položaja i brzine sinhronizovanih sistema. Parkova transformacija iz operativnog u konfiguracijski prostor primijenjena je za definisanje generalizovane greške tako da ograničava izlaz sistema zatvorene petlje željenom dinamikom. Lokalni upravljači su implementirani kako bi se osigurala stabilnost sistema i ostvarila željena stopa konvergencije sa kratkim vremenskim odzivom. Dobiveni rezultati dokazuju brzu reakciju i potpuno sinhronizovanu kontrolu kretanja. Primjena predloženog sistema je detaljno opisana i evaluirana kroz simulaciju i eksperimente. Eksperimentalni rezultati će poslužiti kao osnova za siljedeću fazu istraživanja, a to su Cyber fizički sistemi i teleoperacije.

Ključne riječi: *Bilateralno upravljanje, sinhronizacija, upravljanje kretanja*

EDGE DETECTION ALGORITHM FOR BIOLOGICAL SLICE IMAGES BASED ON EMPIRICAL WAVELET TRANSFORM AND MORPHOLOGY

Yafei Liu[1], Vincenzo Guercio[2], Piercarlo Cattani[3] and Francesco Villecco[4]
[1]College of Information and Electrical Engineering, China Agricultural University, No. 17 Tsinghua East Road, Haidian District, Beijing 100083, China
[2]Engineering School, Deim, University of Tuscia, Largo dell'Università, 01100 Viterbo, Italy
[3]Department of Computer, Control and Management Engineering, University of Rome “La Sapienza”, via Ariosto 25, 00185 Roma, Italy
[4]Department of Industrial Engineering, University of Salerno, via Giovanni Paolo II 132, 84084 Fisciano, Italy


Yafei Liu


Vincenzo Guercio


Piercarlo Cattani


Francesco Villecco

ABSTRACT:
Edge detection is important in extracting image features, and microscopic slice images consist of closed-loop structures and complex internal textures, and extracting the corresponding features has an important role in biology, epidemiology, pathology and other fields. In this study, an edge detection algorithm for slice images based on empirical wavelet transform (EWT) and morphology is proposed. The empirical wavelet divides the Fourier spectrum of the signal into successive intervals, and then constructs a wavelet filter bank for filtering in the corresponding interval segments, and finally obtains the amplitude modulation frequency components by signal reconstruction. The empirical wavelet transform overcomes the modal aliasing problem caused by the scale discontinuity in the time domain, which reflects the characteristics of the empirical wavelet transform. The image components extracted by the empirical wavelet are then enhanced using a morphological algorithm, which can effectively extract the closed-loop edges of the sliced image as well as the significant textures inside. In this paper, the proposed method is tested on locust slice images as an example. The proposed algorithm can also be effectively applied to other biological cross-sectional images.

Keywords: *biological slice images; empirical wavelet transform; morphology; edge detection*

CYBERSECURITY CHALLENGES IN MODERN SUPPLY CHAIN

IZAZOVI KIBERNETIČKE SIGURNOSTI U SUVREMENOM LANCU OPSKRBE

Gordana Zeba[1], Mirjana Čičak[2]
[1,2]University of Slavonski Brod, Mechanical Engineering Faculty, 35000 Slavonski Brod, Croatia


Gordana Zeba


Mirjana Čičak

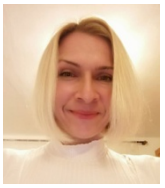
ABSTRACT:
Industry 4.0 has fundamentally changed the business landscape in the world. Companies now operate in a complex environment under the influence of emerging Industry 4.0 technologies and complex networks with partner companies in supply chains to deliver products and services to customers on time, with the required quality, and at the lowest possible cost. The digital transformation of business has increased productivity, efficiency, and competitiveness, but supply chains are becoming more vulnerable concerning security. Supply chains face security risks, such as theft of business data and intellectual property, disruption of operations, and financial losses that threaten the vital functions of supply chain participants. Given the growing interest in cybersecurity, this paper aims to identify trends in cybersecurity research for supply chains and directions for future research. For this reason, the authors conducted a bibliometric analysis of relevant articles on cybersecurity in the supply chain represented in the citation databases of the Web of Science platform. The research findings improve understanding of cybersecurity challenges in supply chain management and provide insights into areas of cybersecurity that require further research.
Keywords: *Industry 4.0, cybersecurity, supply chain, blockchain, bibliometric analysis*

REZIME:
Industrija 4.0 iz temelja je promijenila poslovni krajolik u svijetu. Tvrtke sada djeluju u složenom okruženju pod utjecajem novih tehnologija Industrije 4.0 i složenih mreža s partnerskim tvrtkama u opskrbnim lancima kako bi isporučile proizvode i usluge kupcima pravovremeno, uz potrebnu kvalitetu i uz najniže moguće troškove. Digitalna transformacija poslovanja povećala je produktivnost, učinkovitost i konkurentnost, ali opskrbni lanci postaju sigurnosno ugroženiji. Lanci opskrbe suočeni su sa sigurnosnim rizicima, kao što su krađa poslovnih podataka i intelektualnog vlasništva, prekid poslovanja i financijski gubici koji ugrožavaju vitalne funkcije sudionika u lancu opskrbe. S obzirom na rastući interes za kibernetičku sigurnost, cilj ovog rada je odrediti trendove u istraživanju kibernetičke sigurnosti u opskrbnim lancima i pravce budućih istraživanja. Zbog toga su autori proveli bibliometrijsku analizu relevantnih članaka o kibernetičkoj sigurnosti u opskrbnom lancu, koji su zastupljeni u citatnim bazama podataka platforme Web of Science. Rezultati istraživanja poboljšavaju razumijevanje izazova kibernetičke sigurnosti u upravljanju opskrbnim lancem i pružaju uvid u područja kibernetičke sigurnosti koja zahtijevaju daljnja istraživanja.
Ključne riječi: *Industrija 4.0, kibernetička sigurnost, opskrbni lanac, blockchain, bibliometrijska analiza*

THE EFFECT OF ONLINE LEARNING SETTING ON MOTIVATION, INTENDED EFFORT, EMOTIONAL ENGAGEMENT, AND LANGUAGE LEARNING STRATEGIES AMONG NON-ENGLISH MAJORS IN CROATIA

UTJECAJ ONLINE UČENJA NA MOTIVACIJU, NAMJERAVANI NAPOR, EMOCIONALNI ANGAŽMAN I STRATEGIJE UČENJA JEZIKA MEĐU NEENGLESKIM SMJEROVIMA U HRVATSKOJ

***Fišer Zrinka*[1]**
[1]*University of Slavonskom Brodu, 35000 Slavonski Brod, Croatia*



Zrinka Fišer

ABSTRACT:
Following the findings of previous pre-pandemic research on students' motivation and language learning strategies, a new pilot research was conducted among non-English major undergraduate students with an aim to identify the effects of e-learning on their motivation and intended effort to learnEFL, as well as their emotional engagement and their choice of language learning strategies. The author used theL2MSS, SILL and the Emotional Engagement scales to identify the statistically significant relationships to students' previous experiences in learning EFL. The research serves as a pilot study for the larger-scope investigation with variables of age and English for generic and specific purposes as possible relevant factors.

Keywords: *e-learning, L2MSS, SILL, emotional engagement, EFL students*

REZIME:
Slijedom nalaza prethodnih predpandemijskih istraživanja o motivaciji studenata i strategijama učenja jezika, provedeno je novo pilot istraživanje među studentima preddiplomskog nelingvističkog studija s ciljem prepoznavanja učinaka e-učenja na njihovu motivaciju i namjeravano nastojanje da nauče ESJ, kao i na njihov emocionalni angažman i izbor strategija učenja jezika.Autorica je koristila L2MSS, SILL i skalu emocionalnog angažmana kako bi identificirala statistički značajne odnose s prethodnim iskustvima studenata u učenju ESJ-a. Istraživanje služi kao pilot studija za kasnije opsežnije istraživanje s varijablama dobi i specifičnim i općim ESJ kao mogućim relevantnim čimbenicima.

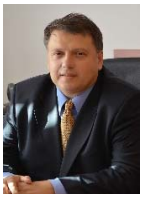
Ključne riječi: *e-učenje, L2MSS, SILL, emocionalni angažman, studenti ESJ*

CYBER VIOLENCE FORM OF DOMESTIC VIOLENCE

Petrică Tertereanu[1], Mihai Dragomir[2], Aurel Mihail Titu[3]
[1]University Politehnica of Bucharest, Faculty of Industrial Engineering and Robotics, Splaiul Independenţei nr. 313, 6th District, Bucharest, Romania
[2]Tehnical University of Cluj Napoca, Romania
[3]Lucian Blaga University of Sibiu, 10 Victoriei Street, Sibiu, România

Petrică Tertereanu

Mihai Dragomir



Aurel Mihail Titu

ABSTRACT:
The scientific paper aims to present an approach to cyber violence in relation to abuse in the real world. In recent times, more attention is being paid to cybercrime, including the problem of domestic abuse facilitated by digital technology and online communications, the increasing accessibility of the internet, the rapid spread of mobile information and the widespread use of social media. Modern technology offers domestic aggressor's new ways to control, coerce and pursue their victims, even going beyond spatial limits. Aggressors can use anti-victim technology to monitor, harass them, install spyware on victims' phones or attack them on social media to humiliate them. Also, numerous other situations of cyber violence faced by victims in the pandemic have been reported, such as: the discovery of viruses in devices, the receipt of suspicious attachments, the compromise of mail or social media accounts, the receipt of fraudulent emails.

Keywords: *cyber violence, electronic devices,information technology, cybercrime, stalkerware*

ON THE OPTIMAL DESIGN OF A SCALE-FREE SUPPLY NETWORK

Piercarlo Cattani[1], Francesco Villecco[2]
[1]Department of Computer, Control and Management Engineering, University of Rome “La Sapienza”, via Ariosto 25, 00185 Roma, Italy
[2]Department of Industrial Engineering, University of Salerno, via Giovanni Paolo II 132, 84084 Fisciano, Italy

Piercarlo Cattani

Francesco Villecco

ABSTRACT:
In this paper we define a scale-free network based both on the preferential attachement parameter, of the Barabasi-Albert model, and on the new parameter of carrying capacity under a logistic growth. The main advantage is that by using this new parameter the network will grow as a set of communites each one with a limited number of nodes, each community with only one hub and a very little number of connections between communities, thus minimizing the number of links. With this model, which fulfills the 80-20 Pareto rule, we will also get an optimal designed network characterized by the limited cost of management.

Keywords: *Supply chain management, scale-free network, preferential attachement, Barabasi and Albert model*

REMOTE LIQUID LEVEL MONITORING BASED ON IOT TECHNOLOGY

Vito Tič
University of Maribor, Faculty of Mechanical Engineering,
Smetanova 17, 2000 Maribor, Slovenia

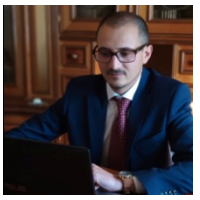
Vito Tič

ABSTRACT:
Industry 4.0 includes comprehensive smart solutions in the field of the entire product cycle, from production itself, storage, all the way to the distribution of the product to the final customer. The optimization of the distribution is especially important when the product has low price compared to its size and cost of transportation. Thus, there is a great opportunity for the use of Industry 4.0 IoT technology by introducing M2M technology for monitoring the stock status at end customers, which can further automate the process of ordering and distribution using IoT and Big Data technologies based on cloud application. Delivery routes can be optimized, thereby reducing logistics and administrative costs and helping to retain business by improving customer service.

Keywords: *IoT, level monitoring, route optimization, planning*

INTERNET OF THINGS IN THE CONSTRUCTION INDUSTRY: A GENERAL OVERVIEW

Angelo Lorusso*[1], Giampiero Celenta[2]
[1](Department of Industrial Engineering, University of Salerno, Via Giovanni Paolo II, 132, Fisciano, 84084, Italy)
[2](MEID4 Academic Spin-Off of the University of Salerno, Via Giovanni Paolo II, 132, Fisciano, 84084, Italy)



Angelo Lorusso

Giampiero Celenta

ABSTRACT:
The development of the Internet of Things (IoT) paradigm over the past few years has gained increasing success and various fields of application. Thanks to the use of this technology, it is possible to visualise and share data on dedicated and easy-to-interface platforms. An Internet of Things network consists of sensors and actuators interconnected and communicating with each other in real time through computer applications. This technology has seen several applications in various sectors, such as automotive, healthcare, telecommunications, education, radically transforming their approach and perspectives. Similarly, the construction industry has also been able to take advantage of this technology and its benefits in various applications. In fact, the IoT paradigm is being applied either to improve construction site phases by connecting the various machines at work or for the sharing of information among all the players in the design phase, or in the complex concept of Smart Cities. The same concept is applied for environmental monitoring for the purpose of living comfort or for structural monitoring for the purpose of structural protection. The aim of this paper is to enrich the understanding of the various applications in the construction world through IoT. In conclusion, we address the new challenges of combining IoT and architectural design with BIM (Building Information Modeling) methodology and the use of sensor data in the service of Machine Learning techniques.

Keywords: *IoT, Sensor, Structural Health Monitoring, Big Data, Machine Learning*

CHALLENGES AND BENEFITS OF USING DIGITAL TWIN TECHNOLOGY

IZAZOVI I PREDNOSTI PRIMJENE TEHNOLOGIJE DIGITALNIH BLIZANACA

Savo Stupar[1], Mirha Bičo Ćar[1],Munira Šestić[1]
Univerzitet u Sarajevu – Ekonomski fakultet, Trg oslobođenja 1. Sarajevo


Savo Stupar


Mirha Bičo Ćar


Munira Šestić

ABSTRACT:
One of the more modern technologies of Industry 4.0, created as a continuation and improvement of the Modeling and Simulation technology, thanks to the explosive development of Artificial Intelligence (primarily Big Data and Internet of Things technology), is the Digital Twin technology, which in fact represents the future of modeling and simulation. The aim of this work is to illuminatethe concept of Digital Twins from the aspect of their usefulness, i.e. the benefits that their application has in companies, as well as the challenges faced by the designers of this technology. When it comes to the advantages that the application of this technology provides to companies, the emphasis will be both on economic aspects, i.e. reducing product development costs, and on functional aspects, i.e. on improving the functionality of products, or more precisely the speed of achieving the appropriate product quality.

Keywords*: Artificial Intelligence, Digital Twins, Internet of Things, Machine Learning, Big Data*

SAŽETAK:
Jedna od savremenijih tehnologija Industrije 4.0, nastala kao nastavak i unapređenje tehnologije Modeliranja i Simulacije, zahvaljujući eksplozivnom razvoju Vještačke inteligencije (prije svega Big Data i Internet of Things tehnologija) jeste tehnologija digitalnih blizanaca, koja u stvari predstavlja budućnost modeliranja i simulacije. Cilj ovog rada je osvjetljavanje koncepta digitalnih blizanaca sa aspekta njihove korisnosti, odnosno benefita, koje njihova primjena ima u kompanijama, kao i izazova sa kojima se susreću dizajneri ove tehnologije. Kada su u pitanju prednosti, koje primjena ove tehnologije pruža kompanijama, naglasak će biti kako na ekonomskim aspektima, odnosno smanjenju troškova razvoja proizvoda, tako i na funkcionalnim aspektima, odnosno na unapređenju funkcionalnosti proizvoda, ili tačnije poboljšanju njihovog kvaliteta, kao i na povećanju brzine i kvaliteta procesa razvoja proizvoda, odnosno brzine postizanja odgovarajućeg kvaliteta proizvoda.

Ključne riječi:*Vještačka inteligencija, digitalni blizanci, internet stvari, mašinsko učenje, veliki podaci*

APPLICATION OF LOAD CELL SENSOR DATA COLLECTION FOR STRENGTH TRAINING AND MUSCULOSKELETAL REHABILITATION

PRIMJENA MJERNOG SENZORA SILEZA PRIKUPLJANJE PODATAKAZA VJEŽBE SNAGE I MIŠIĆNO-KOŠTANU REHABILITACIJU

Amir Hajdar[1], EnsarAbazović[2], Armin Paravlić[3]
[1]University of Sarajevo, Institute of Geodesy and Geoinformatics
[2]University of Sarajevo, Faculty of Sport and Physical Education
[3]University of Ljubljana, Faculty of Sport


Amir Hajdar


EnsarAbazović


Armin Paravlić

ABSTRACT:
Muscular strength is one of the most investigated measures of physical performance. In athletes, higher levels of muscular strength have great discriminatory power to distinguish between good and less successful performers. However, many practitioners avoid occasional testing of their athletes because it is often performed in the laboratory, which can be time consuming and impractical given the dense competitive schedule of elite athletes. ...End user is presented with real-time graphical data readings and ability to export all data collected during a training/or rehabilitation session. For the purpose of providing valuable feedback for strength and conditioning or rehabilitation planning and programming, several metrics of interest can be derived from the force curve, such as peak force, maximum average force, rate of force development etc. Finally, a system prototype is produced to properly collect force data and further validate our muscular testing and training approach.
Keywords: *training, rehabilitation, load cell, dynamometer, IoT*

SAŽETAK:
Mišićna snaga je jedan od najviše istraživanih segmenata u oblasti fizičkih performansi. Viši nivoi mišićne snage nerijetko diskriminiraju dobre i manje uspješne sportiste. Međutim, mnogi izbjegavaju povremeno testiranje svojih sportista jer se ono često izvodi u laboratorijskim uslovima te, obzirom na gust raspored takmičenja elitnih sportista može biti dugotrajno i nepraktično. Stoga se javila potreba za razvojem višenamjenskog, prenosivog izometrijskog dinamometra koji je jednostavan za korištenje u svrhu procjene mišićne snage. ... Svrha ovog rada je prikazati model prikupljanja podataka sa mjernog senzora sile korištenjem bežične komunikacije. U svrhu pružanja korisnih povratnih i nformacija za planiranje i programiranje treninga snage ili rehabilitacije, nekoliko korisnih mjera se može izvesti iz krivulje sile. Ključne su vršna sila, maksimalna prosječn asila, stopa razvoja sile. Prototip sistema je razvijen za pravilno prikupljanje podataka o snazi i daljnju provjeru valjanosti pristupa testiranju i treniranju mišića.
Ključne riječi: *trening, rehabilitacija, senzor, dinamometar, IoT*

MOBILE APPLICATION MSCHEDULER

MOBILNA APLIKACIJA MRASPORED

Suad Sućeska
suad_s@bih.net.ba

Suad Sućeska

ABSTRACT:
Operating system Android contains database management system (DBMS) SQLite. It means that this database management system is on every smartphone. Mobile application mRaspored (mScheduler) uses local database, which is managed by SQLite. This mobile application is intended for keeping a schedule of classes on a smartphone. It enables viewing, adding and update classes and class schedules. It is written for the Android mobile operating system, which is based on the JAVA programming language. The application supports Android from version 25 up to the latest.

Keywords: *mobile application, scheduler, database, database management system (DBMS), SQLite, Android.*

REZIME:
Operativni sistem Android sadrži sistem za vođenje baza podataka (DBMS) SQLite. To znači da se ovaj sistem za vođenje baza podataka nalazi na svakom samrtphone-u. Mobilna aplikacija mRaspored koristi lokalnu bazu podataka koja se vodi pomoću SQLite. Ova mobilna aplikacija je namjenjena za vođenje rasporeda časova na smartphone-u. Ona omogućava pregled, unos i izmjenu predmeta i rasporeda časova. Napisana je za mobilni operativni sistem Android, koji bazira na programskom jeziku JAVA. Aplikacija podržava Android od verzije 25 pa do najnovije.

Ključne riječi: *mobilna aplikacija, raspored časova, baza podataka, sistem za vođenje baza podataka (DBMS), SQLite, Android.*

SIMULATION PLATFORM FOR THE ANALYSIS OF MOTORWAY TRAFFIC SAFETY MANAGEMENT SYSTEMS

SIMULACIJSKA PLATFORMA ZA ANALIZU SUSTAVA UPRAVLJANJA SIGURNOŠĆU PROMETA NA AUTOCESTAMA

Sadko Mandžuka[1], Luka Dedić[2], Goran Kos[3], Krešimir Vidović[4]
[1]Faculty ofTrafficand Transport Sciences, Zagreb, Croatia
[2]Promettis ltd., Zagreb, Croatia
[3]Institut for Tourism, Zagreb, Croatia
[4]Faculty ofTrafficand Transport Sciences, Zagreb, Croatia


Sadko Mandžuka

Luka Dedć


Goran Kos


Krešimir Vidović

ABSTRACT:
The paper describes simulation platform for the analysis of motorway traffic safety management systems based on multicriteria optimization. System is based on estimation accident risk that uses real-time data of traffic flow on motorway section. Simulation platform is realised in the microsimulation traffic model. The approach of calibration is presented, also. The behaviour of drivers in the simulation model is based on Widemann's car following model.

Keywords*: intelligent transport system, road safety, crash potential, multicriteria optimization, simulation platform*

REZIME:
U radu je opisana simulacijska platforma za analizu sustava upravljanja sigurnošću prometa na autocestama temeljena na višekriterijskoj optimizaciji. Sustav se temelji na procjeni rizika od nezgoda koja koristi podatke o prometu na dionici autoceste u stvarnom vremenu. Simulacijska platforma realizirana je u mikro-simulacijskom prometnom modelu. Prikazan je i pristup kalibracije. Ponašanje vozača u simulacijskom modelu temelji se na Widemannovom modelu praćenja automobila.

Ključne riječi: *inteligentni transportni sustav, sigurnost na cestama, potencijal sudara, višekriterijska optimizacija, simulacijska platforma*

VIRTUAL URBAN CONSOLIDATION CENTER

Reinhold Schodl[1], Sandra Eitler[2]
[1,2] University of Applied Sciences BFI Vienna, Austria

Reinhold Schodl

Sandra Eitler

ABSTRACT:
An urban consolidation center is a solution in city logistics that promises traffic-related, environmental, and operational benefits. While the concept is well-known in academia and among city planners, a rather limited number of successful implementations can be found in practice. New information technologies allow adapting the concept to improve its capabilities and acceptance. Thus, this work introduces the concept of the Virtual Urban Consolidation center. Instead of operating a purpose-built, central transshipment hub, the Virtual Urban Consolidation center utilizes existing logistics facilities, which are operated by logistics service providers. The logistics service providers involved and the number and location of the hubs can change dynamically. As the resulting complexity is relatively high, digitization plays a central role to coordinate and optimize operations. Compared to a traditional urban consolidation center, the concept has the potential to improve the scalability of operations and to limit financial risks.

Keywords: *urban consolidation center, traffic and transport systems, city logistics, digitization*

IMPLEMENTATION OF SMART ROAD TECHNOLOGIES IN THE FUNCTION OF ROAD TRAFFIC SAFETY MANAGEMENT

IMPLEMENTACIJA PAMETNIH CESTOVNIH TEHNOLOGIJA U FUNKCIJI UPRAVLJANJA SIGURNOŠĆU CESTOVNOG SAOBRAĆAJA

Lindov Osman[1], Omerhodžić Adnan[2]
[1,2]University of Sarajevo, Faculty of Traffic and Communications,71000 Sarajevo, B&H

Osman Lindov

Adnan Omerhodžić

ABSTRACT:
The functioning of traffic systems has negative characteristic of increasing conflicts caused by increasing demands for mobility. Therefore, the issues of negative impacts of traffic such as traffic accidents, air pollution and noise are becoming more and more critical. Traffic safety management is a very important area for the implementation of digital transformation and innovation in order to reduce risks and achieve more efficient and safer traffic flow. Digital transformation in the field of traffic safety enables a higher level of interaction, communication, prediction, optimization, adaptation, flexibility and efficiency between the basic elements of the system, i.e. man, vehicle, infrastructure and environment. The paper provides an overview of the most important concepts and implementation possibilities of smart road technologies, sensor technologies and innovations in field of traffic safety with reference to the guidelines for future development and improvement.

Keywords: *road safety, smart roads, sensor technologies*

REZIME:
Funkcionisanje saobraćajnih sistema ima negativnu karakteristiku povećanja konflikata koji su uzrokovani povećanjem zahtjeva za mobilnošću. Zbog toga pitanja negativnih uticaja saobraćaja kao što su saobraćajne nezgode, zagađenje zraka i buka postaju sve više kritična. Upravljanje sigurnošću saobraćaja predstavlja veoma značajno područje za implementaciju digitalne transformacije i inovacija u cilju smanjenja rizika i postizanja efikasnijeg i sigurnijeg odvijanja saobraćaja. Digitalna transformacija u području sigurnosti saobraćaja omogućava veći nivo interakcije, komunikacije, predikcije, optimizacije, prilagođavanja, fleksibilnosti i efikasnosti između osnovnih elemenata sistema, odnosno čovjeka, vozila, infrastrukture i okoline. U radu je dat pregled najznačajnijih koncepcija i mogućnosti implementacije pametnih cestovnih tehnologija, senzorskih tehnologija i inovacija u oblasti sigurnosti saobraćaja sa osvrtom na smjernice budućeg razvoja i usavršavanja.

Ključne riječi: *sigurnost saobraćaja, pametne ceste, senzorske tehnologije*

SUSTAINABLE MOBILITY: CONCEPTUAL ASPECTS OF DEVELOPMENT AND MANAGEMENT

Natalya Shramenko[1], Christoph Hupfer[2]
[1,2]Baden-Württemberg Institute of Sustainable Mobility,
Hochschule Karlsruhe University of Applied Sciences

Natalya Shramenko

Christoph Hupfer

ABSTRACT:
The problem of climate change on Earth is associated with environmental pollution and necessitates the reduction of greenhouse gas emissions into the atmosphere, especially in urban agglomerations. Making cities more comfortable, greener and safer is possible through the conscious desire of society to implement sustainable mobility strategies. Planning, developing and implementing innovative projects in the context of sustainable mobility requires management functions.
The article focuses on the key aspects of the development and management of sustainable mobility. Effective management of sustainable mobility in cities requires close interaction of all actors: authorities, citizens, business, and the scientific community. Cooperation between the efforts of the actors on the basis of a comprehensive exchange of information contributes to rethinking the established paradigms of social development, developing innovative solutions for the implementation of strategies and plans for the sustainable development of cities and urban agglomerations.
To monitor the preferences and needs of the population, a participatory mobility development is necessary, which involves people in the process of transformation and change at an early stage. At the same time, digital information and communication platforms are the basis for managing sustainable mobility.
The role of developing and managing sustainable mobility should be assigned to specially created non-profit sustainable mobility institutions that interact with authorities, business, citizens, the scientific community and other stakeholder groups. The functional aspect of such institutions is systematically considered and proposed.

Keywords: *sustainable mobility, sustainable mobility management, participatory mobility, sustainable mobility institutions, climate change, urban agglomeration.*

APPLICATION OF INNOVATIVE TECHNOLOGIES TO IMPROVE URBAN DELIVERY IN THE CITY OF SARAJEVO

PRIMJENA INOVATIVNIH TEHNOLOGIJA ZA POBOLJŠANJE GRADSKE DOSTAVE U GRADU SARAJEVU

Ermin Muharemović[1], Amel Kosovac[2], Belma Memić[3], ElmaAvdagić-Golub[4]
[1,2,3.4]University of Sarajevo, Faculty of Traffic and Communications, 71000 Sarajevo, Bosnia and Herzegovina


Ermin Muharemović


Amel Kosovac


Belma Memić


Elma Avdagić-Golub

ABSTRACT:
The degree of urbanization at the global level is such that the trend of population relocation from rural areas to cities continues and accelerates.This trend is reflected in the City of Sarajevo, as the largest urban center in Bosnia and Herzegovina. Increasing attention is being consecrated to the challenges and problems faced by postal and logistics companies serving urban areas. The first goal of the paper is to provide an overview of innovative technologies that can be used to improve the efficiency and effectiveness of city logistics. Special attention in the paper is focused on the analysis of the current state of delivery and infrastructural limitations in the City of Sarajevo, which are faced by companies that do city delivery. The main goal of the paper is to make a proposal for improving urban delivery in the City of Sarajevo through the application of certain innovative technologies.

Keywords: *city logistics, innovative technologies, urban delivery, improve*

SAŽETAK:
Stepen urbanizacije na globalnom nivou je takav da se trend preseljenja stanovništva iz ruralnih sredina u gradove nastavlja i ubrzava. Ovaj trend je preslikan i na Grad Sarajevo kao najveći urbani centar u Bosni i Hercegovini. Sve veća pažnja se posvećuje izazovima i problemima sa kojima se susreću poštanske i logističke kompanije koje opslužuju urbana područja. Prvi cilj rada je pružiti pregled inovativnih tehnologija koje se mogu koristiti za poboljšanje efikasnosti i djelotvornosti gradske logistike. Posebna pažnja je usmjerena na analizu trenutnog stanja gradske dostave i infrastrukturnih ograničenja u Gradu Sarajevu, sa kojima se susreću kompanije koje rade gradsku dostavu. Glavni cilj rada je dati prijedlog za poboljšanje gradske dostave u Gradu Sarajevu kroz primjenu pojedinih inovativnih tehnologija.

Ključne riječi: *gradska logistika, inovativne tehnologije, urbana dostava, poboljšati.*

APPLICATION OF INTELLIGENT TRANSPORT SYSTEMS IN ROAD TRAFFIC: A REVIEW

Nadica Stojanovic[1], Ivan Grujic[2], Bojana Boskovic[3]
[1]University of Kragujevac, Faculty of Engineering, Sestre Janjic 6, 34000 Kragujevac, Serbia
[2]University of Kragujevac, Faculty of Engineering, Sestre Janjic 6, 34000 Kragujevac, Serbia
[3]Academy of professional studies Šumadija, Department in Trstenik, Serbia


Nadica Stojanovic


Ivan Grujic


Bojana Boskovic

ABSTRACT:
Intelligent transport systems imply the application of modern information, communication, and sensor systems in order to increase traffic safety and the quality of transport and travel services. Today's transport is unimaginable without intelligent transport systems. The application of intelligent transport systems provides a number of social benefits, such as safer road transport, reduced negative impact on the environment, reduced transport costs, improved transport conditions,... In this paper will be presented intelligent transport systems, as well as how their application has a favorable effect on road traffic.

Keywords: *intelligent transport systems, traffic safety, quality of transport, road traffic*

CREATING ONTOLOGIES CONCEPT IN TRANSPORT AND TRAFFICRESEARCH ENVIRONMENT

KONCEPT ZASNIVANJA ONTOLOGIJA U PROMETNO-ISTRAŽIVAČKOM OKRUŽENJU

Pero Škorput[1], Krešimir Vidović[2]
[1]Faculty of Traffic and Transport Sciences, Vukelićeva 4, HR-10000 Zagreb
[2]Ericsson Nikola Tesla, Krapinska 45, Zagreb, Croatia


Pero Škorput


Krešimir Vidović

ABSTRACT:
Ontology engineering in the field of transportation engineering deals with the construction, development, and maintenance of ontologies, which are formal descriptions of concepts and relationships in the domain of transportation technology. Algorithms that are developed in the field of artificial intelligence allow computers to think and behave like humans. Ontological engineering techniques contribute to the development of artificial intelligence in terms of semantic interpretation of textual information from a specific domain of knowledge. This scientific paper describes the conceptual foundation of building ontologies in the field of transportation based on existing data models and analyzes the possibilities of applying artificial intelligence for automated establishment and expansion of ontologies in the transportation field. Also, the paper describes the role of ontologies in semantic applications and the applicative contribution of semantic applications in transportation.

Keywords: *transportation engineering, ontology, data models, intelligent transport system, interoperability*

SAŽETAK:
Ontološko inženjerstvo u području prometnog inženjerstva bave se konstruiranjem, izgradnjom i održavanjem ontologija, što su formalni opisi pojmova i relacija u domeni tehnologije prometa i transporta. Algoritmi koji se razvijaju u području umjetne inteligencije omogućuju računalima da razmišljaju i djeluju kao ljudi. Tehnike ontološkog inženjerstva doprinose razvoju umjetne inteligencije u smislu semantičke interpretacije tekstualnih informacija iz neke konkretne domene znanja. U ovom znanstvenom radu opisana je konceptualna osnova izgradnje ontologija iz područja prometa zasnovana na postojećim modelima podataka te su analizirane mogućnosti primjene umjetne inteligencije za automatizirano zasnivanje i proširivanje ontologija u području prometa. Također, u radu je opisana uloga ontologija u semantičkih aplikacija te aplikativni doprinos semantičkih aplikacija u prometu.

Ključne riječi: *prometnoinženjerstvo, ontologije,podatkovni modeli, inteligentni transportni sustavi, interoperabilnost*

ESTIMATING URBAN AIR QUALITY ACCORDING TO SUSTAINABLE DEVELOPMENT GOAL 11

PROCJENA KVALITETE ZRAKA U GRADOVIMASHODNOCILJU 11 ODRŽIVOG RAZVOJA

Belma Memić[1], Elma Avdagić-Golub[1], Amel Kosovac[1], Ermin Muharemović[1]
[1] University of Sarajevo, Faculty of Traffic and Communications, Sarajevo, Bosnia and Herzegovina


Belma Memić


Elma Avdagić-Golub


Amel Kosovac


Ermin Muharemović

ABSTRACT:
The Sustainable Development Goals (SDGs) and targets represent enormous opportunities and aspirations of the new universal Agenda. Their implementation requesta lot of provision of resources, and investments in technologies and infrastructures. SDG 11, as stated in the 2030 Agenda, aims by 2030and reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.
In this article, it will be analyze and compared the data ofair qualityfor Sarajevo City and other European cities. It is important to create a sustainable city aimed at reducing pollution and improving air quality in the cities using SDG 11.6.2 Indicator Assessment.

Keywords: *Sustainable Development Goals (SDGs), air quality, sustainable city*

REZIME:
Ciljevi održivog razvoja (SDGs) i podciljevi predstavljaju ogromne mogućnosti i težnje novog univerzalnog programa.Njihovo provođenje zahtijeva velika sredstva, te ulaganja u tehnologije i infrastrukturu. SDG 11, kako se navodi u Agendi 2030, ima za cilj do 2030. godine učiniti gradove i naselja uključivim, sigurnim, prilagodljivim i održivim, te smanjiti negativan utjecaj gradova na okoliš po glavi stanovnika, posvećujući posebnu pažnju na kvalitet zraka te upravljanje komunalnim i drugim otpadom.
U ovom članku će se analizirati i uporediti podaci o kvaliteti zraka za Sarajevo i druge evropske gradove. Važno je stvoriti održiv grad sa ciljem smanjenja zagađenja i poboljšanja kvaliteta zraka u gradovima koristeći SDG 11.6.2 indikator procjene.

Ključne riječi: *Ciljeviodrživograzvoja (SDGs), kvalitetzraka, održivi grad.*

APPLICATION OF THE ITS SYSTEM IN LIMITING THE ACCESS OF ROAD VEHICLES TO PARTS OF URBAN ZONES IN SARAJEVO

PRIMJENA ITS-A U OGRANIČENJU PRISTUPA CESTOVNIH VOZILA DIJELOVIMA URBANIH ZONA U SARAJEVU

Mirzet Sarajlić[1], Drago Ezgeta[2], Ajdin Džananović[3]
[1,2,3] University of Sarajevo, Faculty of Traffic and Communications, Sarajevo, Bosnia and Herzegovina


Mirzet Sarajlić


Drago Ezgeta


Ajdin Džananović

ABSTRACT:
Following world trends, it has been noticed that in certain cities of the world we have established zones of restricted access for motor vehicles, and the process of establishing them is also underway in Sarajevo. These are zones in which access for vehicles is limited according to various criteria, and the most common criteria are vehicle carrying capacity and ecological organization. The research will be focused on the city of Sarajevo. The proposal includes zones that would be restricted access zones, along with an explanation of the reasons for establishing the same. After defining the zones, entry and exit locations on the edge areas will be defined, and a technical solution based on intelligent systems will be offered, which will record and check vehicle entry permits in those zones and define alternative routes and conditions. The work will process automation monitoring indicators based on which the effects of the establishment will be monitored during and after the establishment of restricted access zones.
Keywords: *Traffic controle, Intelligent Transport Systems, Access Zones, Vehicle ovement restrictions.*

REZIME:
Prateći svjetske trendove, uočeno je da su u pojedinim gradovima svijeta uspostavljene zone ograničenog pristupa za motorna vozila, a proces njihovog uspostavljanja je u toku i u Gradu Sarajevu. Riječ je o zonama u kojima je pristup vozilima ograničen prema različitim kriterijima, a najčešći kriteriji su nosivost vozila i ekološke karakteristike. Istraživanje je fokusirano na grad Sarajev sa prijedlogom koji uključuje uspostavljanje zone koja bi bila zone ograničenog pristupa, uz obrazloženje razloga za uspostavljanje iste. Nakon definisanja zone, definisane su ulazne i izlazne lokacije na rubnim područjima zone, te predloženo tehničko rješenje bazirano na inteligentnim transportnim sistemima, koje će evidentirati i provjeravati ograničenja za ulazak vozila u te zone i definisati alternativne rute kretanja i ostale uslove. U radu su obrađeni automatizovani indikatori praćenja na osnovu kojih će se pratiti efekti uspostavljanja zone tokom vremena.
Ključne riječi: *Kontrola saobraćaja, inteligentni transportni sistemi, pristupne zone, ograničenja kretanja vozila.*

THE POSSIBILITY OF USING DRONES IN THE PROCESS OF DELIVERY IN THE AREA OF THE CITY OF SARAJEVO

MOGUĆNOST KORIŠTENJA DRONOVA U PROCESU DOSTAVE POŠILJAKA NA PODRUČJU GRADA SARAJEVA

Amel Kosovac[1], Adisa Medić[1], Muharem Šulić[1], Haris Mehičić[1]
[1] University of Sarajevo, Faculty of Traffic and Communications, Sarajevo, B&H


Amel Kosovac


Adisa Medić


Muharem Šulić


Haris Mehičić

ABSTRACT:
In addition to the numerous existing ways of transporting goods, the appearance of new technologies also creates new transport systems in the supply chain. Recently, unmanned aerial vehicles, i.e. drones, have been attracting a lot of attention, which utilization is becoming more and more widespread every day. The delivery of packages in the "last mile of delivery" is the last and one of the most important activities in the process of distribution of goods from the manufacturer to the end-user. Bosnia and Herzegovina, as well as the City of Sarajevo, has a pretty low level of logistics development. The aim of this work is to present the possibility of establishing a delivery system using drones in the area of the capital and the advantages that this system provides in city logistics. Also, the paper will show the economic profitability of using drones in the countries of the region that have a developed system of delivery technology by drones.

Keywords: *drones, unmanned aerial vehicle (UAV), delivery, parcel, beehives, beehives placement criteria.*

SAŽETAK:
Pored mnogobrojnih postojećih načina prijevoza robe, pojavom novih tehnologija javljaju se i novi sistemi transporta u opskrbnom lancu. U posljednje vrijeme veliku pažnju privlače bespilotne letjelice, odnosno dronovi čija primjena svakog dana postaje sve rasprostranjenija. Dostava paketa u „zadnjoj milji dostave“ čini posljednju i jednu od najznačajnijih aktivnosti u procesu distribucije robe od proizvođača do krajenjeg korisnika. Bosna i Hercegovina, a tako i Grad Sarajevo ima poprilično nizak stepen razvijenosti logistike. Cilj ovog rada predstavlja prikaz mogućnosti uspostave sistema dostave pošiljaka primjenom dronova na području glavnog grada te prednosti koje ovaj sistem pruža u gradskoj logistici. Također, u radu će biti prikazana i ekonomska isplativost korištenja dronova u zemljama regiona koje imaju razvijen sistem tehnologije dostave pošiljaka dronovima.

Ključne riječi: dronovi, bespilotne letjelice, dostava, paketi, košnice, kriteriji za postavljanje košnica.

SELECTION OF ENVIRONMENTALLY SUSTAINABLE MEANS OF URBAN MOBILITY DURING DAILY POPULATION MIGRATION IN ORDER TO SATISFY THE NEED FOR TRANSPORTATION USING METHODS OF MULTICRITERIA ANALYSIS

ODABIR EKOLOŠKI ODRŽIVIH SREDSTAVA URBANE MOBILNOSTI PRILIKOM DNEVNIH MIGRACIJA STANOVNIŠTVA U CILJU ZADOVOLJENJA POTREBE ZA PREVOZOM KORIŠTENJEM METODA MULTIKRITERIJUMSKE ANALIZE

Mirzet Sarajlić[1], Adnan Omerhodžić[2], Ajdin Džananović,[3]Adnan Tatarević[4]
[1]Ministry of Transport, Canton Sarajevo, 71000 Sarajevo, B&H
[2,3]University of Sarajevo, Faculty of Traffic and Communications, 71000 Sarajevo, B&H
[4] Institute of Traffic and Communications, Sarajevo, 71000 Sarajevo, B&H


Mirzet Sarajlić

Adnan Omerhodžić

Ajdin Džananović

Adnan Tatarević

ABSTRACT:
Acknowledging the need for movement through the means of environmentally sustainable urban mobility today represents a fundamental link in the transformation of the use of different modes of transportation in cities with the aim of meeting the daily needs of population migration. The data obtained by recording and researching movements will be used to approximate data on the exchange of people in the city of Sarajevo, which is related to the use of means of ecologically sustainable urban mobility. The data that will be researched are traffic flow at characteristic intersections and segmentation by type of modes of transport used in the part of ecologically sustainable urban mobility (bicycles, scooters, pedestrians, etc.). As a result of the paper, there will be an answer to the question of what are the main criteria when choosing transport for daily migrations of the population in the city, which can later be used as a result for planning and managing the way of using certain types of transport in order to meet the needs for daily migrations of the population in the city.
Keywords: *Urban Mobility, Sustainable Mobility Modes, Evaluation Criteria, SAW method*

REZIME:
Zadovoljenje potreba za kretanjem sredstvima ekološki održive urbane mobilnosti predstavlja temeljnu kariku u transformaciji korištenja različitih vidova prijevoza u gradovima s ciljem zadovoljavanja svakodnevnih potreba migracije stanovništva. Podaci dobijeniistraživanjem koristit će se za aproksimaciju podataka o korištenju sredstava ekološki održive urbane mobilnosti. Podaci koji će se istraživati su protok saobraćaja na raskrsnicama i segmentacija po vrstama vidova transporta (bicikli, skuteri, pješaci i dr.). Rezultati rada dat će odgovor na pitanje koji su glavni kriteriji pri odabiru prevoza za dnevne migracije stanovništva u gradu, koji se kasnije kao rezultat može koristiti za planiranje i upravljanje načinom korištenjaodređene vrste transporta u cilju zadovoljavanja potreba za dnevnim migracijama stanovništva u gradu.
Ključne riječi: *Urbana mobilnost, Vozila održive mobilnosti, Kriteriji ocjene, SAW metod*

ADVANCED TRAFFIC MANAGEMENT SYSTEM IN THE FUNCTION OF IMPROVING MOBILITY IN THE CITY OF SARAJEVO

NAPREDNI SISTEM UPRAVLJANJA SAOBRAĆAJEM U FUNKCIJI POBOLJŠANJA MOBILNOSTI U GRADU SARAJEVU

Kamenjašević Nedim[1], Mehanović Mustafa[2], Mirzet Sarajlić[3]
[1,]Cantonal Administration for Inspection Issues Canton Sarajevo, Bosnia and Herzegovina
[2,3]University of Sarajevo, Faculty of Traffic and Communications, Bosnia and Herzegovina

Nedim Kamenjašević

Mustafa Mehanović

Mirzet Sarajlić

ABSTRACT:
Traffic is constantly increasing all over the world as a result of increased traffic, motorization, which has caused the expansion of cities, population growth as well as changes in the structure of the population. Like many cities around the world, traffic jams and congestion are becoming an increasing problem for the City of Sarajevo. The city road network of the City of Sarajevo, has long since reached the limits of the projected capacity of providing quality service to users. The direct negative results of traffic jams and congestion are longer journeys of citizens, and in most cases unforeseen delays, stressful situations for drivers, ... It is the task and challenge of this work to offer a solution for monitoring, managing and controlling traffic on the existing road network of the City of Sarajevo, while increasing the level of road service and traffic safety, and reducing negative consequences such as the length of journeys, reducing the number of traffic accidents, and reducing fuel consumption and reduction of air pollution in the City of Sarajevo.
Keywords: *traffic, traffic jams, negative impacts of traffic, traffic monitoring, managing and controlling traffic*

REZIME:
Saobraćaj je u cijelom svijetu u stalnom porastu kao rezultat povećanog saobraćaja i motorizacije, što je uzrokovalo širenje gradova, porast stanovništva kao i promjene u strukturi stanovništva. Kao i u mnogim gradovima širom svijeta, saobraćajne gužve i zagušenja postaju sve veći problem Grada Sarajeva. Gradska mreža saobraćajnica Grada Sarajeva, odavno je dostigla granice projektovanog kapaciteta pružanja kvalitetne usluge korisnicima. Direktni negativni rezultati saobraćajnih gužvi i zagušenja su duža putovanja građana, a u većini slučajeva nepredviđena kašnjenja, stresne situacije za vozače, ... Zadatak i izazov ovog rada je ponuditi rješenje za praćenje, upravljanje i kontrolu saobraćaja na postojećoj mreži saobraćajnica Grada Sarajeva, uz povećanje nivoa usluga na cestama i sigurnosti saobraćaja, te smanjenje negativnih posljedica kao što su dužina putovanja, smanjenje broja saobraćajnih nesreća, te smanjenje potrošnje goriva i smanjenje zagađenja zraka u Gradu Sarajevu.
Ključne riječi: *saobraćaj, saobraćajne gužve, negativni uticaji saobraćaja, nadzor saobraćaja, upravljanje i kontrola saobraćaja*

CHALLENGES OF PHYSICAL AND DIGITAL INTEGRATION OF TRANSPORT INFRASTRUCTURE IN BOSNIA AND HERZEGOVINA

IZAZOVI FIZIČKE I DIGITALNE INTEGRACIJE TRANSPORTNE INFRASTRUKTURE U BOSNI I HERCEGOVINI

Drago Ezgeta[1], Samir Čaušević[2], Mistafa Mehanović[3]
[1,2,3]University of Sarajevo, Faculty of Traffic and Communications,71000 Sarajevo, B&H


Drago Ezgeta


Samir Čaušević


Mustafa Mehanović

ABSTRACT:
The development of the modern transport system in Bosnia and Herzegovina requires the intensive application of information and communication technologies that will enable the digitization of the transport system. Digitalization of transport enables the transformation of the physical transport system into a physical cybernetic transport system that includes the wide application of artificial intelligence and information and communication technologies. The transport system of the EU countries is characterized by a strong development of intelligent transport systems based on the European framework ITS architecture. In order to successfully integrate the transport system of Bosnia and Herzegovina with the transport system of the EU member states, in addition to the construction of physical infrastructure, its digital connection is necessary to enable the implementation of interoperable services of intelligent transport systems on the transport network of Bosnia and Herzegovina.

Keywords: *digitization, intelligent transport systems,transportinfrastructure*

REZIME:
Razvoj suvremenog transportnog sustava u Bosni i Hercegovini zahtijeva intenzivnu primjenu informacijsko komuniacijskih tehnologija koje će omogućiti digitalizaciju transportnog sustava. Digitalizacija transporta omogućava transformaciju fizičkog transportnog sustava u transportni fizičko kibernetički sustav koji uključuje široku primjenu umjetne inteligencije i informacijsko komunikacijskih tehnologija. Transportni sustav zemalja EU karakterizira snažan razvoj inteligentnih transportnih sustava baziranih na europskoj okvirnoj ITS arhitekturi. Za uspješno integriranje transportnog sustava Bosne i Hercegovine sa transportnim sustavom zemalja članica EU pored izgradnje fizičke infrastrukture potrebno je njeno digitalno povezivanje kako bi se omogućila implementacija interoperabilnih usluga inteligentnih transportnih sustava na transportnoj mreži Bosne i Hercegovine.

Ključne riječi: *digitalizacija, inteligentni transportni sustavi, transportna infrastruktura*

DYNAMIC TRAFFIC FLOW ASSIGNMENT ON PARALLEL NETWORKS

Armen Bagdasaryan[1], Antonios Kalampakas[1], Mansur Saburov[1]
[1] Department of Mathematics, College of Engineering and Technology,
American University of the Middle East, Kuwait


A. Bagdasaryan


A. Kalampakas


M. Saburov

ABSTRACT
Nowadays, with ever-growing transportation networks, the optimal traffic flow allocation is one of the most important problems with both theoretical and practical aspects not only in transportation itself, but also in economics and communicaton. In 1952 Glenn Wardrop formulated two principles of optimality of flows in networks that describe the situations of the user (or Wardrop) equilibrium and the system optimum. The first Wardrop principle describes an optimal flow distribution across alternative parallel links in the network, namely, it states that the effective costs of all utilized links are equal and less than the effective costs of those unutilized links for every fixed source-destination pair, while the system optimum is the optimal distribution of the flow for which the average effective cost for all used links is minimal. The problems of finding a Wardrop equilibrium and system optimum are the topics of active research both in theory and practice. In this regard, the aim of this paper is to present some original results on optimal flow that is the Wardrop equilibrium and simultaneously the system optimum of the network. In general, for a given network the flows that satisfy Wardrop's first and second prinicples do not coincide, but there are networks that have identical Wardrop equilibrium and system optimum. We study the Wardrop optimal flows that satisfy both principles that is the Wardrop equlibrium as well as the system optimum. A network that has a Wardrop optimal flow is called a Wardrop optimal network. We investigate dynamic properties of the Wardrop optimal networks and examine the Wardrop optimal flows on networks of parallel links. In this setup the traffic traveling from the origin to the destination can use any of the alternative parallel links. The flow passing through each link of the network creates a congestion externality that causes an increase in the time needed for the journey, which is captured by an increasing link-specific latency function. To this end, we present a new dynamical model of optimal flow distribution by proposing a discrete-time replicator equation on the Wardrop optimal network, for which we provide a geometric description of the optimal flow and describe the equilibrium and stability conditions of the replicator equation dynamics. For the proposed replicator equation on the Wardrop optimal network, the Nash equilibrium, the Wardrop equilibrium, and the system optimum are the same flow distribution of the network. We present a new algorithm for simulation of dynamic flow distribution in networks, and propose the conceptual and algorithmic structure of intelligent information system for dynamic traffic flow assignment in transportation networks.

Keywords: *flows in networks, dynamic traffic assignment, Wardrop optimal flow, Wardrop optimal network, replicator equation, dynamical model, intelligent information system, algorithm*

MODEL OF OPTIMIZATION OF CARGO SPACE VOLUME UTILIZATION IN DELIVERY VEHICLES

MODEL OPTIMIZACIJE ZAPREMINSKE ISKORIŠTENOSTI TOVARNOG PROSTORA U DOSTAVNIM VOZILIMA

Maida Eljazović[1], Ermin Muharemović[2]
[1](Nelt Ltd., East Sarajevo, B&H)
[2](University of Sarajevo, Faculty of Traffic and Communications, Sarajevo, B&H)


Maida Eljazović Ermin Muharemović

ABSTRACT:
Optimum use of the volume of the cargo space of the vehicle requires compliance of the dimensions of pallets, transport packaging and basic packaging with the dimensions of the vehicle's cargo space. A detailed analysis of the packed goods and the way of filling the space in the delivery vehicle requires a comparison of the system data with the actual data during loading. This problem stems from the complexity of the input data, which is greatly influenced by the ordering method, the choice of packaging, the quantity and number of different items.The paper proposes a model for optimizing the volume provided by software in relation to the actual volume. The model introduces coefficients that allow a more precise calculation of the actual volume.

Keywords: *optimization, packaging, volume utilization, vehicle fleet, utilizationcoefficient*

SADRŽAJ:
Optimalno korištenje zapremine tovarnog prostora vozila, zahtijeva usklađenost dimenzija paleta, transportnog pakovanja i osnovnog pakovanja sa dimenzijama tovarnog prostora vozila. Detaljna analiza spakovane robe i načina popunjavanja prostora u dostavnom vozilu zahtijeva poređenje sistemskih podataka sa stavrnim podacima prilikom utovara.Ovaj problem proizilazi iz kompleksnosti ulaznih podataka na koje veliki uticaj ima način komisioniranja, odabir ambalaže, količina i broj različitih artikala. U radu se predlaže model za optimizaciju zapremine koju daju softveri u odnosu na stvarnu zapreminu. Model uvodi koeficijente koji omogucavaju preciziniji izracun stvarne zapremine.

Ključne riječi: *optimizacija, ambalaža, zapreminska iskorištenost, vozni park, koeficijent iskorištenja*

MOBILITY-AS-A-SERVICE AND THE FUTURE OF URBAN MOBILITY: A HUMAN-CENTERED APPROACH TO MULTIMODAL JOURNEY PLANNING

MOBILNOST KAO USLUGA I BUDUĆNOST URBANE MOBILNOSTI: PRISTUP USMJEREN ČOVJEKU PRI PLANIRANJU MULTIMODALNOG PUTOVANJA

Mandžuka Bia[1], Jurčević Marinko[1], Vidović Krešimir[1]
[1]University of Zagreb, Faculty ofTransport and Traffic Sciences, 10000 Zagreb, Croatia


Bia Mandžuka


Marinko Jurčević


Krešimir Vidović

ABSTRACT:
This paper examines the potential of Mobility as a Service (MaaS) to shape the future of urban mobility from a human-centered perspective. The concept of smart mobility and its effects on human behavior and urban areas are discussed (as a key component of Smart City Paradigm), and a definition and background of MaaS is provided, including a taxonomy of integration levels. The paper also analyzes two existing Multimodal Journey Planners within the MaaS ecosystem.

Keywords*: Mobility-as-a-Service; urban mobility, human-centered, Multimodal Journey Planners (MJPs)*

REZIME:
Koncept i paradigma „Mobilnost kao usluga“ predstavlja novi način pružanja usluga mobilnosti na jednom mjestu, gdje je u fokusu krajnji korisnik –i njegove stvarne potrebe.U radu je opisan potencijal spomenute paradigme, a koja će prije svega transformirati percepciju urbane mobilnosti na individualnoj razini. Osim toga, u radu je opisan koncept Pametnog grada kao i jedna od ključnih komponenti – Pametna mobilnost, a koja, između ostalog, počiva na inteligentnim transportnim rješenjima. Dana je definicija MaaS-a kao i prikaz taksonomije razina integracije. Rad također analizira dva postojeća multimodalna planera putovanja (engl. MultimodalJourneyPlanners – MJPs) unutar MaaS ekosustava.

Ključne riječi: *Mobilnost kao usluga; urbana mobilnost; krajnji korisnik; multimodalni putni planeri*

POSSIBILITIES OF QUEUING SYSTEM AT POSTAL OPERATORS

MOGUĆNOSTI PRIMENE SISTEMAZA POBOLJŠANJE REDOVA ČEKANJA KOD POŠTANSKIH OPERATORA

Blagojević Mladenka[1], Šarac Dragana[2], Amel Kosovac[3], Ermin Muharemović[4]
[1]University of Belgrade – Faculty of Transport and Traffic Engineering, 11000 Belgrade, Serbia
[2]University of Novi Sad – Faculty of Technical Sciences, 21000 Novi Sad, Serbia
[3,4]University of Sarajevo, Faculty of Traffic and Communications, 71000 Sarajevo, Bosnia and Herzegovina


Mladenka Blagojeivć


Dragana Šarac


Amel Kosovac


Ermin Muharemović

ABSTRACT:
The postal operators are often faced with the problem of long queues. Customers expect fast and efficient service and operators must meet their requirements. This paper describes the use of various systems for queue organization and information as a tools for optimizing the queuing system at the selected postal operator with the aim of reducing queues and increasing the number of served customers. The number of postal service customers who support the application of systems for queue organization and information was investigated, as well as the customers who support the application of these systems in combination with mobile applications. In the research, several simulations were performed in the MATLAB software package. The goal is to reduce the waiting time of customers by using mobile applications.

Keywords: *postal operator, queuing system, mobile applications*

REZIME:
Poštanski operatori se često suočavaju sa problemom dugih redova. Korisnici očekuju brzu i efikasnu uslugu, a operatori bi trebalo da ispune njihove zahteve. U radu je opisano korišćenje sistema za organizaciju redova čekanja i informisanje o istim kao alata za optimizaciju sistema čekanja kod izabranog poštanskog operatora u cilju smanjenja redova i povećanja broja usluženih korisnika. Istražen je broj korisnika poštanskih usluga koji podržavaju primenu sistema za poboljšanje redova čekanja, kao i korisnika koji podržavaju primenu ovih sistema u kombinaciji sa mobilnim aplikacijama. U istraživanju je urađeno nekoliko simulacija u softverskom paketu MATLAB. Cilj je da se smanji vreme čekanja korisnika korišćenjem mobilnih aplikacija.

Ključne riječi: *poštanski operator, sistem redova čekanja, mobilne aplikacije*

DEVELOPMENT AND DESIGN OF AIR PURIFIER DEVICE PROTOTYPE

RAZVOJ I DIZAJN PROTOTIPA UREĐAJA ZA PROČIŠĆAVANJE ZRAKA

Vedad Saletović[1], Adis J. Muminović[1], Isad Šarić[1], Nedim Pervan[1]
[1]Department of Mechanical Design, Faculty of Mechanical Engineering, University of Sarajevo, Sarajevo, Bosnia and Herzegovina


Vedad Saletović


Adis J. Muminović


Isad Šarić


Nedim Pervan

ABSTRACT:
Air pollution is one of the main environmentalproblems today. It is a problem which cannot be solved in many cities around the world. Sarajevo, as main capital of Bosnia and Herzegovina, is one of those cities. Few times during every year, Sarajevo is the most polluted city in the world, especially during winter season. Taking in consideration that air pollution cannot be solved on global level for one town or country, engineers are started to work on the devices that can improve air quality in small closed spaces like offices, schools or homes. This paper is focused on the design and development of an air purification device intended for indoor use, full development process is presented, from initial design to prototype manufacturing using additive manufacturing (3D printing).

Keywords: *Air pollution, air purification, design, development, device,*

SAŽETAK:
Zagađenje zraka je jedan od glavnih okolinskih problema u današnje vrijeme. Zagađenje zraka predstavlja problem koji se trenutno ne može u potpunosti riješiti u velikom broju gradova širom svijeta. Sarajevo, kao glavni grad Bosne i Hercegovine, predstavlja jedan od najzagađenijih gradova u svijetu. Nekoliko puta godišnje Sarajevo ponese titulu najzagađenijeg svjetskog grada, posebno u zimskom periodu. Pošto se ovaj probem ne može riješiti na globalnom nivou jednog grada ili države, inžinjeri su se okrenuli razvoju uređaja za poboljšanje kvalitete zraka u malim zatvorenim prostorijama kao što su uredi, škole ili kuće. Glavni focus ovog rada je razvoj i dizajn uređaja za pročišćavanje zraka u zatvorenim prostorijama. Prikazan je kompletan proces od razvoja inicijalnih koncepata do proizvodnje prototupa upotrebom aditivnih tehnologija (3D printanja).

Ključne riječi: *zagađenje zraka, pročišćivanje zraka, dizajn, razvoj, uređaj*

CONDITIONS FOR AMORPHIZATION OF Ce-Ag ALLOYS DURING QUENCHING FROM A LIQUID STATE

Tetiana Kalinina[1], Oleksandr Lysenko[1], Vladeta Jevremović[2], Anton Khlebnikov[1], Tetiana Dorozhka[1]

[1] Dniprovsk State Technical University (DSTU), Faculty of metallurgy, 51918 Kamianske, Ukraine
[2] Academy of Professional Studies Šumadija – Department in Trstenik, Trstenik, Serbia,


Tetiana Kalinina


Oleksandr Lysenko


Vladeta Jevremović


Anton Khlebnikov


Tetiana Dorozhka

ABSTRACT:
The results of X-ray studies of the structure of $Ce_{100-x}Ag_x$ alloys (x=5-40 at.%), obtained by quenching from a liquid state (QLS) with cooling rates $\upsilon \approx (10^4 - 10^6)$ K/s are presented. It is shown that as the process of QLS is accelerated, the structure of alloys with silver content x=10-35 changes from a mixture of equilibrium eutectic phases (γ-Ce+CeAg) at $\upsilon<\upsilon_c$ to amorphous at $\upsilon \geq \upsilon_c^{'}$. A metastable nanocrystalline (~40 nm) phase with a body-centered cubic (BCC) lattice crystallizes polymorphically at intermediate values of $\upsilon_c \leq \upsilon \leq \upsilon_c^{'}$. The peculiarities of the formation of the structure of the studied alloys depending on the cooling rate are explained in terms of the concept of TTT (temperature-time-transformation) diagrams.

Keywords: *Ce-Ag alloys, quenching from a liquid state (QLS), cooling rate, X-ray diffraction analysis, metallic glass.*

INTEROPERABILITY, SCALABILITY, AND AVAILABILITY OF ENERGY TYPES IN HYBRID HEATING SYSTEMS

Vira Shendryk[1,2,3], Reza Malekian[4,5], Paul Davidsson[6,7]
[1]Department of Computer Science and Media Technology, Malmö University, 205 06, Malmö, Sweden
[2] Internet of Things and People Research Centre, Malmö University, 205 06, Malmö, Sweden
[3]Department of Information Technologies, Sumy State University Sumy, 40007, Sumy, Ukraine
[4]Department of Computer Science and Media Technology, Malmö University, 205 06, Malmö, Sweden
[5]Internet of Things and People Research Centre, Malmö University, 205 06, Malmö, Sweden
[6]Department of Computer Science and Media Technology, Malmö University, 205 06, Malmö, Sweden
[7]Internet of Things and People Research Centre, Malmö University, 205 06, Malmö, Sweden

Vira Shendryk

Reza Malekian

ABSTRACT:
A promising approach to improve sustainability within the energy sector is to incorporate renewable energy sources into existing energy systems. However, such hybrid energy systems have several characteristics that make developing and coordinating the challenging, e.g. due to the need to manage large amounts of heterogeneous data in a distributed and dynamic manner. This paper analyses important characteristics of hybrid heating systems, such as interoperability, scalability, and availability of energy sources. The purpose is to determine how the availability of different energy sources within a hybrid heating system affects sustainability and environmental impact, as well as how interoperability and scalability can affect the overall performance of the hybrid heating system. All these quality characteristic parameters were considered in the aspect of heterogeneous data management.

Keywords: *hybrid heating system, interoperability, scalability, availability of energy sources.*

ENERGY EFFICIENCY OF INDUSTRIAL DRYING MACHINE AND EFFECTS TO NATURAL GAS CONSUMPTION AND CARBON FOOTPRINT

ENERGETSKA EFIKASNOST INDUSTRIJSKOG POSROJENJA ZA SUŠENJE I EFEKTI NA POTROŠNJU PRIRODNOG PLINA I KARBONSKOG OTISKA

Mesud Ramić[1], Maximilian Pleitz[1], Ejub Džaferović[2], Amra Hasečić[2]
[1]Pleitz GmbH, Laucha/Erfurt, Germany
[2]Mechanical Faculty of Sarajewo, Sarajewo, Bosnia-Herzegowina


M. Ramić


M. Pleitz


E. Džaferović


A. Hasečić

ABSTRACT
In this study, the drying process of the industrial drying machine for textiles was examined in terms of natural gas consumption, savings and reduction of carbon footprint. The study has been based on experimental part, CFD analysis as well the economic and thermodynamic calculation. Cases without heat recovery and with heat recovery were compared. The calculation was undertaken assuming energy savings and carbon footprint reduction after installation of a heat exchanger. It shows the fuel consumption and carbon footprint of a stenter that can be decreased significantly using heat recovery exchangers. Using close to 20% of recovered energy in total consumption leads to significant reduction of carbon footprint. To illustrate the results, these are compared with the CO_2 absorption capacity of a mixed forest and set in relation to a specific number of trees.

Keywords: *Energy Efficiency, Heat Recovery, Waste Heat, Decarbonisation, GHG*

SAŽETAK
U ovoj studiji, proces sušenja industrijskog postrojenja za sušenje tekstila ispitan je sa aspekta potrošnje prirodnog plina, mogućih ušteda i smanjenja emisije ugljen-dioksida. Studija se temelji na eksperimentalnom dijelu, CFD analizi te ekonomskom i termodinamičkom proračunu. Uspoređeni su slučajevi bez povrata toplotne energije otpadnih gasova i sa povratom toplotne energije. Izračun je urađen sa ciljem procjene moguće uštede energije i smanjenja emisije ugljen-dioksida nakon ugradnje izmjenjivača toplote. Prikazana je potrošnja goriva i emisija ugljen-dioksida postrojenja za sušenje tekstila koji se mogu značajno smanjiti korištenjem izmjenjivača toplote. Korištenje blizu 20% otpadne energije u ukupnoj potrošnji dovodi do značajnog smanjenja uglen-dioksida. Za ilustraciju, rezultati se uspoređuju s kapacitetom apsorpcije CO_2 koje postiže mješovita šuma i postavljaju u odnos na odgovarajući broj stabala.

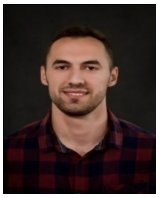
Ključne riječi: *energetska efikasnost, povrat toplote, otpadna toplota, dekarbonizacija, GHG*

RENEWABLE ENERGY SOURCES PHOTOVOLTAIC POWER PLANTS AND CONSTRUCTIVE SOLUTIONS RELATED TO LOCALITY AND CLIMATE

OBNOVLJIVI IZVORI ENERGIJE FOTONAPONSKE ELEKTRANE I KONSTRUKTIVNA RJEŠENJAVEZANA UZ LOKALITE I KLIMU

Miron Torlo[1], Tarik Balić[2], Špago Damir[3]
[1] ”Džemal Bijedić” University of Mostar – Faculty of Mechanical Engineering, miron.torlo@gmail.com,
[2] “Prompt Reply BH”, tarik.balic97@gmail.com
[3] ”Džemal Bijedić” University of Mostar – Faculty of Mechanical Engineering, damir.spago@unmo.ba


Miron Torlo


Tarik Balić


Damir Špago

ABSTRACT:
Energy consumption is increasing every day, which is why renewable energy is increasingly being offered as one of the most important solutions in the fight against climate change and the energy crisis. Exactly one of these forms is solar energy. Solar radiation is directly converted to heat or electricity. The conversion is done by different devices, some of which are photovoltaic cells for generating electricity.
This paper shows how to increase the energy efficiency of photovoltaic power plants with a somewhat different approach to constructive solutions of load-bearing structure. Constructive solutions in this paper are causally related to the geographical position and the local climate. A particularly constructive solution was made in the paper with technical and economic analysis.

Keywords: *energy efficency, sunlight, photovoltaic cells, construction*

SAŽETAK
Potrošnja energije je svakim danom sve veća, zbog ćega se obnovljivi izvori energijesve više nude kao jedno od najvažnijih rješenja u borbi protiv klimatskih promjena I energetske krize. Upravo jedan od tih oblika je sunčeva energija. Sučevo zračenje se izravno pretvara u toplotnu ili električnu energiju. Pretvorba se vrši različitim uređajima od kojih su neki fotonaponske čelije za proizvodnju električne energije. U ovom radu prikazano je kako nešto drukčijim pristupom konstruktivnim rješenjima nosive konstrukcije povećati energetsku učinkovitost fotonaponskih elektrana.konstruktivno rješenje u ovom radu uzročno je povezano sa geografskim položajem i lokalnom klimom. Za ovo konstruktivno rješenje uradu je data tehnička I ekonomska analiza.

Ključne riječi: *energetska učinkovitost, sunčeva svijetlost, fotonaponske čelije, konstrukcija*

ANALYSIS AND CHOICE OF GAS TURBINE BLADE

ANALIZA I IZBOR LOPATICA ZA GASNE TURBINE

Muharem Šabić[1], Edvin Šimić[1],
[1] University of Sarajevo, Faculty of Traffic and Communications, Sarajevo, B&H

Muharem Šabić

Edvin Šimić

ABSTRACT:
The turbine blades are responsiblefor extracting energy from the high temperature gas produced by the combustor.These turbineblades are required to withstand large centrifugal forces,very high temperatures and are operated in aggressiveenvironments.Blades materialsproperties to be weighted are corrosion resistance, wear resistance, yield strength, elastic properties, coefficient of thermal expansion and manufacturing price.Thermal barrier coating(TBC) is coating used for turbine blades and it improves the heat resistance of the material. This paper presents Analytic Hierarchy Process for material selection for the PT6 engine.

Keywords:*Gas turbine engine, blade, alloy, oxidation, corrosion, thermal barrier coating, Analytic Hierarchy Process.*

SAŽETAK:
Lopatice turbine su odgovorne za konverziju energije iz proizvoda sagorijevanja nastalih u komori za sagorijevanje. Turbinske lopatice moraju izdržati velike centrifugalne sile, vrlo visoke temperature i rade u agresivnom okruženju. Osobine materijala lopatica koja se ponderišu su otpornost na koroziju, otpornost na habanje, granica razvlačenja, elastičneosobine, koeficijent toplotnog širenja i cijena proizvodnje. Toplotni otporni premaz poboljšava toplotnu otpornost materijala. Ovaj rad predstavlja primjenu analitičkog hijerarhijskog procesa za izbor materijala za lopatice PT6 motora.

Ključne riječi: *Gasni turbinski motor, lopatica, legura, oksidacija, korozija, toplotni otporni premaz, analitički hijerarhijski proces.*

MACHINE LEARNING OPTIMIZATION OF AIR HEATING TIME IN THE HEATING CONTROL SYSTEM OF A SMART HOUSE

Sydorenko Valeriy[1], Perekrest Andriy[2],Shendryk Vira[3,4], Shendryk Sergii[5]
[1] Kremenchuk Mykhailo Ostrohradskyi National University, 39600, Kremenchuk, Ukraine
[2]Kremenchuk Mykhailo Ostrohradskyi National University, 39600, Kremenchuk, Ukraine
[3]Sumy State University Sumy, 40007, Sumy, Ukraine
[4]Malmö University, 211 19,Malmö, Sweden
[5]Sumy National Agrarian University, 40000 Sumy, Ukraine


Valeriy Sydorenko


Andriy Perekrest


Vira Shendryk


Sergii Shendryk

ABSTRACT:
To optimize the heating control system in a smart home, it is necessary to have a tool that allows you to determine the optimal air heating time. This study is dedicated to the synthesis of the model of the regression dependence of air heating time on the parameters of the heating system and the internal and external parameters of the room. The research justified and derived mathematical expressions for structural and parametric identification of models based on the linear method of least squares based on machine learning. The expediency of using ensembles of models based on decision trees and on the basis of bagging and boosting is substantiated. It is noted that these models have a high predictive power and have proven themselves well in the case of small samples. Three types of prognostic models were built and analyzed. For the three investigated heating devices, a trio of the above models was built and trained. The results show that the nature of the heating process is similar in all cases, but the degree of influence of external weather conditions is different. Conditions and restrictions for using models are defined.

Keywords: *heating control system, smart home, heating time, machine learning.*

QUALITATIVE ANALYSIS OF THE STRUCTURE OF NO_x EMISSIONS DURING PULVERIZED COMBUSTION OF COAL AND BIOMASS AND STAGED AIR SUPPLY CONDITIONS IN FURNACE

KVALITATIVNA ANALIZA STRUKTURE EMISIJE NO_x PRI SAGORIJEVANJU SPRAŠENOG UGLJA I BIOMASE U LETU I PRI STEPENOVANOM PRIVODU VAZDUHA U LOŽIŠTE

Nihad Hodzic[1], Anes Kazagic[2], Kenan Kadic[2]
[1]University of Sarajevo - Faculty of Mechanical Engineering, BiH - 71000 Sarajevo,
[2]JP Elektroprivreda BiH d.d. - Sarajevo, Power utility, BiH - 71000 Sarajevo


Nihad Hodzic


Anes Kazagic


Kenan Kadic

ABSTRACT
In general, in the combustion of fuels, the generation and emission of NOx is influenced by three major groups of factors, reflected through the characteristics: combustion processes, furnaces and fuels. More specifically, for the generation of nitrogen oxides in pulverized combustion of coal dust, significant influence has: nitrogen content in coal, the way nitrogen is bound in coal, volatile content, ... The mechanisms of chemical reactions in which nitrogen oxides are formed in furnaces are also very complex, primarily in the formation of NO+NO2=NOx. In this regard, this paper presents the results of laboratory research to pulverized combustion of powdered brown coals from the Central Bosnian mining basin and in staged air supply conditions, with qualitative structure analysis NOx emissions for different test regimes. The results include the emission, ie the structure of NOx generated and for the test regimes of co-firing of coal with waste wood biomass.

Keywords: *reactor, coal, wood biomass, combustion, air staging, emission NO_x*

SAŽETAK
Općenito, pri sagorijevanju goriva na generisanje i emisiju NO_x uticaj imaju šire tri grupe faktora ogle-dane kroz karakteristike goriva, ložišta i samog procesa sagorijevanja. Konkretnije, pri sagorijevanju ugljenog praha u letu na generisanje azotnih oksida značajan uticaj imaju sadržaj azota u uglju, način na koji je azot vezan u uglju, sadržaj volatila, struktura koksnog ostatka, tip gorionika, ... Pri tome su i mehanizmi hemijskih reakcija u kojima nastaju azotni oksidi, u prvom redu pri nastajanju $NO+NO_2= =NO_x$, u ložišnim sistemima veoma kompleksni. S tim u vezi su u ovom radu predstavljeni rezultati labo-ratorijskih istraživanja sagorijevanja sprašenih bosanskohercegovačkih mrkih ugljeva iz srednjobosa-nskog rudarskog bazena u letu i u uvjetima stepenovanog privoda vazduha za sagorijevanje u ložište, pri čemu je za emisiju NO_x, izmjerenu pri različitim ispitnim postavkama, izvršena kvalitativna analiza stru-kture NO_x. Rezultati uključuju i emisiju, odnosno strukturu nastalog NO_x i pri kosagorijevanju predme-tnih ugljeva sa otpadnom drvnom biomasom.

Ključne riječi: *reaktor, ugalj, drvna biomasa, sagorijevanje, OFA zrak, emisija NO_x*

OPTIMIZATION OF PHOTOVOLTAIC SYSTEMS FOR TWO DIFFERENT REGIONS IN BOSNIA AND HERZEGOVINA COVERING ELECTRICITY DEMAND OF A TYPICAL HOUSEHOLD

OPTIMIZACIJA FOTONAPONSKIH SISTEMA ZA DVIJE RAZLIČITE REGIJE U BOSNI I HERCEGOVINI KOJI POKRIVAJU POTREBE ZA ELEKTRIČNOM ENERGIJOM TIPIČNOG DOMAĆINSTVA

Azrudin Husika[1], Damir Špago[2],Halima Hadžiahmetović[3], Safet Isić[4]
[1,3]University of Sarajevo, 71000 Sarajevo, Bosnia and Herzegovina
[2,4] “Džemal Bijedić” University of Mostar, 88104 Mostar, Bosnia and Herzegovina


Azrudin Husika


Damir Špago


Halima Hadžiahemtovič


Safet Isić

ABSTRACT:
The paper presents the optimization of photovoltaic systems to cover the electricity needs of a typical household for two climatic regions in Bosnia and Herzegovina, whose representatives are the cities of Sarajevo and Mostar. The solar potential was measured and downloaded from the PV GIS database in order to compare the measured and downloaded values. The optimization showed that the cost-optimized systems for both regions should have 13 kW of installed PV panels with connection to the grid without the use of batteries.The optimization also showed a lower consumption of electricity from the grid for the Mostar area as well as a reduction in carbon dioxide emissions in the amount of 10 kg annually.

Keywords: *solar potential, photovoltaic cells, optimization, household.*

REZIME:
U radu je predstavljena optimizacija fotonaponskih sistema za pokrivanje potreba za električnom energijom tipičnog kućanstva za dvije klimatske regije u Bosni i Hercegovini za čije su predstavnike uzeti gradovi Sarajevo i Mostar. Solarni potencijal se mjerio i preuzet je iz baze podataka PV GIS kako bi se izvršila komparacija izmjerenih i preuzetih vrijednosti. Optimizacijom se pokazalo kako troškovno optimalni sistemi za obe regije trebaju imati 13 kW instaliranih PV panela sa priključkom na mrežu bez upotrebe baterija. Također, optimizacija je pokazala da je zabilježena manja potrošnja električne energije iz mreže za grad Mostar kao i smanjenje emisija karbon dioksida za 10 kg.

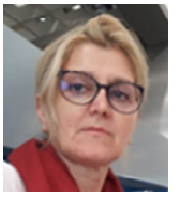
Ključne riječi: *solarni potencijal, fotonaponske ćelije, optimizacija, domaćinstvo.*

NUMERICAL SIMULATIONS OF HYDRAULIC TRANSIENTS IN HYDROPOWER SYSTEM WITH A SURGE TANK

NUMERIČKE SIMULACIJE HIDRAULIČKIH TRANZIJENATA U HIDROENERGETSKOM SISTEMU SA VODOSTANOM

Hata Milišić[1], Emina Hadžić[2]
[1,2]University of Sarajevo, Faculty of Civil Engineering,71000 Sarajevo, Bosnia and Herzegovina


Hata Milišić


Emina Hadžić

ABSTRACT:
A surge tank aims reduce the effect of water hammer to protect a pipeline. For a surge tank to be effective, the maximum height of a surge must be found, then the surge tank can be properly sized for the system.The choice of the shape and dimensions of the surge tank is one of the more complex problems in hydropower and is solved jointly by the designer and the supplier of the turbine, because the proper operation of the hydroelectric power plant depends on it. Considering that the surge tanks are underground facilities, and the construction is expensive, the aim this stady was to find the optimal shape of the surge tank, which would satisfy the stability criteria with less investment. In this paper, a numerical calculation of the water hammer and mass oscilations was performed using the WHAMO software through the example of the HPP Vranduk, which is to be built on the Bosna River (Bosnia and Herzegovina).

Keywords: *hydraulic transients, mass oscillation, surge tank, water hammer, WHAMO*

REZIME:
Vodostan ima za cilj smanjiti učinak vodenog udara kako bi zaštitio cjevovod. Da bi vodostan bio efikasan, mora se pronaći maksimalna visina vodostana i tada se vodostan može pravilno dimenzionirati za sistem. Izbor oblika i dimenzija vodostana jedan je od složenijih problema u hidroenergetici, a rješavaju ga zajednički projektant i isporučilac turbine, jer od toga zavisi pravilan rad hidroelektrane. S obzirom da su vodostani podzemni objekti, a izgradnja je skupa, cilj ove studije je bio da se pronađe optimalan oblik vodostana, koji bi uz manje ulaganja zadovoljio kriterijume stabilnosti. U ovom radu izvršen je numerički proračun hidrauličkog udara i masovnih oscilacija pomoću softvera WHAMO na primjeru HE Vranduk koja se gradi na rijeci Bosni (Bosna i Hercegovina).

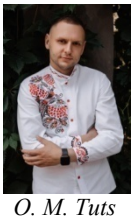
Ključne riječi: *hidraulički tranzijenti, oscilacijevodene mase, vodostan, hidraulički udar, WHAMO*

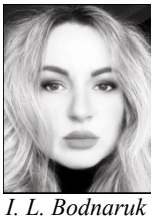
MODELING OF THERMAL PROTECTION OF PIPELINES FROM DESTRUCTION IN TECHNOLOGICAL CORRIDORS

Oleg M. Mandryk[1], Lubomur S. Shlapak[2], Oleh M. Tuts[3], Iryna L. Bodnaruk[4]
[1,2,3,4]Ivano-Frankivsk National Technical University of Oil and Gas,
76019 Ivano-Frankivsk, Ukraine


O. M. Mandryk


L. S. Shlapak


O. M. Tuts


I. L. Bodnaruk

ABSTRACT:
The fuel and energy complex is an important part of the real sector of the economy. It plays a key role not only in the energy supply of the country, but also generates state budget revenues. An important role in the fuel and energy security of the country is played by the pipeline transport of liquid and gaseous hydrocarbons, without which it is difficult to imagine the life support of the population and the normal functioning of the national economic complex. In this paper is analyzed annual.The obtained solution of the problem of thermal conductivity in combination with the approach to determining the radiation effect of the heat flow and the thermophysical characteristics of the pipe material and heat-resistant bandage allow us to develop the optimal design of protection against thermal radiation from a fire according to the "fire in the pit" scenario, and on this basis, technological measures to minimize the consequences on the environment.

Keywords: *avalanche destruction, modeling, long-distance transportation, temperature field, inclined cylinder*

RESEARCH OF PULSE COMBUSTION WITH INTENTION OF APPLICATION IN HIGH POWER BOILERS

ISTRAŽIVANJE PULZIRAJUĆEG SAGORIJEVANJA SA INTENCIJOM PRIMJENE U KOTLOVIMA VELIKE SNAGE

Nihad Hodzic[1], Kenan Kadic[2]
[1] University of Sarajevo - Faculty of Mechanical Engineering, BiH - 71000 Sarajevo,
[2] JP Elektroprivreda BiH d.d. - Sarajevo, Power plant Kakanj - Kakanj, BiH - 72240 Kakanj


Nihad Hodzic


Kenan Kadic

ABSTRACT:
Improving energy efficiency, operating and time availability of high power boilers is a continuous energy imperative, in parallel with the promotion of sustainable development. In this regard, extensive research on the characteristics of pulse combustion of gaseous fuels in a simple and robust modular burner, with aerodynamic valves, without moving parts of burner and cooled by water, has been conducted so far at the University of Sarajevo - Faculty of Mechanical Engineering, Laboratory for Pulsed Combustion. The obtained results indicate that such a burner can be used as a primary and auxiliary burner in the furnace in order to further turbulence of the furnace atmosphere and thus improve the efficiency of conversion of chemical energy from fuel to heat energy. In addition, the obtained results indicated that this burner can be used as a device for generating high-frequency pressure waves and sound energy in the zones of combustion furnaces or flue gas ducts in order to prevent the formation or removal of already formed ash deposits from boiler heating surface.
Keywords: *burner, pulse combustion, pressure, frequency, ash*

SAŽETAK:
Povećanje energetske efikasnosti, pogonske i vremenske raspoloživosti kotlova velike snage, uz istovremenu promociju održivog razvoja, je stalni imperativ. Takva usmjerenost, istovremeno, predstavlja i snažan motiv za istraživanje novih tehnologija za konverziju primarne energije iz goriva. U vezi sa ovim su do sada na Univerzitetu u Sarajevu - Mašinski fakultet, Laboratorija za pulzirajuće sagorijevanje, obavljena obimna istraživanja karakteristika pulzirajućeg sagorijevanja plinovitog goriva u jednostavnom i robustnom gorioniku modularnog tipa, sa aerodinamičkim ventilima, bez pokretnih dijelova i hlađen vodom. Dobijeni rezultati i saznanja upućuju na to da se predmetni gorionik može upotrijebiti kao osnovni ili pomoćni gorionik u ložištu s ciljem dodatne turbulizacije ložišne atmosfere te samim tim i povećanja stepena efikasnosti konverzije hemijske energije iz goriva u toplotnu. Pored toga, dobijeni rezultati upućuju i na to da se predmetni gorionik može primijeniti i kao uređaj za generisanje visokofrekventnih talasa pritiska i zvučne energije u zonama ložišta ili kanala dimnih gasova s ciljem sprječavanja formiranja ili pak odnošenja već formiranih naslaga pepela sa kotlovskih ogrijevnih površina.
Ključne riječi: *gorionik, pulzirajuće sagorijevanje, pritisak, frekvenca, pepeo*

SUSTAINABLE MOBILITY: CHANGING MINDSETS AND RETHINKING PARADIGMS

Natalya Shramenko[1], Christoph Hupfer[2]
[1](Baden-Württemberg Institute of Sustainable Mobility, Hochschule Karlsruhe University of Applied Sciences)
[2](Baden-Württemberg Institute of Sustainable Mobility, Hochschule Karlsruhe University of Applied Sciences)


Natalya Shramenko


Christoph Hupfer

ABSTRACT
The global problem of climate change necessitates the reduction of greenhouse gas emissions. Achieving the UN 2030 Sustainable Development Goals and the goals of the Paris Climate Agreement requires a transition from traditional approaches to planning, organization and development of cities and urban agglomerations to building sustainable systems and developing sustainable mobility. In this regard, it is necessary to change the worldview and rethink the paradigms of the further development of society in the context of global problems and crises. The publication focuses on the main paradigms.
The study analyzes statistical data, which shows that the transport sector is the largest consumer of energy and plays a significant role in global greenhouse gas emissions. Thus, a significant reduction in greenhouse gas emissions, as well as the creation of a comfortable and safe urban environment, will be facilitated by a change in the model of consumption and mobility in cities.
The directions for rethinking the established paradigms of the development of society in the face of climate change and the development of sustainable mobility are systematized. This can serve as a basis for system-wide transformations and further research on the development of activities and innovative solutions in the formation of strategies for the sustainable development of urban agglomerations. At the same time, for successful innovation processes in the development of sustainable mobility, comprehensive political support and decisive action from the administrative structures are required.

Keywords: *sustainable mobility, climate change, greenhouse gas, urban agglomeration, green logistics, transport.*

FLUE GAS EMISSIONS ON THE OXYGEN-ENRICHED COMBUSTION OF BROWN COAL AND WOODY BIOMASS

EMISIJA DIMNIH PLINOVA PRI KOSAGORIJEVANJU MRKIH UGLJEVA I OTPADNE DRVNE BIOMASE U ATMOSFERI OBOGAĆENOJ KISEONIKOM

Kenan Kadić[1], Nihad Hodžić[2]
[1] JP Elektroprivreda BiH d.d. - Sarajevo, Power plant Kakanj - Kakanj, BiH - 72240 Kakanj
[2] University of Sarajevo - Faculty of Mechanical Engineering, BiH - 71000 Sarajevo


Kenan Kadić


Nihad Hodžić

ABSTRACT
With the aim of expanding the existing knowledge and especially obtaining new knowledge, research was carried out in laboratory conditions on the co-firing of a mixture of brown coal and waste woody biomass in a pulverized state, in the conditions of an oxygen-enriched atmosphere - research into the possibility of applying new combustion technologies from the field of oxy fuel combustion for different solid fuels. In addition to changing the composition of the oxidant in the combustion furnace (O_2≥21%), the test regimes were also performed at different process temperatures (950÷1250) °C and for different mixtures of the subject fuels with (0÷20)% biomass pro-portion in the mixture. As a key result of the research, it was established that the fuels in question can be used without hindrance in the treated conditions of the oxy fuel combustion technology: the efficiency of the conversion of primary energy from the fuel is very hi-gh, and at the same time, the extraction of CO_2 from the resulting flue gases in their po-ssible further treatment is significantly facilitated (CCS - Carbon capture and storage).

Keywords: *emissions, oxygen-enriched combustion, coal, biomass*

SAŽETAK
S ciljem proširenja postojećih te naročito dobijanja novih saznanja, u la-boratorijskim uslovima su izvršena istraživanja kosagorijevanja mješavine mrkih ugljeva i otpadne drvne biomase u sprašenom stanju i to u uslovima kiseonikom obogaćene atmosfere - istraživanja mogućnosti primjene novih tehnologija sagorijevanja iz oblasti oxy fuel sagorijevanja za različita čvrsta goriva. Osim promjene sastava oksi-dansa u ložištu (O_2≥21%), ispitni režimi su izvedeni i pri različitoj procesnoj temperaturi (950÷1250) °C te za različite mješavine predmetnih goriva sa (0÷20)% udjela biomase u mješavini. Kao ključni rezultat istraživanja utvrđeno je da se predmetna goriva mogu nesmetano primijenjivati u tretiranim uslovima oxy fuel tehnologije sagorijevanja: pri tome je efikasnost konverzije primarne energije iz goriva veoma visoka a istovremeno je iz nastalih dimnih plinova u njihovom mogućem daljnjem tretmanu znatno olakšano izdvajanje CO_2 (CCS - Carbon capture *and storage).*

Ključne riječi: *emisija, atmosfera obogaćena kiseonikom, ugalj, biomasa*

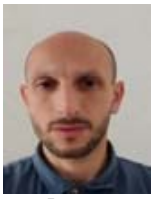
GLOBAL DYNAMICS OF A CERTAIN NONLINEAR SYSTEM OF DIFFERENTIAL EQUATIONS WITH THE APPEARANCE OF HOPF BIFURCATION

GLOBALNA DINAMIKA JEDNOG NELINEARNOG SISTEMA DIFERENCIJALNIH JEDNAČINA S POJAVOM HOPFOVE BIFURKACIJE

Vahidin Hadžiabdić[1], Midhat Mehuljić[1], Jasmin Bektešević[1], Adnan Mašić[1], Nedim Pervan[1]
[1]Faculty of Mechanical Engineering, University of Sarajevo, 71000 Sarajevo, Bosnia and Herzegovina


Vahidin Hadžiabdić


Midhat Mehuljić


Jasmin Bektešević


Adnan Mašić


Nedim Pervan

ABSTRACT:
In this paper, a certain system of ordinary differential equations is observed and the existence of Hopf bifurcation is analyzed. A detailed analysis of local stability depending on the parameters was performed. During the analysis of global stability, the existence of an stable limit cycle surrounding the unstable equilibrium point and Hopf bifurcations was shown. This case was found to be a supercritical Hopf bifurcation.Several nullclines and a bifurcation diagram for certain parameter values are graphically illustrated.

Keywords: *stability, dynamics, equilibrium, Hopf bifurcation, limit cycle.*

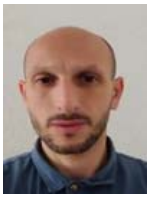
REZIME:
U ovom radu proučavan se određeni sistem diferencijalnih jednačina i analizira postojanje Hopfove bifurkacije. Provedena je detaljna analiza lokalne stabilnosti ovisno o parametrima. Tokom analize globalne stabilnosti pokazano je postojanje stabilnog graničnog ciklusa koji okružuje nestabilnu točku ekvilibrijuma (ravnoteže) i Hopfove bifurkacije. Utvrđeno je da je ovaj slučaj superkritična Hopfova bifurkacija. Grafički je ilustrirano nekoliko nulklinala i bifurkacijski dijagram za određene vrijednosti parametara..

Ključne riječi: *stabilnost, dinamika, ekvilibrijum, Hopfova bifurkacija, granični ciklus*

THE GLOBAL BEHAVIOR OF A CERTAIN GENERAL DIFFERENCE POLYNOMIAL EQUATION

GLOBALNO PONAŠANJE JEDNE OPĆE POLINOMIJALNE DIFERENTNE JEDNAČINE

Jasmin Bektešević[1] , Vahidin Hadžiabdić[1], Midhat Mehuljić[1], Adnan Mašić[1], Fatih Destović[2]
[1]Faculty of Mechanical Engineering, University of Sarajevo, 71000 Sarajevo, Bosnia and Herzegovina
[2]Faculty of Educational Sciences, University of Sarajevo, Sarajevo, Bosnia and Herzegovina


Jasmin Bektešević


Vahidin Hadžiabdić


Midhat Mehuljić


Adnan Mašić


Fatih Destović

ABSTRACT:
We investigate a polynomial difference equation of type

$$x_{n+1} = P(x_n)x_{n-1} + P(x_{n-1})x_{n-1} + bx_{n-1}, \quad n = 0,1,2,\ldots$$

in the first quadrant of initial conditions (x_{-1}, x_0) *where* $b \geq 0$, $2P(0) + b < 1$ *and* $P(x)$ *is polynomial with nonnegative coeffcients. We find explicit equation of the planar curve that separates basins of attraction of the point at infinity and locally asymptotically stable zero equilibrium point.*

Keywords: *basin of attraction, period-two solutions, local stability, global stability, equilibrium.*

REZIME:
U ovom radu istržujemo polinomijalnu diferentnu jednačiu oblika

$$x_{n+1} = P(x_n)x_{n-1} + P(x_{n-1})x_{n-1} + bx_{n-1},$$

u prvom kvadrantu početnih uvjeta (x_{-1}, x_0) *gdje su* $b \geq 0$, $2P(0) + b < 1$ *i* $P(x)$ *je polinom sa nenegativnim koeficijentima. Našli smo eksplicitnu jednačinu krive u ravni koja razdvaja bazene atrakcije tačke u beskonačnosti i lokalno asimptotski stabilnog nula ekvilibrijuma.*

Ključne riječi: *bazen privlačenja, periodičko rješenje perioda 2, lokalna stabilnost, globalna stabilnost, ekvilibrijum*

BIOMEDICAL APPLICATION OF NANOCOMPOSITES BASED ON FULLERENES-C60

BIOMEDICINSKA PRIMJENA NANOKOMPOZITA NA BAZI FULERENA-C60

***Bratovcic Amra*[1]**
[1]*University of Tuzla, Faculty of Technology, 75000 Tuzla, Bosnia and Herzegovina*

Amra Bratovcic

ABSTRACT:
This paper discusses the chemical and physical properties of fullerene C60 and the methods of fullerene functionalization.Due to the extremely hydrophobic character of fullerenes, it is necessary to modify them in the sense that they become primarily soluble in water so that they can be used in biological systems and biomedicine.Here, the chemical composition of the latest sensors, their characteristics and application are studied in detail.Fullerene-C60 nanocomposites are widely used in biomedicine as antioxidants, antiviral agents, HIV-1 protease inhibitors, drug carriers, but also in carcinoma diagnostics and photodynamic therapy.They are also used as electrochemical sensors and biosensors.

Keywords: *fullerenes,antioxidants, inhibitors, drug delivery vehicles, photodynamic therapy, electrochemical sensors, biosensors.*

REZIME:
U ovom radu se govori o hemijskim i fizikalnim svojstvima fulerena C60 te metodama funkcionalizacije fulerena.Zbog izrazito hidrofobnog karaktera fulerena potrebno ih je modificirati u smislu da postanu primarno topljivi u vodi kako bi se mogli koristiti u biološkim sistemima i biomedicini.Ovdje se detaljno proučava hemijski sastav najnovijih senzora, njihove karakteristike i primjena.Nanokompoziti fuleren-C60 naširoko se koriste u biomedicini kao antioksidansi, antivirusni agensi, inhibitori HIV-1 proteaze, nosači lijekova, ali i u dijagnostici carcinoma i fotodinamskoj terapiji.Također se koriste kao elektrohemijski senzori i biosenzori.

Ključne riječi: *fulereni,antioksidansi, inhibitori, dostavljači lijekova, fotodinamska terapija, elektrohemijski senzori, biosenzori.*

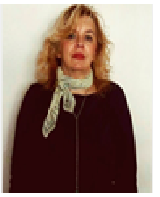
CHEMICAL ANALYSIS OF POMEGRANATE FRUITS TAKEN FROM DIFFERENT LOCATIONS IN HERZEGOVINA (BOSNIA AND HERZEGOVINA)

HEMIJSKA ANALIZA PLODOVA ŠIPKA NA RAZLIČITIM LOKACIJAMA HERCEGOVINE (BOSNA I HERCEGOVINA)

Alma Mičijević[1], Aida Šukalić[2], Alma Leto[3], Sanela Nazdrajić[4]
[1,2,3]University of Mostar, Faculty of Agromediteranean, 88104 Mostar, Bosnia and Herzegovina
[4]University of Mostar, Faculty of Education, 88104 Mostar, Bosnia and Herzegovina


Alma Mičijević


Aida Šukalić


Alma Leto


Sanela Nazdrajić

ABSTRACT:
Pomegranate is one of the first cultivated fruits with remarkably refreshing sour-sweet taste. Because of pomegranate's dietary and therapeutic value, there has been an increased interest in the production of the fruit in recent years. Fruits are consumed fresh or processed into juice.
The aim of this research was to determine the chemical parameters in different samples of pomegranate fruit collected on six different locations in Herzegovina, in the close proximity of City of Mostar. In this research pH-value, the dry matter content, the acidity degree and total sugars content, were determined. The total of twelve samples was examined, two from each location, both with pure seeds and seeds with mesocarp.
The results of the research show that this is a sour fruit type, because the pH-value determined ranged from 3,04 to 4,14. Somewhat higher pH-value was determined on four locations, in samples with seeds with mesocarp. The results of the acidity degree determination show somewhat higher values in the seeds with mesocarp samples, while the dry matter content and total sugars content were higher in pure seeds samples, taken from all locations.
Keywords: *chemical analysis, different locations, pomegranate fruits, seeds with mesocarp*

REZIME:
Šipak je jedan od prvih kultivisanih plodova sa izrazito osvježavajućim kiselkasto-slatkim okusom. U posljednje vrijeme je povećan interes za uzgoj ove voćne vrste zbog njene dijetotarapeutske vrijednosti. Plodovi se konzumiraju u svježem stanju ili prerađuju u sok.
Cilj ovog istraživanja je bio odrediti hemijske parametere u različitim uzorcima šipka na 6 lokacija područja Hercegovine, u neposrednoj blizini grada Mostara. U ovom istraživanju odeđivani su: pH-vrijednost, sadržaj suhe materije, stepen kiselosti i sadržaj ukupnih šećera. Ukupno je ispitano 12 uzoraka, sa svakog lokaliteta po 2 i to uzorak čistog zrna i zrna sa mezokarpom.
Rezultati istraživanja pokazuju da se radi o kiseloj voćnoj vrsti, jer se pH-vrijednost kretala u granicama od 3,04 do 4,14. Na četiri lokaliteta pH-vrijednost je imala nešto veće vrijednosti u uzorcima sa mezokarpom. Rezultati određivanja stepena kiselosti je nešto veće vrijednosti imao u uzorcima zrna sa mezokarpom, dok je sadržaj suhe materije i ukupnih šećera veći u uzorcima čistog zrna na svim ispitivamin lokacijama.
Ključne riječi: *hemijskaanaliza, različitelokacije, čistozrno, zrnosamezokarpom*

THE RELATIONSHIP BETWEEN FOLIC ACID AND HEALTHY REPRODUCTION

Jia Lijun[1], Andrea Formato[2], Giampiero Celenta[3], Raffaele Romano[2]
[1]College of Food Science and Nutritional Engineering, China Agricultural University, Beijing, China
[2]Department of Agricultural Science, University of Naples "Federico II", via Università 100, 80055 Portici, Naples, Italy
[3]MEID4, Academic Spin-Off of the University of Salerno, Via Giovanni Paolo II,132, 84084 Fisciano, Italy


Jia Lijun


Andrea Formato


Giampiero Celenta


Raffaele Romano

ABSTRACT:
Since 1991, when the UK Medical Research Council first confirmed that folic acid supplementation before and after pregnancy can prevent the occurrence of NTDs (neural tube malformations) and reduce the incidence by 50-70%, the preventive effect of folic acid on NTDs has been recognized as one of the most exciting medical discoveries of the late 20th century. Since then, the effects of folic acid on fetal growth and development have been the focus of scholars' research. More and more studies have shown that folic acid is associated with other fertility problems as well as fetal birth defects. In particular, many studies in recent years have explained the relationship between folic acid and healthy fertility from the epigenetic aspects such as genetic and histone modification. Therefore, combined with relevant literature, the author reviews some current research results, in order to clarify the specific pathogenesis and other unsolved problems through further research.

Keywords: *Folic Acid, Pregnancy Results, Folic Acid Supplement.*

EFFECT OF BAKING CONDITIONS AND RECIPES ON THE QUALITY OF COOKIES

Zhou Shuai[1], Raffaele Romano[2], Gianpiero Celenta, Andrea Formato[2]
[1]College of Food Science and Nutritional Engineering, China Agricultural University, Beijing Laboratory of Food Quality and Safety, Beijing, 100083, China
[2]Department of Agricultural Science, University of Naples "Federico II", via Università 100, 80055 Portici, Naples, Italy
[3]MEID4, Academic Spin-Off of the University of Salerno, Via Giovanni Paolo II,132, 84084 Fisciano, Italy


Zhou Shuai


Raffaele Romano


Giampiero Celenta


Andrea Formato

ABSTRACT:
In order to develop popular butter cookie products with good shape and taste, and lay a foundation for the research and development of various flavor cookies, in this paper, we studied the processing technology of butter cookies. The single factor test and orthogonal test were carried out to obtain the best processing recipes according to the sensory score. Finally, it was determined that the best butter cookie production process was 200 g of low gluten flour, 130 g of butter, 60 g of powdered sugar, 40 g of fine granulated sugar, 50 g of eggs, 3 drops of vanilla extract, and the baking temperature is 180°, baking time is 17.5 min. The butter cookies made under the best recipe and process conditions have good sensory quality, attractive color, moderate sweetness and crisp taste.

Keywords: *Cookies; Baking conditions; Recipes; Single factor test; Orthogonal test; Sensory evaluation.*

TECHNOLOGIES AND TECHNOLOGICAL PROCESS OF FOREST UTILIZATION– CASE STUDY „SARAJEVO ŠUME“

TEHNOLOGIJE I TEHNOLOŠKI PROCESI ISKORIŠTAVANJA ŠUMA – STUDIJ SLUČAJA K.J.P. „SARAJEVO ŠUME“

Halilović Velid[1], Musić Jusuf[1], Knežević Jelena[1], Hodžić Elmin[2]
[1] University of Sarajevo, Faculty of Forestry, Sarajevo, Bosnia and Herzegovina
[2]Cantonal Forestry „Sarajevo šume“ d.o.o. Sarajevo, Bosnia and Herzegovina


Velid Halilović


Jusuf Musić


Jelena Knežević


ElminHodžić

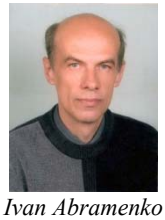
ABSTRACT:
The scientific discoveries in all areas of development of human society resulted in dynamic changes of work technologies in forestry as well, which isprimary reflected in introducing of new technologies and work machines. ... .The share of works in certain phases of forest utilization realized by PFE or private contractors was determined. Analysis showed that PFE realized 72% of felling and processing works, and private contractors 28%. Results of survey showed that PFE owned 69 chainsaws, and private contractors 40. PFE realized 74% of wood extracting works, and private contractors 26%. PFE owns 19 tractors, and private contractors 14. Customers realized loading and remote transport of wood in 100% cases.Used working machines are questionablefrom the aspect of technical obsolescence and do not fulfill the most of requirements from the domains of economy, ecology, ergonomics, etc., and it is necessary to invest in the sector of forest utilization. All of the above mentioned require a whole series of measures to improve the situation in the forest enterprise.
Keywords*: forestry, using of machines, technology, technological process, chainsaws, tractors*

REZIME:
Naučna dostignuća u svim sferama razvoja ljudskog društva rezultirala su dinamičnim promjenama tehnologija rada i u šumarstvu, što se prije svega ogleda u uvođenju novih tehnologija rada i sredstava rada. ... Analizom je utvrđeno da u fazi sječe i izrade preduzeće vlastitim kapacitetima realizuje 72% radova, a kooperanti 28% radova. Anketiranjemje utvrđeno da preduzeće posjeduje 69 motornih pila, a njihovi kooperanti 40. U fazi privlačenja drvetapreduzeće vlastitim kapacitetom realizuje 74% radova, a kooperanti 26%. Preduzeće posjeduje 19 traktora, a privatni izvođači 14. U fazi daljinskog transporta kupac vrši utovar i daljinski transport u 100% slučajeva. Sredstva rada koja se koriste su upitna sa aspekta tehničkog zastarijevanja i ne zadovoljavaju najveći broj zahtjeva iz domena ekonomičnosti, ekologije, rgonomije itd., te je neophodno ulaganje u sektor iskorištavanja šuma. Sve to zahtijeva čitav niz mjera kako bi se poboljšalo stanje u preduzeću šumarstva.
Ključne riječi: *šumarstvo, korištenje strojeva, tehnologija, tehnološki proces, motorne pile, traktori*

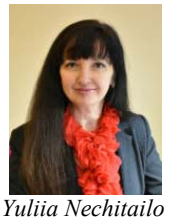
SIMULATION MODELING OF MULTIDIMENSIONAL MASS FLOTATION SEPARATORY PROCESSES CONSIDERINGTHE DISTRIBUTION OF PARAMETERS

Sergii Tymchuk[1], Ivan Abramenko[1], Vira Shendryk[2], Yuliia Nechitailo[1], Viktor Zhyla[1]
[1] State Biotechnological University, Kharkiv, 61002, Ukraine
[2]Sumy State University, 40007 Sumy, Ukraine


Sergii Tymchuk


Ivan Abramenko


Vira Shendryk


Yuliia Nechitailo


Viktor Zhyla

ABSTRACT:
A probabilistic-statistical mathematical model of the technological process of flotation has been developed, which belongs to the class of mass diffusion processes with drift. The use of Markov chains in compiling the apparatus model made it possible to make maximum use of a priori information about the physics of the process and ensure in dynamics the connection of qualitative and quantitative indicators of final products with the main control and disturbing influences. The implementation of the model was carried out using the MathLab software package and can be used to synthesize the corresponding automatic control systems.

Keywords:*separation processes, flotation, Markov chains, distribution of parameters, modeling.*

REVIEW OF PARASITIC NEMATODES OF FISH FROM THE UNA RIVER (BOSNIA AND HERZEGOVINA)

PREGLED PARAZITSKIH NEMATODA RIBA IZ RIJEKE UNE (BOSNA I HERCEGOVINA)

Isat Skenderović [1], Edina Hajdarević [1], Alen Bajrić[1], Subha Avdić[2]
[1] Faculty of Natural Sciences and Mathematics, University of Tuzla, Tuzla
[2]Biotechnical faculty, University of Bihać, Bihać


Isat Skenderović


Edina Hajdarević


Alen Bajrić


Subha Avdić

ABSTRACT:
Based on the available literature data, the presence of 24 species of fish parasites belonging to the following groups: Monogenea (1), Nematoda (9), Cestodes (8) and Acanthocephala (6) was found in the river Una. Ichthioparasitological research of fish from the Una River (Bosnia and Herzegovina) showed the presence of different species of nematodes. The presence of 9 species of nematodes was found in the investigated fish species: Raphidascaris acus, Rhabdochona denudata, Sterliadochona tenuissima, Capillaria salvelini, Capillaria rrevispicula, Cucullanus dogieli, Camallanus truncatus, Camallanus lacustris and Eustrongylides tubifex. The presence of nematodes was determined in 17 species of fish from 7 families: Cottidae, Thymallidae, Esocidae, Siluridae, Percidae, Salmonidae i Cyprinidae.

Keywords: *river Una, ichthyofauna, parasitofauna, nematodes.*

REZIME:
Na osnovu dostupnih literaturnih podataka u rijeci Uni je konstatovano prisustvo 24 vrste parazita riba koje pripadaju skupinama: Monogenea (1), Nematoda (9), Cestodes (8) i Acanthocephala (6). Ihtioparazitološka istraživanja riba iz rijeke Une (Bosna i Hercegovina), pokazala su prisustvo različitih vrsta nematoda. Kod istraživanih vrsta riba utvrđeno je prisustvo 9 vrsta nematoda: Raphidascaris acus, Rhabdochona denudata, Sterliadochona tenuissima, Capillaria salvelini, Capillaria rrevispicula, Cucullanus dogieli, Camallanus truncatus, Camallanus lacustris i Eustrongylides tubifex. Prisustvo nematoda je utvrđeno kod 17 vrsta riba iz 7 porodica: Cottidae, Thymallidae, Esocidae, Siluridae, Percidae, Salmonidae i Cyprinidae.

Ključne riječi: *rijeka Una, ihtiofauna, parazitofauna, nematode.*

INVESTIGATION OF THE ANTHROPOGENIC IMPACT ON CHEMISTRY, QUALITY INDICATORS AND CONCENTRATIONS OF SELECTED CHEMICAL ELEMENTS OF THE RIVER BREGAVA

ISPITIVANJE ANTROPOGENOG UTICAJA NA HEMIZAM, INDIKATORE KVALITETE I KONCENTRACIJE ODABRANIH HEMIJSKIH ELEMENATA RIJEKE BREGAVE

Dalila Ivanković[1], Almir Šestanc[2]
[1]University DžemalBijedićMostar, Faculty of Education,88000 Mostar, BiH
[2]University of Tuzla, Faculty of Natural Sciences and Mathematics, 75000 Tuzla, BiH


Dalila Ivanković


Almir Šestan

ABSTRACT:
Water is one of the basic, necessary conditions for the survival and development of living organisms on Earth.The Bregava River originates from the permanent springs of Bitunja and Hrgud and the periodic springs of Mali and Veliki Suhović.The larger place through which it flows is Stolac.In this paper, the concentrations of heavy metals, biogenic elements and physico-chemical parameters of the water quality of the Bregava River were analyzed at eight localities in four seasons.The quality parameters should indicate the degree of contamination of watercourses with polluting substances and their potential impact on the use of water for various purposes, and their dependence on climatic conditions.Also, the results provide an assessment of the impact of physico-chemical quality parameters on the chemistry of heavy metals in the Bregava River and their ecotoxicity from an ecological point of view.

Keywords: *Chemistry, physical-chemical, heavy metals, bioelements, pollution.*

REZIME:
Voda je jedan od osnovnih, neophodnih, uslova za opstanak i razvoj živih organizama na Zemlji. Rijeka Bregava nastaje od stalnih vrela Bitunje i Hrguda i periodičnih vrela Malog i Velikog Suhovića. Veće mjesto kroz koje protiče je Stolac. U ovom radu analizirane su koncentracije teških metala, biogenih elemenata te fizikalno-hemijskih parametra kvaliteta vode rijeke Bregave na osam lokaliteta i to u četiri godišnja doba.Parametri kvaliteta treba da ukažu na stepen opterećenosti vodotoka zagađujućim materijama i njihov potencijalni uticaj na korištenje vode za različite namjene, te njihovu zavisnost od klimatskih uvjeta. Također, rezultati daju procjenu uticaja fizičko-hemijskih parametara kvalitete na hemizam teških metala u rijeci Bregavi i njihovu ekotoksičnost gledano sa ekološkog aspekta.

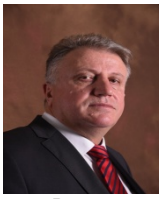
Ključne riječi*: Hemizam, fizičko-hemijski, teški metali, bioelementi, zagađenje.*

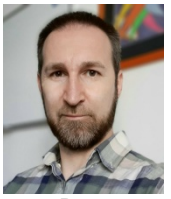
INVENTORY OF URBAN GREENERY USING GIS APPLICATIONS

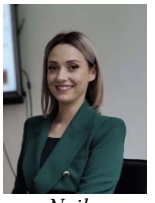
INVENTURA URBANOG ZELENILA KORSITEĆI GIS APLIKACIJE

Admir Avdagić[1], Besim Balić[2], Dino Hadžidervišagić[3], Nejla Kalača[4]
[1,2,3,4]University of Sarajevo, Faculty of Forestry, Sarajevo, Bosnia and Herzegovina


Admir Avdagić


Besim Balić


Dino Hadžidervišagić


Nejla Kalača

ABSTRACT:
In this paper we show application of GIS methods to inventory urban greenery. Using one case study we develop interactive GIS map of all trees, bushes and other urban inventory (garbage cans, benches etc.). Total research area is 68487,45 m^2, in municipality Novi Grad Sarajevo - Otoka. In this paper we used a QField application for collecting data and QGIS for mapping and creating interactive map with database. In total we recorded 308 trees, 222 bushes and 155 of different other urban inventories. For every tree we estimated a health condition, crown shape etc. using VTA method (visual tree assessment). Created map and database can be used in practice for monitoring of urban greenery.

Keywords: *inventory of urban greenery, GIS, QGIS, QField*

REZIME:
U ovom radu je prikazana aplikacije GIS metoda prilikom inventure urbanog zelenila. Koristeći studij slučaja kreirali smo interaktivnu GIS mapu svi stabala, grmova, i ostalog urbanog mobilijara (kante, klupe itd.). Ukupna istraživana površina je 68487,45 m^2 i nalazi se u općini Novi Grad Sarajevo, naselje Otoka. Za prikupljanje podataka korištena je Qfiled aplikacija a za mapiranje i kreiranje interaktivne mape sa bazom podataka korišten je QGIS softver. Ukupno je snimljeno 308 stabala, 222 grma i 155 elemenata parkovskogmobilijara. Za svako stablo je ocjenjeno zdravstveno stanje te, oblik krošnje itd. koristeći VTA metodu (visual tree assessment). Kreirana mapa i baza se u praksi može koristit za monitoring stanja urbanog zelenila.

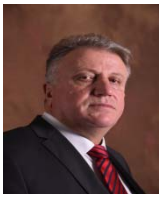
Ključne riječi: *inveturaurbanogzelenila, GIS, QGIS,QField*

MODELS TO ESTIMATE A QUALITY AND STRUCTURE OF WOOD ASSORTMENT OF STANDING TREES OF BEECH (Fagussylvatica L.) IN SOUTHWESTBOSNIA AND HERZEGOVINA

MODELI ZA PROCJENU KVALITETA I STRUKTURE DRVNIH SORTIMENATA DUBEĆIH STABALA BUKVE (Fagussylvatica L.) U JUGOZAPADNOJ BOSNI I HERCEGOVINI

Admir Avdagić[1], Besim Balić[2], Ahmet Lojo[3], Jusuf Musić[4]
[1,2,3,4]University of Sarajevo, Faculty of Forestry, Sarajevo, Bosnia and Herzegovina

Admir Avdagić



Besim Balić

Ahmet Lojo

Jusuf Musić

ABSTRACT:
For forest management planning is very important to know the quality and quantity of forests. Also is very important to know the structure and quality of wood assortments that can be produced from standing trees. In this paper, we develop a models to estimate a quality wood assortment structure according to the JUS standard which is still in use in Bosnia and Herzegovina. To calculate the average percentage,share of assortment of volume beech trees we used a logarithmic function. As result wedeveloped models for each assortment, which can be used to calculate a percentage share of ever assortment in total tree volume. Developed models can be used in practice or its possible to create aassortments tables of beech which are used in forestry practice.

Keywords: *model. Beech, wood assortments, JUS standard*

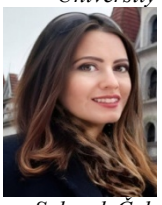
REZIME:
Za planiranje gazdovanja šumama je veoma važno poznavanje kvaliteta i kvantiteta stanja šume. Pored toga, vrlo je važno i poznavanje strukture i kvaliteta drvnih sortimenata koji se mogu izraditi od dubećih stabala. U ovom radu smo kreirali modele za procjenu strukture i kvaliteta drvnih sortimenata prema JUS standardima koji su još uvijek u upotrebi u Bosni i Hercegovini. Da bih izračunali prosječni procentualni udio pojedinih sortimenata u ukupnoj zapremini stabala bukve koristili smo logaritamsku funkciju. Kao rezultat kreirali smo modele za svaki sortiment pomoću kojih je moguće izračunati procentualni udio svakog sortimenta u zapremini stabla. Dobiveni modeli imaju svoju praktičnu primjenu ili moguće kreirati sortimentne tablice koje se koriste u šumarskoj praksi.

Ključne riječi: *model, bukva, drvni sortimenti, JUS standard*

EVALUATION OF PROPERTIES OF MATERIALS FOR FUNCTIONAL FOOTBALL SPORTSWEAR

EVALUACIJA SVOJSTAVA MATERIJALA ZA FUNKCIONALNU NOGOMETNU ODJEĆU

Salopek Čubrić Ivana[1], Čubrić Goran[2], Petrov Antonija[3], Rolich Tomislav[4]
[1,2,3,4]University of Zagreb Faculty of Textile Technology, Zagreb, Croatia


Ivana Salopek Čubrić


Goran Čubrić


Antonija Petrov


Tomislav Rolich

ABSTRACT:
Sport is an important part of many people's lives. Sports materials should provide maximum comfort to the person who wears them during sports performance. The above proves a view of the global market where sportswear occupies an important place within the entire textile industry. Advances in technology and the development of high-performance materials have also improved the performance of sportswear. The functionality of materials intended for the production of sportswear and new design solutions are tested primarily on professional athletes. The research presented in this paper focuses on the investigation of materials that are intended for the production of functional sportswear. The research compares the standard and recycled materials with different percentages of elastane yarn. In the focus of the research are the following material properties: mass per unit area, thickness, bending rigidity, porosity, water vapour permeability, and drying speed. The results of measurements are discussed within the context of material use and more appropriate materials within an evaluated set of materials are outlined.

Keywords: *yarn, material, measurement, football, sportswear*

REZIME:
Sport je važan dio života mnogih ljudi. Sportski materijali trebaju pružati maksimalnu udobnost osobi koja ih nosi tijekom sportske izvedbe. Navedeno dokazuje pogled na globalno tržište na kojem sportska odjeća zauzima značajno mjesto u cjelokupnoj tekstilnoj industriji. Napredak tehnologije i razvoj materijala visokih performansi također su poboljšali performanse sportske odjeće. Funkcionalnost materijala namijenjenih izradi sportske odjeće i nova dizajnerska rješenja testiraju se prvenstveno na profesionalnim sportašima. Istraživanja prikazana u ovom radu usmjerena su na ispitivanje materijala koji su namijenjeni za izradu funkcionalne sportske odjeće. Istraživanje uspoređuje standardne i reciklirane materijale s različitim postocima elastanske pređe. U fokusu istraživanja su sljedeća svojstva materijala: masa po jedinici površine, debljina, krutost savijanja, poroznost, propusnost vodene pare i brzina sušenja. O rezultatima mjerenja raspravlja se u kontekstu upotrebe materijala i ocrtavaju se prikladniji materijali unutar ocjenjivanog skupa materijala.

Ključne riječi: *pređa, materijal, mjerenje, nogomet, sportska odjeća*

TECHNOLOGIES FOR REMEDIATION OF POLLUTED ENVIRONMENT: BETWEEN CLASSIC PROCESSES AND THE CHALLENGES OF NEW APPROACHES

TEHNOLOGIJE ZA REMEDIJACIJU ZAGAĐENE ŽIVOTNE SREDINE: IZMEĐU KLASIČNIH PROCESA I IZAZOVA NOVIH PRISTUPA

Miroslav Vrvić
BREM GROUP Ltd, 11090 Belgrade, Str. Oslobodjenja 39b, Serbia

Miroslav Vrvić

ABSTRACT:
The negative effects on environment of the life activities of our distant ancestors are reflected in the active use of fire in everyday life, which is confirmed by numerous scientific evidences.
Later, the pollution of air, water, soil and food accelerated and became more complicated, which led to an alarming situation in the present time and especially in the future. In the last few years, researchers have focused on poly- and perfluoroalkyl substances-PFASs, and micro- and nanoplastics, as global pollutants.
...
Modern remediation concepts are based on the principles of green chemistry and green engineering, with the aim of "closing the loop" of the circular economy and fulfilling the unsustainable 2030 sustainable development agenda, which in real time coordinates can only be: smart development.

Keywords:*Global pollution, PFASs, plastics, remediation, advanced technologies, circular economy, smart development.*

REZIME:
Negativni efekti životnih aktivnosti naših dalekih predaka na okolinu, ogledaju se u aktivnom korišćenju vatre u svakodnevnom životu, što potvrđuju brojni naučni dokazi.
Kasnije se zagadjenje vazduha, vode, zemljišta i hrane ubrzavalo i usložnjavalo, što je dovelo do alarmantnog stanja u vremenu sadašnjem i pogotovo u budućnosti. Poslednjih nekoliko godina u centru pažnje istraživača su poli- iperfluoroalkilsupstance-PFOSs i mikro- i nanoplastika, kao globalni polutanti.
...
Savremeni koncepti remedijacije, baziraju se na principima zelene hemije i zelenog inženjerstva, sa ciljem „zatvaranja petlje“ cirkularne ekonomije i ispunjenja neodržive agende 2030 održivog razvoja, koji u realnim vremenskim koordinatama može da bude samo: pametan razvoj.

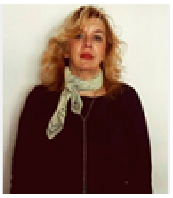
Ključne reči: *Globalne zagađujuće supstancei, PFASs, plastika, napredne tehnologije, cirkularna ekonomija, pametan razvoj.*

NITRATES AND NITRITES IN DRINKING WATER WITH A HUMAN HEALTH RISK ASSESSMENT IN THE CITY OF MOSTAR

NITRATI I NITRITI U VODI ZA PIĆE SA PROCJENOM RIZIKA PO ZDRAVLJE LJUDI NA PODRUČJU GRADA MOSTARA

Aida Šukalić[1], Alma Leto[2], Alma Mičijević[3], Lamija Torlo[4]
[1,2,3,4]University of Mostar, Faculty of Agromediteranean,88104 Mostar, Bosnia and Herzegovina


Aida Šukalić


Alma Leto


Alma Mičijević


Lamija Torlo

ABSTRACT:
The paper presents the results of monitoring drinking water at four locations in the City of Mostar with the aim of monitoring the concentration of nitrates and nitrites. The wellsprings where the samples were collected are Radobolja, Studenac, Bosnjaci, and Salakovac. Eight samples were taken at each location over the course of one year in different time intervals. The samples were delivered to the Institute for Public Health in Mostar, where the analyses were performed. The research was conducted using the descriptive-research method and spectrophotometric method. The human health risk assessment was also performed by calculating the Hazard Quotient Index (HQI). It was determined that the samples from all locations are in accordance with the Rulebook on health safety of drinking water (Official Gazette of Bosnia and Herzegovina, 40/10) and that they do not exceed the MDK values for nitrates and nitrites. It was also determined that there is no health risk for adults and children from the intake of nitrates and nitrites from drinking water from these wellsprings.

Keywords: *nitrates, nitrites, drinking water, risk assessment*

REZIME:
U radu su prikazani rezultati monitoringa vode za piće na 4 lokaliteta u Gradu Mostaru s ciljem praćenja koncentracije nitrata i nitrita. Izvorišta na kojima su prikupljeni uzorci su Radobolja, Studenac, Bošnjaci i Salakovac. Uzeto je po 8 uzoraka na svim lokalitetima u toku jedne godine u različitim vremenskim intervalima. Uzorci su dostavljeni u Zavod za javno zdravstvo Mostar, gdje su i urađene analize. Istraživanje je provedeno metodama deskriptivnog istraživanja, spektrofotometrijskom metodom te je urađena i procjena rizika po zdravlje ljudi proračunom Hazard Quotient Indeks (HQI). Utvrđeno je da su uzorci sa svih lokaliteta u skladu sa Pravilnikom o zdravstvenoj ispravnosti vode za piće (Službeni glasnik BiH, broj 40/10), te da ne premašuju MDK vrijednosti za nitrate i nitrite. Također je utvrđeno da nema rizika po zdravlje odraslih i djece unosom nitrata i nitrita iz vode za piće sa ovih izvorišta.

Ključne riječi: *nitrati, nitriti, voda za piće, procjenarizika*

COMPARATIVE ASSESSMENT OF THE QUALITY OF APPLE JUICE PRODUCED BY ECOLOGICAL AND TEHNOLOGICAL PROCESS

KOMPARATIVNA OCJENA KVALITETA SOKA OD JABUKE PROIZVEDENOG EKOLOŠKIM I TEHNOLOŠKIM POSTUPKOM

Fatima Muhamedagić[1], Edina Šertović[2], Mehmed Cero[3]
[1,2]Biotehnical Faculty, University of Bihać, Luke Marjanovica, Bosnia and Herzegovina
[3]Federal Ministry of the Environment and Tourism, Sarajevo, Bosnia and Herzegovina

Fatima Muhamedagić

Mehmed Cero

ABSTRACT:
Today, there is a growing trend of demand and consumption of domestic products produced in an organic way, and this primarily refers to the production of juices, jams and other products.In Bosnia and Herzegovina, the apple is the most important and most widespread fruit species. It has a good yield and a relatively low cost. ... In these researches, analyzes were performed: physical-chemical, microbiological and organoleptic, i.e. sensory evaluation.The results of the research of apple juice samples showed certain deviations in physicochemical parameters while the microbiological parameters were the same. The sensory properties of the tested samples showed that organically produced apple juice has lower scores compared to technologically produced apple juice. The acceptability test showed satisfactory and good acceptability of organically produced juices compared to conventional ones, which were rated very well by potential consumers.

Keywords: *apple, apple juice, ecological production, technological production*

SAŽETAK:
Danas je sve veći trend potražnje i potrošnje domaćih proizvoda proizvedenih na ekološki način, a to se prije svega odnosi na proizvodnju sokova, džemova i drugih proizvoda. U Bosni i Hercegovini jabuka je najvažnija i najrasprostranjenija voćna vrsta. Ona ima dobar prinos i relativno nisku cijenu. ... U ovim istraživanjima obavljene su analize: fizičko-hemijske, mikrobiološke i organoleptičke, odnosno senzorske ocjene. Rezultati istraživanja uzoraka soka od jabuke pokazali su određena odstupanja u fizičko-hemijskim parametrima dok su mikrobiološki parametri bili isti. Senzorska svojstva ispitanih uzoraka pokazala su da ekološki proizveden sok od jabuke ima niže ocjene u odnosu na tehnološki proizveden sok od jabuke. Test prihvatljivosti pokazao je zadovoljavajuću i dobru prihvatljivost ekološki proizvedenih sokova u odnosu na konvencionalne, koji su potencijalni potrošači ocijenjeni vrlo dobrima.

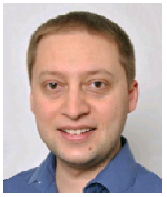
Ključne riječi: *jabuka, sok od jabuke, ekološki proizvedeno, tehnološki proizvedeno*

THE QUANTUM-CHEMICAL PREDICTION FOR SOME NMR SPECTRAL PARAMETERS IN SYSTEMS BASED ON AROMATIC POLYAMIDES

Andrey Tokar[1], Olga Chihvintseva[2], Milan Milosavljević[3]
[1]Dnipro State Agrarian and Economic University, Sergiya Yefremova st., 25, Dnipro, 49009, Ukraine, e-mail: atokar_2004@ukr.net
[2]e-mail: diso@i.ua
[3] Nalco Water, An Ecolab Company, Naperville, Illinois, USA, Department in Belgrade, Serbia, e-mail: milan.milosavljevicm@gmail.com

Andrey Tokar

Olga Chihvintseva



Milan Milosavljević

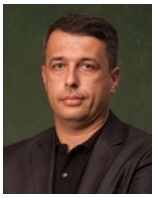
ABSTRACT:
Using the ab initio methods of quantum chemistry a detailed theoretical study of the basic parameters for nuclear magnetic resonance spectra has been carried out using the example of N-phenylbenzamide, which plays the role of a prototype for a monomeric chain of aromatic polyamides, in particular phenylons. The calculation results are quite consistent with the data of this type, as obtained earlier, and indicate a valid reproduction of the spectral characteristics for the model system within the selected theoretical approximation, both in vacuo as well as in the medium of dipolar aprotic solvents, namely dimethylacetamide and dimethyl sulfoxide.

Keywords: *ab initio calculations, ^{1}H NMR-spectrum, solvation energy, polarizable continuum method, Onsager solvation model.*

CONTRIBUTION TO THE KNOWLEDGE OF GRAPEVINE PRODUCTION IN SOUTEASTERN EUROPE – CASE STUDY OF MONTENEGRO

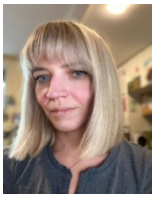
PRILOG POZNAVANJU PROIZVODNJE VINOVE LOZE U JUGOISTOČNOJ EUROPI – STUDIJA SLUČAJA CRNE GORE

Dejan Zejak[1], Branislav Dudic[2], Gabriela Pajtinková Bartáková[2], Katarína Gubíniová[2]
[1] Biotechnical Center, Rakonje XV/13, 84000, Bijelo Polje, Montenegro
[2] Faculty of Management, Comenius University Bratislava, 82005 Bratislava, Slovakia


Dejan Zejak


Branislav Dudic


Gabriela Pajtinková Bartáková

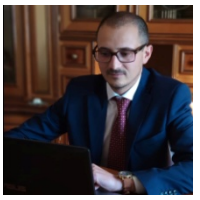

Katarína Gubíniová

ABSTRACT:
This study deals with the analysis of statistical data on grapevine production in Montenegro for a decade 2001-2011 including data available from the census of 1878 and for the period 1930 - 2021. The official data of the Kingdom of Yugoslavia and the Official Gazette of Montenegro for the years 2001-2011were used as for the analyses. The average number of the total grapevines is 17,351,164 (with the raneg from 18,464,357 to 16,093,922), and the standard deviation 1,080,273. The average number of productive age of grapevines is 16,107,641. The amounts range from 17,020,057 to 15,304,384 (standard deviation 837,625). The average total yield expressed in tons is 38,057(range 43,989 - 32,815, standard deviation 3,758). The average yield per vine expressed in kilograms we calculated on 2.37 kg. The amounts range from 2.79 to 1.90, with the standard deviation 0.25. By analysing the obtained data and within the specific agro-ecological conditions of Montenegro, we can plan further production of vines in Montenegro.
Keywords: *Vitis vinifera L., grapevine, production, vineyard, statistical data, trends, Montenegro*

REZIME:
Ova studija bavi se analizom statističkih podataka o proizvodnji vinove loze u Crnoj Gori za deceniju 2001-2011, uključujući neke podatke dostupne iz popisa stanovništva iz 1878. i za period 1930-2021. Službeni podaci Kraljevine Jugoslavije i Službeni list Crne Gore za razdoblje 2001.-2011. korištena je kao polazište za analizu. Prosječan broj ukupnih čokota izračunali smo na 17.351.164. u rasponu od 18.464.357 do 16.093.922 (period 2001-2011), sa standardnom devijacijom 1.080.273. Prosječan broj rodnihstabala je 16.107.641. u rasponu od 17.020.057 do 15.304.384, sa standardnom devijacijom 837.625. Prosječni ukupni prinos izražen u tonama je 38.057; raspon vrijednosti od 43.989 do 32.815, sa standardnom devijacijom od 3.758. Prosječni prinos po čokotu je 2,37 kiogramau (od 2,79 do 1,90), sa standardnom devijacijom 0,25. Analizom dobivenih podataka u specifičnim agroekološkim uslovima Crne Gore, može se planirati daljirazvoj ovog sektora u Crnoj Gori.
Ključne reči: *Vitis vinifera L., vinova loza, proizvodnja, vinograd, podaci, trendovi, Crna Gora*

STRUCTURAL DYNAMICS OF STEEL FRAMES WITH THE APPLICATION OF FRICTION ISOLATORS

Angelo Lorusso[1], Giampiero Celenta[2]
[1](Department of Industrial Engineering, University of Salerno, Via Giovanni Paolo II, 132, Fisciano, 84084, Italy)
[2](MEID4 Academic Spin-Off of the University of Salerno, Via Giovanni Paolo II, 132, Fisciano, 84084, Italy)



Angelo Lorusso

Giampiero Celenta

ABSTRACT:
The conservation of architectural and historical heritage against natural disasters, such as earthquakes, is a very topical subject. Structural design with respect to seismic actions has seen various approaches in the literature regarding the response of the structure to a seismic event. In this context, the use of seismic isolators is introduced to limit the accelerations transmitted to the structure, since their introduction in the construction industry they have had an evident evolution and several technological developments. In the present study, it is proposed to study the dynamic behaviour of ideal regular and irregular structures subjected to seismic actions using a flexible multybody model developed in Simscape within the Simulink environment. The proposed workflow consisted of an initial modelling phase and an equivalent mathematical model, then the model was evaluated through the study of modal analysis and its dynamic behaviour, and finally the responses of the building subjected to simulated stresses of five different seismic events that have occurred since 1980 were recorded. This was followed by the modelling, simulation and optimisation phase of seismic isolators sliding on a curved surface. In conclusion, based on the theory of structural dynamics and vibrations, it is possible to model a flexible multybody system capable of representing the dynamic behaviour of steel structures insulated by insulators under study.

Keywords: *Structural Health Monitoring, Structural Design, Seismic Isolators, Multibody*

FIRE RESISTANCE OF STEEL GIRDERS

OTPORNOST NA POŽAR ČELIČNIH GREDA

Sanin Dzidic[1], Amir Ademovic[2], Ahmed El Sayed[2]
[1] University of Bihac – Technical Faculty, Department of Civil Engineering, Bihac
[2] International BURCH University, Faculty of Engineering and Natural Sciences, Sarajevo


Sanin Dzidic


Amir Ademovic


Ahmed El Sayed

ABSTRACT:
Steel as structural material has excellent mechanical properties at ambient temperatures, but also one major drawback, which is low fire resistance. However, there are methods for increasing fire resistance of steel structures and members, like gypsum encasing, intumescent coatings, and spray-applied, fire-resistant materials (SFRMs). In addition, mandatory and carefully selected application of the active and passive fire protection measures can significantly contribute to the fire resistance to all buildings. This paper analyzes the fire resistance of main girders of skeleton structural system subjected to the permanent and variable actions, but also contribution of the of the spray-applied, fire-resistant materials to the fire resistance of steel beams based upon the critical temperature method according to Eurocode 3 when subjected to Standard ISO 834-1 fire curve. Qualitative Research method, based on empirical analysis of different beams with different geometrical properties and steel grades, was used in this paper. This research highlights specific aspects to designers and engineers in selection of structural materials depending on the type of structures to be designed and constructed, as well as building life and its exploitation.
Keywords: *steel beams, fire resistance, fire protection, Eurocode 3*

SAŽETAK:
Čelik kao konstrukcijski materijal ima odlična mehanička svojstva na ambijetalnoj temperaturi, ali i jedan veliki nedostatak, a to je niska otpornost na požar. Međutim, postoje metode za povećanje otpornosti na požar čeličnih konstrukcija i elemenata, kao što su kutijasta zaštita od gispanih ploča, ekspandirajući premazi i požarnootporni materijali koji se nanose sprejom (SFRM). U dodatku, obavezna i pažljivo odabrana primjena mjera aktivne i pasivne zaštite od požara može značajno doprinijeti otpornosti na požar svih objekata. U ovom radu analizirana je otpornost na požar glavnih nosača skeletnog konstruktivnog sistema izloženog stalnim i promjenjivim djelovanjima, ali i doprinos otpornosti na požar čeličnih greda zaštićenih požarnootpornim materijalima koji se nanose sprejom, a na osnovu metode kritične temperature prema prema Eurokodu 3, pri izlaganju Standardnoj krivulji požara ISO 834-1. U radu je korištena metoda kvalitativnog istraživanja zasnovana na empirijskoj analizi različitih greda različitih geometrijskih svojstava i kvaliteta čelika. Rezultati ovog istraživanja sa specifičnih aspekata mogu informirati i doprinijeti kritičkom razmišljanju projektanata i inženjera u odabiru konstruktivnih materijala u zavisnosti od vrste konstrukcija koje se projektuju i grade, kao i vijeka trajanja objekata i njihove eksploatacije.
Ključne riječi: *čelične grede, otpornost na požar, zaštita od požara, Eurocode 3*

CONTRIBUTION TO REASONS FOR THE SEISMIC RISK RE-EVALUATION FOR STRUCTURAL DESIGN OF HIGH-RISE BUILDINGS IN BOSNIA AND HERZEGOVINA

PRILOG REEVALUACIJI SIZMIČKOG RIZIKA ZA OBJEKTE U BOSNI I HERCEGOVINI

Sanin Dzidic[1], Faruk Avdic[2], Ahmed El Sayed[2], Amir Causevic[3]
[1] University of Bihac – Technical Faculty, Department of Civil Engineering, BiH - 77000 Bihac
[2] International BURCH University, Faculty of Engineering and Natural Sciences, Department of Civil Engineering, BiH – 71000 Sarajevo
[3]University of Sarajevo, Faculty of Architecture, BiH – 71000 Sarajevo


Sanin Dzidic


Faruk Avdic


Ahmed El Sayed


Amir Causevic

ABSTRACT:
National Annex BAS EN 1998-1/NA:2018 consists maps of seismic hazard for reference return period of 475 and 95 years for Bosnia and Herzegovina, ... Given that the National Rulebook for Technical Standards for Construction of Buildings in Seismic Areas and seismological maps for Yugoslavia are still legally valid in Bosnia and Herzegovina, it is necessary to the compare findings in seismic design according to Eurocode 8 and National Rulebook for territory of Bosnia and Herzegovina. ... The findings from this research presented in this paper for City of Banja Luka can contribute and inform in next steps in reevaluation of maps of seismic hazard in Bosnia and Herzegovina - as was the conclusion at the meeting in Institute for Standardization of Bosnia and Herzegovina attended by members of academic community, representatives of relevant ministries and institutes, held on February 15, 2022.
Keywords: *earthquake resistance design, maps of seismic hazard, Eurocode 8, Bosnia and Herzegovina*

SAŽETAK:
Nacionalni dodatak BAS EN 1998-1/NA:2018 kao svoj sastavni dio sadrži karte seizmičkog hazarda za referentne povratne periode od 475 i 95 godina za Bosnu i Hercegovinu, ... S obzirom na to da su Pravilnik o tehničkim normativima za građenje objekata u seizmičkim područjima i seizmološke karte za SFRJ u isto vrijeme i dalje pravno važeći u Bosni i Hercegovini, potrebno je uporediti vrijednosti seizmičkih sila prema Eurokodu 8 i Pravilniku za teritorij Bosne i Hercegovine. .... Rezultati ovog kvalitativnog istraživanja za Grad Banja Luka predstavljeni u ovom radu mogu doprinijeti i informirati u narednim koracima u reevaluaciji karata seizmičkog rizika u Bosni i Hercegovini, a reevaluacija je i zaključak sa sastanka u Institutu za standardizaciju BIH kojem su prisustvovali članovi akademske zajednice, predstavnici nadležnih ministarstava i instituta, održan 15.02.2022.
Ključne riječi: *projektovanje seizmički otpornih građevina, karte seizmičkog rizika, Eurocode 8, BiH*

ASPHALT MIXTURES FOR M17.3 MAIN ROAD NEUM-STOLAC IN B&H

ASFALTNE MJEŠAVINE NA MAGISTRALNOM PUTU M17.3 NEUM-STOLAC U BIH

Merima Šahinagić – Isović[1], Marko Ćećez[2], Kenan Mostarlić[3], Fuad Ćatović[4]
[1,2 4]Dzemal Bijedic University of Mostar, Faculty of Civil Engineering, Mostar, B&H
[3]AIK Engineering, doo Banovići, B&H

Merima Šahinagić-Isović

Marko Ćećez

Kenan Mostarlić

Fuad Ćatović

ABSTRACT:
Asphalt is an artificial composite of natural materials, with definedparticle size distribution of stone aggregate, stone flour and precisely defined amount of bitumen, where all particles are covered with bitumen. Asphalt mixtures are the most popular material for pavement structures. Asphalts are used for load-bearing layers, bond layers and wearing layers of pavement structures in modern road construction.
The subject of this paper is the identification, analysis and understanding of all components of asphalt, as well as asphalt properties, testing methods, method of installation, as well as systematic maintenance of structures formain road M17.3 Neum - Stolac in Bosnia and Herzegovina.

Keywords: *asphalt, testing, maintenance, road*

REZIME:
Asfalt je vještački kompozit od prirodnih materijala, definisane mineralne granulacije frakcija kamenog agregata, kamenog brašna i tačno definisane količine bitumena, gdje su sva zrna obavijena bitumenom. Asfaltne mješavine su najpopularniji materijal za izradu kolovoznih konstrukcija. Asfalti se koriste za izradu nosivih, vezanih i habajućih slojeva kolovoznih konstrukcija u savremenoj cestogradnji.
Predmet istraživanja ovog rada je identificiranje, analiza i razumjevanje svih komponenti asfalta, kao i asfalta u cjelosti sa svim svojim karakteristikama, metodama ispitivanja, načinom ugradnje, kao i sistemskim održavanjem konstrukcija, magistralnie ceste M17.3 Neum – Stolac u Bosni i Hercegovini.

Ključne riječi: *asfalt, ispitivanje, održavanje, cesta*

3D DIGITAL RECONSTRUCTION OF HERITAGE BUILDINGS BY USING OLD 2D PLANS

3D DIGITALNA REKONSTRUKCIJA OBJEKATA KULTURNO-HISTORIJSKOG NASLIJEĐA UPOTREBOM STARIH 2D NACRTA

Nedim Tuno[1],Admir Mulahusić[2], Jusuf Topoljak[3], Dušan Kogoj[4]
[1, 2, 3]Univerzitet u Sarajevu, Građevinski fakultet
[4]Univerzitet u Ljubljani, Fakultet za građevinarstvo igeodeziju


Nedim Tuno


Admir Mulahusić


Jusuf Topoljak

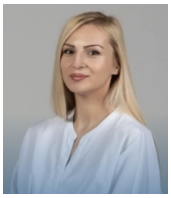

Dušan Kogoj

ABSTRACT:
The paper describes a method of finding the optimal solution to use amateur digital cameras with lenses that are not designed for measuring purposes, including those installed on mobile phones, in the process of digitizing existing documents of architectural and other material heritage. By combining the data contained in the old 2D plans as well as the data from other preserved technical drawingswith the data measured directly in the field, high-quality geometric data is obtained.In this way, a reliable basis is obtained for the creation of adequate 3D models of the considered cultural heritage buildings.Thanks to this, the versatile application of digital cameras in the preservation of cultural and historical heritage is enabled, through the high-quality and fast creation of permanent records for future generations. This creates predispositions for the effective management of digital spatial data within cultural heritage while ensuring a basis for their safe use. Through the necessary introduction of norms and specifications in the process of geospatial data collection, an important contribution is made to raising awareness of the importance of cultural and historical heritage.
Keywords: *geospatialtechnologies, 3D models, culturalandhistoricalheritage*

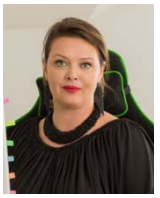
SAŽETAK:
U radu je opisano iznalaženje optimalnog načina primjene amaterskih digitalnih kamera sa objektivima koji nisu konstruisani u mjerne svrhe, uključujući i one ugrađene na mobilne telefone, u postupku digitalizacije postojećih dokumenata graditeljskog i drugog materijalnog naslijeđa. Kombinujući podatke sadržane na starim nacrtima i drugim sačuvanim tehničkim crtežimasa podacima mjerenim direktno na terenu, dolazi se do kvalitetnih geometrijskih podataka.Na taj način dolazi se do osnove zaizradu adekvatnih 3D modela razmatranih građevina kulturnog naslijeđa. Zahvaljujući tome, omogućena je svestrana primjena digitalnih kamera u očuvanju kulturno-historijske baštine, kroz kvalitetno i brzo stvaranje permanentnih zapisa za buduće generacije. Tako se stvaraju predispozicije za učinkovito upravljanje prostornim podacima materijalnog naslijeđa, uz osiguranje podloge za njihovo sigurno korištenje.Kroz neophodno uvođenje normi i specifikacija za prikupljanje geoprostornih podataka doprinosi se podizanju svijesti o važnosti kulturno-historijskog naslijeđa.
Ključne riječi:*geospatialtechnologies, 3D models, culturalandhistoricalheritage*

SUSTAINABLE MODEL OF PRESCHOOL EDUCATION FACILITIES
ODRŽIVI MODEL OBJEKATA PREDŠKOLSKOG ODGOJA

Nerma Smajlović Orman[1], Adnan Novalić[1], Maja Popovac Roso[2], Ahmed El Sayed[3]
[1]International BURCH University Sarajevo – Faculty of Engineering and Natural Sciences, Department of Architecture, BiH – 71000 Sarajevo
[2]University “Džemal Bijedić” Mostar – Faculty of Civil Engineering, BiH – 88000 Mostar
[3]International BURCH University Sarajevo – Faculty of Engineering and Natural Sciences, Department of Civil Engineering, BiH – 71000 Sarajevo


Nerma Smajlović Orman


Adnan Novalić


Maja Popovac Roso

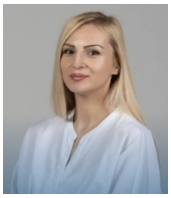

Ahmed El Sayed

ABSTRACT:
In preschool design, at least three different groups are affected by the built environment: children, teachers, and parents. Despite the observation of children’s behavior and understanding of their needs, a joint effort is significant among architects and educators in preschool facilities; architects are trained to appraise and evaluate space that should be created, while preschool educators understand another dimension of the children's environment and its effects. ... Furthermore, this paper explores the existing design principles and recognized models in preschool education. Experiences and statistics from member countries of the Organization for Economic Cooperation and Development support this study. Qualitative research methodology is used, based on in-depth analysis of published literature. It is expected to develop a list of involved parties that appear in the sustainable model of preschool. This paper will derive, as a conclusion, the basics of design guidelines within advantages and disadvantages of existing models in preschool education, and develop a basis for a future sustainable model of preschool facilities.
Keywords: *preschool education facilities, design principles, sustainable model.*

SAŽETAK:
Kod projektovanja predškolske ustanove, izgrađeni okoliš utječe na najmanje tri različite skupine: djecu, učitelje i roditelje. Uprkos promatranju ponašanja djece i razumijevanju njihovih potreba, značajan je zajednički trud arhitekata i odgajatelja u predškolskim ustanovama; arhitekti su osposobljeni za procjenu i vrednovanje prostora koji treba kreirati, dok odgajatelji razumiju drugu dimenziju dječjeg okruženja i njegovih učinaka. .... Nadalje, ovaj rad istražuje postojeće principe projektovanja i priznate modele u predškolskom odgoju i obrazovanju. Iskustva i statistike zemalja članica Organizacije za ekonomsku suradnju i razvoj podupiru ovu studiju. Korištena je kvalitativna metodologija istraživanja temeljena na dubinskoj analizi objavljene literature. To će očekivano iznjediriti listu involviranih strana kod kreiranja održivog modela predškolskog obrazovanja. Kao zaključak, ovaj rad će dati osnove projektantskih smjernica u okviru prednosti i nedostataka postojećih modela predškolskog odgoja i obrazovanja, te razviti temelj za budući održivi model predškolskih ustanova.
Ključne riječi: *objekti predškolskog odgoja, principi projektiranja, održivi model.*

IN-DEPTH ANALYSIS OF CURRENT LEGISLATION ON ARCHITECTURAL STANDARDS AND NORMS OF PRESCHOOL EDUCATION FACILITIES IN BOSNIA AND HERZEGOVINA

Nerma Smajlović Orman[1], Adnan Novalić[1], Maja Popovac Roso[2], Ahmed El Sayed[3]
[1]International BURCH University Sarajevo – Faculty of Engineering and Natural Sciences, Department of Architecture, BiH – 71000 Sarajevo
[2]University “Džemal Bijedić” Mostar – Faculty of Civil Engineering, BiH – 88000 Mostar
[3]International BURCH University Sarajevo – Faculty of Engineering and Natural Sciences, Department of Civil Engineering, BiH – 71000 Sarajevo


Nerma Smajlović Orman


Adnan Novalić


Maja Popovac Roso


Ahmed El Sayed

ABSTRACT:
According to the administrative organization of Bosnia and Herzegovina, the laws on preschool education that are currently in force in Federation of BiH were passed at the cantonal level, while in Republic of Srpska the law was passed at the entity level. This is also the case in Brčko District; the law that is currently in force was passed at the district level. This paper aims to summarize the reflection on the complexity of the legislation regarding the administrative organization in BiH, which enacts various laws and regulations on preschool education. The main goal of the work is to create a framework for the adoption of unique norms in the design of preschool facilities in BiH. Qualitative comparative analysis, based on a review of the relevant regulations in legislative administrative units in BiH, was used in this paper. This paper's findings suggested adopting architectural norms on the state level, considering the lack of architectural norms in certain administrative units. Given this, conclusions are focused on the analysis of architectural norms and statistics in member countries of the Organization for Economic Cooperation and Development and their experiences compared to existing norms in BiH.

Keywords: *preschool education facilities, architectural norms, regulations, Bosnia and Herzegovina*

OVERVIEW OF OPTIMIZATION TOOLS FOR READY-MIXED CONCRETE DISPATCHING PROBLEM BASED ON MIXED-INTEGER LINEAR PROGRAMMING

Mateja Držečnik[1], Uroš Klanšek[2]
[1]University of Maribor, Faculty of Civil Engineering, Transportation Engineering and Architecture
[2]University of Maribor, Faculty of Civil Engineering, Transportation Engineering and Architecture


Mateja Držečnik


Uroš Klanšek

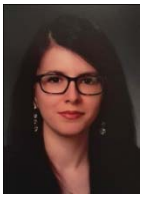
ABSTRACT:
The ready-mixed concrete dispatching problem (RMCDP) represents an actual optimization challenge that often encounters in construction management. Namely, the RMCDP comprises the optimal selection of production plants from the multitude of those available that should meet the timed demand for fresh concrete shown by active construction sites. Besides, the RMCDP solution needs to provide bases for optimal determination of delivery vehicles, order quantities as well as transportation routes among concrete batching plants and construction sites. Due to combinatorial nature of feasible space, determining the exact optimal solution of RMCDP most times exceeds human capacities and needs to be handled by advanced computer-aided tools. In this context, the present paper gives an overview of state-of-the-art optimization tools for RMCDP based on mixed-integer linear programming. Their features are discussed in terms of objectives, constraints, input and output data. The study reveals a literature gap and indicates perspective directions for further research in the field under consideration.

Keywords: *construction management, ready-mixed concrete dispatching problem, optimization tools, mixed-integer linear programming*

DESIGN AND TECHNOLOGY OF CONSTRUCTION OF REINFORCED SOIL STRUCTURES

PRORAČUN I TEHNOLOGIJA IZVOĐENJA KONSTRUKCIJA OD ARMIRANOG TLA

Đonko, Danija[1], Špago, Azra[2]
[1,2]Džemal Bijedić University of Mostar, Faculty of Civil Engineering, Mostar, Bosnia and Herzegovina




Danija Đonko *Azra Špago*

ABSTRACT:
Development of modern methods of soil reinforcement has led to a greater application of reinforced soil in civil engineering, especially in road design. Reinforced soil retaining structures are a cost-effective alternative to traditional reinforced concrete retaining structures. They have many advantages, some of which are adaptability to site conditions, simple and fast construction, economy, aesthetic features, excellent performance under seismic conditions and durability, and they can be safely construced as steep slopes or vertical walls. All that makes reinforced soil structures excellent and efficient solution in both rural and urban areas. Application of reinforced soil structures in transportation systems was anylized in this paper: MSE (mechanically stabilized earth) wall for a new road construction in an urban area, steep reinforced soil slope for road widening, and reinforced soil embankment for a new road.

Keywords: *reinforced soil, design and construction technology, mechanically stabilized earth walls, reinforced soil slopes*

SAŽETAK:
Zahvaljujući razvoju modernih metoda armiranja tla, armirano tlo ima sve češću upotrebu u građevinarstvu, naročito kod saobraćajnica. Potporne konstrukcije od armiranog tla su povoljna alternativa za tradicionalne potporne konstrukcije od armiranog betona. Imaju mnogo prednosti kao što su mogućnost prilagodbe uvjetima terena, jednostavnost i brzina izvođenja, ekonomičnost, estetika, dobro ponašanje u seizmičkim uvjetima i trajnost, te mogu biti sigurno izvedene sa strmim nagibima ili kao vertikalni zidovi. Sve to čini konstrukcije od armiranog tla odlično i povoljno rješenje i u ruralnim i urbanim sredinama. U radu je analizirana primjena konstrukcija od armiranog tla kod saobraćajnica: potporni zid od armiranog tla za potrebe izgradnje novog putau urbanoj sredini, kosina od armiranog tla sa strmim nagibom za potrebe proširenja postojećeg puta i nasip od armiranog tla za potrebe izgradnje novog magistralnog puta.

Ključne riječi: *armirano tlo, proračun i tehnologija izvođenja, zidovi od armiranog tla, kosine od armiranog tla*

AIRPORT PAVEMENT MAINTENANCE AND REPAIR

ODRŽAVANJE I POPRAVKA MANEVARSKIH POVRŠINA AERODROMA

Muharem Šabić[1], Edvin Šimić[1], Džubur Damir[1]
[1] University of Sarajevo, Faculty of Traffic and Communications, Sarajevo, B&H


Muharem Šabić


Edvin Šimić


Damir Džubur

ABSTRACT:
Long-term use of the airport pavement without adequate maintenance can endanger adequate bearing capacity, riding qualities and surface friction characteristics.The rate the pavement deteriorates depend on the environment, traffic loading, poor sub grade stabilityand interim maintenance. Recognizing defects and understanding their cause helps rate pavement condition and select an effective repair.Inspection procedure and sampling has to be identified in order to get PCI (Pavement Classification Index) and subsequent treatment measures. The repair methodologies have to be developed for each category of damages.

Keywords: *Flexible pavement,rigidpavement, Pavement Classification Number (PCN), California bearing ratio (CBR), Modulus of Subgrade Reaction (k).*

SAŽETAK:
Dugotrajna upotreba manevarskih površina aerodroma bez adekvatnog održavanja može ugroziti nosivost, kvalitet voženja i koeficijent trenja. Brzina propadanja kolovozne konstrukcije zavisi od uslova okoline, saobraćajnog opterećenja, smanjene nosivosti podloge i neadekvatnog održavanja. Prepoznavanje oštećenja i identifikacija njihovog uzroka pomaže u ocjeni stanja kolovoza i odabiru efikasne popravke. Potrebno je identificirati procedure inspekcije i uzorkovanja kako bi se dobio PCI (indeks klasifikacije kolovozne konstrukcije) i predložiti mjere popravke. Za svaku kategoriju oštećenja potrebno je razviti određenu metodologiju popravke.

Ključne riječi: *Fleksibilana kolovozna konstrukcija, kruta kolovozna konsrukcija, indeks nosivosti kolovozne konstrukcije, Kalifornijski indeks nosivosti, modul reakcije podloge*

ANALYSIS OF GLULAM BEAMS STRENGTHENED WITH FRP STRIPES

ANALIZA LIJEPLJENO LAMELIRANIHGREDA OJAČANIH SA KOMPOZITNIM TRAKAMA

Azra Mahinić Vrce[1], Žana Džubur[2], Merima Salčin[3], Mirsad Tarić[4]
[1,2,3]DzemalBijedic University of Mostar, Faculty of Civil Engineering, 88104 Mostar, Bosnia and Herzegovina
[4]University of Pristina, Faculty of Technical Sciences


Azra Mahinić Vrce


Žana Džubur


Merima Salčin


Mirsad Tarić

ABSTRACT:
The most sustainable material used in building is wood. In addition to being an anisotropic material, the presence of defects in wood has a significant impact on the mechanical characteristics of glued laminated timber. Innovations in the field of materials has a significant role in economic success. The process of upgrading timber structures using fiber reinforced polymers (FRP) has grown intensively in the last decade. It was the combination of these two materials that resulted in the improvement of the mechanical characteristics of glued laminated structures in terms of load-bearing capacity and stiffness. The paper presents an analysis of experimental research in the field of using FRP strips to improve the mechanical characteristics of glued laminated timber, a comparison of the research results, as well as a numerical analysis of the experimental model.

Keywords: *glulam,timber, FRP reinforcement,strips, beam,*

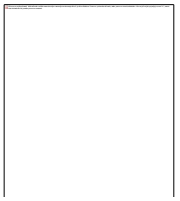
REZIME:
Najodrživiji materijal koji se koristi u izgradnji je drvo. Pored toga što je anizotropan materijala, prisustvo grešaka u drvetu im značajan uticaj na mehaničke karakteristike i lijepljeno lameliranog drveta. Inovacije na području materijala imaju značajan udio u ekonomskom uspjehu. Postupak oplemenjivanja drvenih konstrukcija primjenom polimera ojačanih vlaknima (FRP) intenzivno je porasla u posljednjoj deceniji. Upravo je kombinacija ova dva materijala rezultirala poboljšanjem mehaničkih karakteristika lijepljeno lameliranih konstrukcija u pogledu nosivosti i krutosti. U radu je prikazana analiza eksperimentalnih istraživanja u oblasti korištenja FRP traka za poboljšanje mehaničkih karakteristika lijepljenog lameliranog drveta, poređenje rezultata istraživanja, kao i numerička analiza eksperimentalog modela.

Ključne riječi: *lijepljeno lamelirano drvo,drvo,FRP ojačanje,trake, greda,*

EVOLUTION OF THE CONCEPT OF HEALTH AND WELLBEING THROUGH THE INTERNATIONAL SUSTAINABILITY RATING SYSTEMS OF BUILDINGS

EVOLUCIJA KONCEPTA ZDRAVLJA I DOBROSTANJA KROZ MEĐUNARODNE SISTEME SERTIFIKACIJA ODRŽIVOSTI ZGRADA

Kosara Kujundžić[1], Slavica Stamatović Vučković[2]
[1]A TEAM ltd., 85330 Kotor, Montenegro
[2] University of Montenegro, Faculty of Architecture, 81000 Podgorica, Montenegro



Kosara Kujundžić

Slavica Stamatović Vučković

ABSTRACT:
Firstly established in 1990s (BREEAM ,1990; LEED,1998), the sustainability rating systems have been constantly evolving in terms of the sustainability categories, evaluation criteria and indicators.Moreover, the health and wellbeing-relatedaspects have been improving, especially within the lately introduced systems, e.g., WELL, 2016.In addition to the initially prevailing quantifying parameters, qualitative, especially biophilic aspectshave been addressed. These tendences underline the sustainable architecture paradigm shifting toward regenerative approach fosteringlife-supporting, symbiotic and interdependent relationships between built and natural environment with the focus being on health and well-being of building users.

Keywords: *sustainability rating systems, health and well-being, building users, sustainable architecture,qualitative parameters,biophilic design, regenerative sustainability*

REZIME:
Međunarodni sistemi sertifikacije održivosti zgrada se od pojavljivanja 90-ih godina XX vijeka (BREEAM,1990; LEED, 1998)konstantno razvijaju u smislu kategorija održivosti, kriterijumai indikatora evaluacije, kao i aspekata koji se odnose na zdravlje i dobrostanje, posebno u okviru kasnije uvedenog sistemaWELL (2016).Pored prvobitno preovlađujućih kvantifikacionih parametara, usvojeni su i kvalitativni,naročito biophilic aspekti projektovanja.Ove tendencije naglašavajumijenjanje paradigme održive arhitekture karegenerativnompristupu koji pospješuje živototvorne, simbiotske i međuzavisne odnose između izgrađenog i prirodnog okruženja s fokusom na zdravlje i dobrostanje korisnika zgrada.

Ključne riječi: *sistemi sertifikacije održivosti zgrada, zdravlje i dobrostanje,korisnici, održiva arhitektura, kvalitativni parametri, biophilic dizajn, regenerativna održivost*

THE ADAPTIVE REUSE OF HISTORIC BUILINGS - CASE STUDY THE WHITE FORTRESS IN SARAJEVO

Yousef Zaarir
International Burch University. Faculty of Engineering and Natural Sciences
Ul.Francuskerevolucije bb.71 210 Ilidža, Sarajevo, Bosnia and Herzegovina

Yousef Zaarir

ABSTRACT:
The aim of the research is to apply the term of adaptive reuse on the historic building White fortress in Sarajevo. The paper focuses on the implementation of the adaptive reuse of the historic Buildings, also the social benefits of the implementation of this term on the white fortress as a way of rehabilitation of the building. Qualitative Research Methodology is used in this research and aimed to review and analyzed similar examples of similar historic buildings across the world, that have been rehabilitated in the same way, in order to apply the same principle on this selected case study building. The research results are that the adaptive reuse of the historic sites and buildings could be applied on the White Fortress in Sarajevo, and this implementation of building reuse will have social and economic benefits for the city. The reuse of White Fortress (BijelaTabije) could be a good approach to save the building from damage or destroy, although it may use for a new function.

***Keywords*:** *Social benefits. Adaptive reuse. Rehabilitation. White fortress, Historic Buildings, New additions.*

SUSTAINABILITY OF THE STRUCTURAL CONSTRUCTION MATERIALS OF FAMILY HOUSES IN BOSNIA HERZEGOVINA, POSSIBLE ALTERNATIVES UP TO SUSTAINABLE CONSTRUCTION PRINCIPLES

Yousef Zaarir
International Burch University. Faculty of Engineering and Natural Sciences
Ul.Francuskerevolucije bb.71 210 Ilidža, Sarajevo, Bosnia and Herzegovina

Yousef Zaarir

ABSTRACT:
With the advancement of construction technologies, the use of new types of construction materials, as well as the need for investors to make new housing facilities as economical and energy efficient as possible the development in the design importance and the way of understanding the space, today it is possible to recognize a significant difference between the sustainable and the local way of construction.
This paper focus on the sustainable principle of the building construction materials, in this paper will investigate on the structural system of family houses in Bosnia and Herzegovina checking and comparing it with the principle of the sustainable building construction. The results gained by analyzing seven family houses were built in last 10 years in Bosnia and comparing it with the scientific sustainable principles of the building construction. It has been conducted that the structural construction materials of the family houses in Bosnia mostly match the sustainable construction principle.

Keywords: *Sustainability, Building, materials, sustainable principles. Sustainable structure.*

DETERMINATION OF THERMAL TRANSMITTANCE (U) OF A GROUND COMPOSITE FLOOR STRUCTURE WITH AND WITHOUT VERTICAL EDGE INSULATION

ODREĐIVANJE PROLAZA TOPLOTE (U) KOMPOZITNE KONSTRUKCIJE PRIZEMLJA SA I BEZ VERTIKALNE IVIČNE IZOLACIJE

Jovana Jovanović
Faculty of Civil Engineering and Management, University Union Nikola Tesla, Belgrade, Serbia

Jovana Jovanović

ABSTRACT:
In this manuscript, the floor slab construction of modeled multi-story steel building and its static loads were configured and analyzed. Static analysis and modelling of multi-story steel building was made in SAP (SAPV14-2000) software according to the Yugoslavian engineering standards, i.e. JUS standards (PBAB 87). The floor slab construction is composite, consisting of reinforced concrete slab and form of crossed, steel girders beneath it. ... The used, simplified, mathematical equations have been previously validated in the Energy Efficiency Handbook, created by ENSI (Energy Saving International AS), Norwegian consulting company for the needs of energy-retrofitted buildings. The mentioned Norwegian Energy Saving International AS company has been known for the services on energy capacity of buildings, energy efficient and eco-friendly refurbishments of outdated buildings. The present computations of thermal transmittance coefficient U of a ground floor in the paper were carried out in compliance with the building ISO standard (13370:2017).
Keywords: *floor slab construction, multi-story steel building, energy consumption, thermal transmittance coefficient, ground floor*

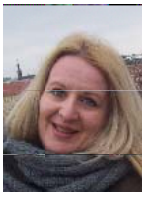
REZIME:
U ovom članku, konfigurisana su i analizirana, konstrukcija podne ploče višespratne čelične zgrade i njena statička opterećenja. Statička analiza i modelovamje višespratne čelične zgrade je izvršeno u SAP softveru (SAPV14-2000) prema Jugoslovenskim inžinjerskim standardima, tj.JUS standardima (PBAB 87). Konstrukcija podne ploče je kompozitna i sastoji se od armirano-betonske ploče i ukrštenih čeličnih nosača ispod nje. ... Korišćene, pojednostavljene matematičke jednačine su prethodno potvrđene u Priručniku za energetsku efikasnost, koji je kreirao ENSI (Energy Saving International AS), Norveška konsultantska kompanija za potrebe energetski opremljenih zgrada. Pomenuta Norveška Energy Saving International AS kompanija je poznata po uslugama utvrđivanja energetske kapacitivnosti zgrada, energetski efikasnim i ekološkim popravkama zastarjelih zgarda. Prikazani proračuni koeficijenta prolaza toplote U prizemlja, u radu su sprovedeni u skladu sa građevinskim ISO standardom (13370:2017).
Ključne riječi: *konstrukcija podne ploče, višespratna čelična zgrada, energetska potrošnja, koeficijent prolaza toplote, prizemlje*

THERMAL BRIDGES - EFFECTS AND SOLUTIONS IN THE ENERGY RENOVATION OF BUILDINGS

TOPLINSKI MOSTOVI - EFEKTI I RJEŠENJA U ENERGETSKOJ OBNOVI OBJEKTA

Japić Emina[1], HusetićAida[2]
[1,2] University of Bihać, Faculty of Technical Engineering,77000 Bihać, Bosnia and Herzegovina

Emina Japić



Aida Husetić

ABSTRACT:
Today, the building industry is one of the largest energy consumers in the world. In addition to the loss of energy through the building envelope and openings on the building, there is also a loss of energy on the surface due to thermal bridges. A thermal bridge is a smaller area on the facade of the building where the heat flow is increased due to a change in the material, thickness, or construction part geometry. Due to the existence of thermal bridges, the building loses up to 30% of heat. To avoid the problem of thermal bridges, proper planning, design, and performance are necessary. During the renovation of existing buildings, thermal bridges must be properly evaluated in the energy audit. In this paper, the basic types of structural, systemic, and geometric thermal bridges will be discussed, as well as how their impact can be reduced during the energy renovation of existing buildings. The use of materials with low thermal conductivity in the energy renovation of buildings could help reduce the impact of thermal bridges.

Keywords: *thermal bridges, energy efficiency, energy loss*

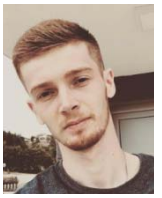
REZIME:
Danas je zgradarstvo jedan od najvećih potrošača energije u svijetu. Pored gubitka energije kroz ovojnicu objekta i otvore na objektima, dolazi do gubitka energije i na površini gdje se nalaze toplinski mostovi. Toplinski most je manje područje na ovojnici objekta kroz koje je toplinski tok povećan zbog promjene materijala, debljine ili geometrije građevinskog dijela. Usljed postojanja toplinskih mostova objekat gubi i do 30% toplote. Kako bi se izbjegao problem pojave toplinskih mostova potrebno je pravilno planiranje, projektovanje i izvođenje. Prilikom obnove postojećih zgrada toplinski mostovi se moraju pravilno ocijeniti u energetskom pregledu. U ovom radu će se obraditi osnovni tipovi toplotnih mostova konstruktivni, sistemski i geometrijski, te način na koji se njihov utjecaj može smanjiti prilikom energetske obnove postojećih objekata. Korištenje materijala niske toplinske provodljivosti u energetskoj obnovi zgrada moglo bi se pomoći smanjenju utjecaja toplinskih mostova.

Ključne riječi: *toplinski mostovi, energetska efikasnost, gubitak energije*

THE ROLE OF HEAT PUMPS IN THE ENERGY EFFICIENCY OF BUILDINGS: REVIEW
ULOGA TOPLOTNIH PUMPI U ENERGETSKOJ UČINKOVITOST OBJEKATA: PREGLED

Husetić Aida[1], Salkić Redžo[2]
[1,2,] University of Bihać, Faculty of Technical Engineering, 77000 Bihać, Bosnia and Herzegovina

Aida Husetić



Redžo Salkić

ABSTRACT:
The benefits of energy efficiency in buildings are best seen through financial savings for heating, cooling, and electricity consumption. The paper will analyze heat pump systems from the aspect of energy sources, media, and efficiency parameters.
Systems with geothermal heat pumps achieve high heating factors in the range of 3-6 during the coldest days of the year, while heat pumps that use air as a source of heat energy achieve a heating factor of 1.75-2.50 only during cold days. The efficiency and economy of the system also depend on other factors, the type of heating/cooling elements, the purpose and orientation of the rooms, and other physical factors of the space (surface area, volume, built-in materials, and their thermal properties, etc.). The paper will therefore analyze all these factors from the aspect of overall energy efficiency in building construction. An analysis of electricity consumption is given for space heating using a heat pump and electric boiler.

Keywords: *heat pumps, energy efficiency, heating, cooling, energy.*

REZIME:
Prednosti energetske efikasnosti u zgradarstvu se najviše osjeti kroz financijske uštede za grijanje, hlađenje i potrošnju električne energije. U radu će se analizirati sistemi toplotnih pumpi s aspekta izvora energije, medija i parametara učinkovitosti.
Sistemi s geotermalnim toplotnim pumpama dostižu visoke faktore zagrijavanja u rasponu 3-6, tijekom najhladnijih dana u godini, dok toplotne pumpe koje koriste zrak kao izvor toplotne energije postižu faktor grijanja 1,75-2,50 tijekom hladnih dana. Učinkovitost i ekonomičnost sistema ovisi i od drugih faktora, vrste grijnih,/rashladnih tijela, namjene i orijentacije prostorija i drugih fizičkih faktora prostora (površine, zapremine, ugrađenih materija i njihovih termičkih svojstava i sl.). Rad će, stoga analizirati sve ove faktore s aspekta ukupne energetske učninkovitosti u građevinskom objektu. Data je i analiza potrošnje električne energije za grijanje pomoću toplotne pumpe i električnog bojlera.

Ključne riječi: *toplotne pumpe, energetska efikasnost, grijanje, hlađenje, energija.*

THE INFLUENCE OF THE QUALITY OF ELECTRONIC LEARNING PLATFORMS ON IMPROVING THE COMPETENCES AND PERFORMANCE OF EMPLOYEES

UTICAJ KVALITETA PLATFORMI ZA ELEKTRONSKO UČENJE NA UNAPREĐENJE KOMPETENCIJA I PERFORMANSI ZAPOSLENIH

Haris Palalija[1], Elvir Čizmić[2], Zijada Rahimić[2],Munira Šestić[2]
[1]Symphony Digital SA, Bosnia and Herzegovina
[2]University of Sarajevo, School of Economics and Business, Bosnia and Herzegovina


Haris Palalija


Elvir Čizmić


Zijada Rahimić


Munira Šestić

ABSTRACT:
The paper examines the effectiveness of electronic platforms for the improvement of the performances and competencies of employees in organizations. The introductory part of the paper is focused on recognizing the conceptual framework for understanding the culture of learning and human resources development, and especially for modeling an effective e-learning system in organizations with a focus on talented employees. ... The paper presents the results of research for the key constructs of e-learning system design that influence the development of competences and the improvement of human resources performances in organizations in Bosnia and Herzegovina. The research sample consists of 228 randomly selected respondents from different organizations of the service sector. Finally, the paper aims to propose possible future guidelines in the process of shaping the content and the electronic platforms functioning with the aim of strengthening the competencies and performances of talents.
Keywords: *Human resource development, Continuous learning culture, Electronic learning, Employee competencies*

SAŽETAK:
Rad razmatra učinkovitost elektronskih platformi za unapređenje performansi i kompetencija zaposlenika u organizacijama. Uvodni dio rada je fokusiran na prepoznavanje konceptualnog okvira za razumijevanje kulture učenja i razvoja ljudskih resursa, a posebno zamodeliranje efektivnog sistema elektronskog učenja u organizacijama sa fokusom na talentirane zaposlenike. ... U radu su predstavljenirezultati istraživanja ključnihkonstrukatadizajnasistema elektronskog učenja koji utiču na razvoj kompetencija i unapređenje performansi ljudskih resursa u organizacijamau Bosni i Hercegovini. Uzorak istraživanja čini 228 nasumično odabranih ispitanika iz različitih organizacijai oblasti uslužnog sektora. Konačno, rad ima za cilj da predložimoguće buduće smjernice u procesu oblikovanja sadržaja i načina funkcioniranja elektronskih platformi sa ciljem jačanja kompetencija i performansi talenata.
Ključne riječi: *Razvoj ljudskih resursa, Kultura kontinuiranog učenja, Elektronsko učenje, Kompetencije zaposlenika*

PERCEPTION DIFFERENCES OF ELECTRONIC LEARNING QUALITY AND CONTENT IN SERVICE BUSINESSES

PERCEPCIJA KVALITETA I SADRŽAJA PLATFORMI ZA ELEKTRONSKO UČENJE U USLUŽNIM BIZNISIMA

Elvir Čizmić[1], Haris Palalija[2], Senad Softic[1], Munira Šestić[1]
[1]University of Sarajevo, School of Economics and Business, Bosnia and Herzegovina
[2]Symphony Digital SA, Bosnia and Herzegovina


Elvir Čizmić


Haris Palalija


Senad Softić


Munira Šestić

ABSTRACT:
The paper analyzes the perception of different categories of human resources related to the use of digital platforms for the improvement of electronic learning for various organizational and operational business aspects. .... Next, the paper presents the results of the research on the key constructions of the design of the e-learning systems used in organizations in Bosnia and Herzegovina, viewed through the analysis of differences in the perception of human resources for various criteria of differentiation. The research sample consists of 228 randomly selected respondents from different organizations and different areas of the service sector. Finally, the paper aims to suggest the guidelines that should be followed in the process of shaping the content and functioning of electronic platforms with regard to the different categories of human resources usage, with the tendency for increasing their overall efficiency.
Keywords: *Electronic learning platforms, User perception, Organizational support, Continuous learning culture*

SAŽETAK:
Rad razmatra percepciju različitih kategorija ljudskih resursa vezano za korištenje digitalnih platformi za unapređenje elektronskog učenja spram više organizacijskih i operaciono poslovnih aspekata. Uvod rada prepoznaje ključne spoznaje vezano za navedeni problem kroz analizu dosadašnjih rijetkih istraživanja na ovom polju. ... Potom su u radu predstavljeni rezultati istraživanja ključnihkonstrukataoblikovanja sistema elektronskog učenja sagledanih kroz analizu razlika u percepciji ljudskih resursa koji iste koriste u organizacijama u Bosni i Hercegovini, prema različitim kriterijima diferencijacije. Uzorak istraživanja čini 228 nasumično odabranih ispitanika iz različitih organizacija i oblasti uslužnog sektora. Konačno, rad ima za cilj da ponudismjernice koje bi se trebaleslijediti u procesu oblikovanja sadržaja i načina funkcioniranja elektronskih platformi u pogledu različitih kategorija ljudskih resursa koji ih koriste, sa namjerom uvećanja njihove ukupne učinkovitosti.
Ključne riječi: *Elektronske platforme za učenje, Percepcija korisnika, Organizacijska podrška, Kultura kontinuiranog učenja*

JOB ANALYSIS IMPACT IN SATISFACTION AND PERFORMANCE OF EMPLOYEE WITHIN DIGITALIZATION CONTEXT CHALLENGES

UTICAJ ANALIZE POSLA NA ZADOVOLJSTVO I PERFORMANSE ZAPOSLENIH U KONTEKSTU IZAZOVA DIGITALIZACIJE

Elvir Čizmić[1], Đevad Šašić[2], Venan Hadžiselimović[3], Adil Trgo[4]
[1]University of Sarajevo, School of Economics and Business, Bosnia and Herzegovina
[2] University of Sarajevo, Faculty of Administration,Bosnia and Herzegovina
[3]CEO HIFA-OIL doo,Bosnia and Herzegovina
[4]Dzemal Bijedic University of Mostar, Faculty of Economics, Bosnia and Herzegovina




Elvir Ćizmić *Đevad Šašić* *Venan Hadžiselimović* *Adil Trgo*

ABSTRACT:
Bearing in mind the specificities of transitional societies in the context of the process of changing ownership relations and the development of new management concepts, it is necessary to consider the impact of technological innovations and digitization on the description, standardization and specialization of work in the context of employee satisfaction and performance. The goal of the research is to examine how a clear job description, precisely defined job standardization, and clear job-related specialization and competencies specification determine.... The research sample consists of 186 respondents randomly selected from different types of organizations, the analysis of which is intended to provide clear guidelines related to the shaping of work design parameters in the context of contemporary phenomena related to automation, digitalization and the use of man-machine interfaces with a focus on increasing performance and employees' job satisfaction.
Keywords: *Digitization, Job Abalysis, Job standardization, Job specification, Employee performance*

SAŽETAK:
Imajući u vidu specifičnosti tranzicijskih društava u kontekstu procesa promjene vlasničkih odnosa i razvoja novih koncepata upravljanja, potrebno je razmotriti pitanja uticaja tehnoloških inovacija i digitalizacije na opis, standardizaciju i specijalizaciju posla u kontekstu zadovoljstva i performansi zaposlenika. Cilj istraživanja je ispitati na koji način jasan opis posla, precizna standardizacija posla, te jasna specijalizacija i specifikacijakompetencija vezana za posao determiniraju performanse …. Istraživački uzorak se sastoji od 186 ispitanika slučajno odabranih iz reda različitih vrsta organizacija čijom analizom se želi doći do jasnih smjernica vezanih za oblikovanje parametara dizajna posla u kontekstu savremenih fenomena vezanih za automatizaciju, digitalizaciju i korištenje sučelja čovjek-mašina sa fokusom na podizanje performansi i zadovoljstva zaposlenika poslom.
Ključne riječi: *Digitalizacija, Analiza posla, Standardizacija posla, Specifikacija posla, Performanse zaposlenika*

NEW TECHNOLOGIES AND UPDATING OF HIGHER EDUCATION

Darko Lovrec
University of Maribor, Faculty of Mechanical Engineering, 2000 Maribor, Slovenia

Darko Lovrec

ABSTRACT:
New technologies that are present within the concepts of Industry I4.0 and the increasingly present I5.0 or Society 5.0 require the mastery of appropriate, even completely new, knowledge and skills. Due to the extremely rapid development and introduction of new technologies in the modern industrial environment, in most cases they represent a considerable obstacle to the existing personnel, experts employed in the industry. The knowledge that today's employees acquired years ago during their education is therefore often either outdated or non-existent, because of the need for these skills, e. g. it didn't exist three decades ago. Likewise, all modern knowledge must be possessed by an expert who is educated in the present time.
The paper presents the starting points and guidelines for the reform of higher education for a green and sustainable transition to Society 5.0. The outcomes of the reform should be suitable for those educated in regular programmes, as well as for those who want to acquire additional necessary knowledge and competences.

Keywords: *Society 5.0, higher education, reform, starting points, guidelines*

MICRO-CREDENTIALS AS AN EFFECTIVE WAY OF ACQUIRING NECESSARY MODERN SKILLS

Darko Lovrec[1], Vito Tič[2]
[1,2]University of Maribor, Faculty of Mechanical Engineering, 2000 Maribor, Slovenia


Darko Lovrec


Vito Tič

ABSTRACT:
The rapid introduction and use of new technologies consequently requires the mastery of relevant, even completely new, knowledge and skills. Thus, a gap appears between the knowledge that currently employed workers acquired during their education years ago, and the knowledge they need now. For the knowledge and skills to be adequate for mastering new technologies, it is necessary to receive additional education or requalification. Thus, several options are available, such as various shorter or longer courses or trainings, independent study, internal supplementary education, and the like. These activities are not regulatedsystematically. The providers of various trainings are different, as are the individual contents, which often take place at a local or internal level. One of the possibilities of how to reduce the gaps in the necessary new knowledge in the field of New Technologies as quickly and efficiently as possible, is the introduction of micro-credentials.
The paper presents the starting points of the European Union which support the development, implementation and regulate the mutual recognition of micro-credentials, both between individual institutions, companies, sectors and within the EU area. Micro-credentials enable the effective implementation of lifelong learning, which is critical to providing everyone with the knowledge, skills and competencies they need to succeed in their personal and professional lives.

Keywords: *New Technologies, EU-education reform, Micro-credentials, objectives, implementation*

RESILIENCE IN REMOTE WORKING IN FOUR COUNTRIES OF THE WESTERN BALKANS

REZILIJENTNOST U RADU NA DALJINU U ČETIRI DRŽAVE ZAPADNOG BALKANA

Petrušić Irena[1], Đukanović Borislav[2]
[1]University of Adriatic, Faculty of Management,Herceg Novi, Montenegro
[2]University of DonjaGorica, Faculty of Applied Psychology, Podgorica, Montenegro


Irena Petrušić


Borislav Đukanović

ABSTRACT:
In researches of remote working, predominantly positive effects stand out within economic sphere (Gajendran, Harisson, 2007; Bloom et all., 2013; Burke, 2015) and somewhat more accentuated negative ones regarding psychosocial adaptability (Sang, Gui, Halsam, 2010).
In this study, we tended to examine both of these, emphasizing psychosocial adaptability. The research covered 1,031 respondents working remotely from Bosnia and Herzegovina, Montenegro, Northern Macedonia and Serbia. Three research instruments are applied: Scale of psychosocial adaptability, Questionnaire on economic aspects of remote work and Questionnaire on employment in the "Gig" economy.Largely contrary to expectations, respondents in all four countries are well adjusted to remote working among other things due to the fact that it provides them significantly better earnings, despite number of difficulties and limitations.

Keywords: *remote work, resilience, Bosnia and Herzegovina, Montenegro, Northern Macedonia, Serbia*

REZIME:
U istraživanjima rada na daljinu ističu se pretežno pozitivni efekti u ekonomskoj sferi (Gajendran, Harisson, 2007;Bloometall., 2013; Burke,2015) i nešto naglašenije negativni u pogledu psihosocijalne prilagođenosti Sang, Gui, Halsam, 2010). U ovoj studiji mi smo nastojali da ispitamo jedne i druge, stavljajući težište na psihosocijalnu prilagođenost. Istraživanjem su obuhvaćen 1.031 ispitanik koji rade na daljinu u BiH, Crnoj Gori, Sjevernoj Makedoniji i Srbiji. Primijenjena su tri istraživačka instrumenta: Skala psihosocijalne prilagođenosti, Upitnik o ekonomskim aspektima rada na daljinu i Upitnik o zapošljavanju u "Gig" ekonomiji.
Pretežno suprotno očekivanjima, ispitanici u sve četiri države su dobro psihosocijalno prilagođeni radu na daljinu. Zadovoljstvo radom na daljinu uslovljeno je između ostalog itime što im pruža značajno bolje zarade, uprkos nizupoteškoća i ograničenja.

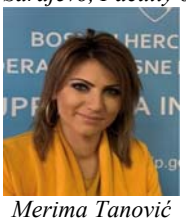
Ključne reči: *rad nadaljinu, rezilijentnost, BiH, Crna Gora, Sjeverna Makedonija, Srbija*

IMPACT OF E-GOVERNANCE REGULATIONS ON THE BUSINESS ENVIRONMENT IN BOSNIA AND HERZEGOVINA

UTJECAJ PROPISA O E-UPRAVLJANJU NA POSLOVNO OKRUŽENJE U BOSNI I HERCEGOVINI

Đevad Šašić[1], Merima Tanović[2], Amel Delić[3], Amar Kozadra[4]
[1, 2, 3, 4] University of Sarajevo, Faculty of Administration,Bosnia and Herzegovina


Đevad Šašić


Merima Tanović


Amel Delić

Amar Kozadra

ABSTRACT:
Following the notion that countries with traditional bureaucracy in administrative procedures make difficulties in doing business, as well as the existing indicators of corruption in the country, Bosnia and Herzegovina set the quality of the public services provision as one of key priorities in the accession process to European Union. Primary prerequisite for future harmonization in this sense is better regulation.Relevant international indicators position Bosnia and Herzegovina as stagnantly unfavorable business environment for investors and businesses, ... The research is focused at predicting the impact of regulations and strategic reforms to the digital transformation of the public sector in Bosnia and Herzegovina, with emphasis to the improvement of business environment and effectiveness of administrative procedures.Within the research, key stakeholders (citizens, business entities, civil society) shall identify ex-ante the degree of innovation and transformational effect on the acceleration of administrative procedures.
Keywords: *public sector reform, e-governance, new digital era, digital transformation, better regulation*

SAŽETAK:
Slijedeći ideju da zemlje sa tradicionalnim birokratizmom u upravnim postupcima čine teškoće u poslovanju na tržištu, kao i postojeće pokazatelje korupcije u zemlji, Bosna i Hercegovina je postavila kvalitet pružanja javnih usluga kao jedan od ključnih prioriteta u procesu pridruživanja Evropskoj uniji. Primarni preduslov za buduću harmonizaciju u ovom smislu je bolja pravna regulacija.Relevantni međunarodni pokazatelji pozicioniraju Bosnu i Hercegovinu kao stagnirajuće nepovoljno poslovno okruženje za investitore i biznise, ... Predmet istraživanja usmjeren je na predikciju utjecaja propisa i strateških reformi na digitalnu transformaciju javnog sektora u Bosni i Hercegovini, s posebnim osvrtom na unapređenje poslovnog ambijenta i efektivnost upravnih postupaka. U okviru istraživanja ključni subjekti (građani, poslovni subjekti, civilno društvo) će ex-ante identificirati stepen inovacije i transformacijskog učinka na akceleraciju administrativnih procesa.

Ključne riječi: *reforma javnog sektora, e-upravljanje, nova digitalna era, digitalna transformacija, bolja regulacija*

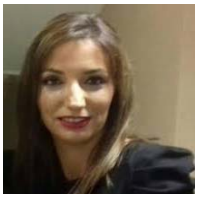
FROM NEGATIVNE INTEREST RATES TOWARD OLD NORMALITY

OD NEGATIVNIH KAMATNIH STOPA KA STAROJ NORMALNOSTI

Milorad Katnic[1], Ivana Katnić[2], Anđela Jakšić-Stojanović[3]
[1]University of Donja Gorica, Faculty of International Economics, Finance and Business, 81000 Podgorica, Montenegro
[2]University of Donja Gorica, Faculty of International Economics, Finance and Business, 81000 Podgorica, Montenegro
[3]University of Donja Gorica, Faculty of Culture and Tourism, 81000 Podgorica, Montenegro


Milorad Katnic


Ivana Katnić


Anđela Jakšić-Stojanović

ABSTRACT:
World has dramatically changed. Economic and demographic transformation of developed countries makes pressure on the decrease of interest rates. Interest rates were under this pressure but also under expansive monetary policy, for couple of years negative. For the first time in economic history negative reference interest rates were transformed in negative long-term market interest rates. Many have thought that it will be new economic reality. They made plans and expectations based on cheap money. However, some rules are still valid. Monetary expansion policy leads to inflation. While trying to stop high inflation central banks have introduced restrictive monetary politics. Restrictive monetary policy means higher interest rates.
This paper investigates phenomena of negative interest rates, their causes and consequences. Especially in the context of return to the old normality- rapid and significant increase of interest rates on market.
Keywords:*interest rates, old normality, market, money, public debt*

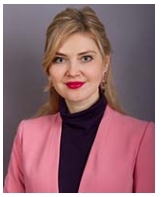
REZIME:
Svijet se u mnogome promijenio. Ekonomska i demografska transformacija razvijenih država vrši pritisak na smanjenje kamatnih stopa. Kamatne stope su, pod ovim pritiskom ali i usljed ekspanzivnih monetarnih politika, nekoliko godina bile negativne. Po prvi put u ekonomskoj istoriji negativne referentne kamatne stope su se transformisale u negativne dugoročne kamatne stope, na tržištu. Mnogi su pomislili da je to nova ekonomska normalnost. Svoje planove i očekivanja zasnovali su na jeftinom novcu. Ali neka pravila i dalje važe. Monetarna ekspanzija vodi inflaciji. U obuzdavanju inflacije centralne banke (u)vode restriktivne monetarne politike. Restriktivne monetarne politke znače veće kamatne stope.
Ovaj rad proučava fenomen negativnih kamatnih stopa, njihove uzroke i posljedice. Posebno u kontekstu stare normalnosti odnosno naglog i značajnog povećanja kamatnih stopa na tržištu.
Ključne riječi: *kamatne stope, stara normalnost, tržište, novac, javni dug*

CONCEPTUAL FOUNDATIONS FOR THE FORMATION OF THE PARADIGM OF NEO-INDUSTRIALIZATION IN MODERN CONDITIONS

Yuri Doroshenko [1], Irina Malykhina[1], Olga Leonova[1]
[1]Belgorod State Technological University named after V.G. Shukhov


Doroshenko Yuri Anatolievich


Malykhina Irina Olegovna


Leonova Olga Viktorovna

ABSTRACT:
This article presents the conceptual foundations for the formation of the neo-industrialization paradigm as an effective tool for increasing the economic, scientific and technological sovereignty of the Russian Federation in modern conditions, characterized by a high level of instability in the geopolitical situation, volatility of the national currency, and an unprecedented scale of sanctions pressure on the Russian economy. The article analyzes the scientific and theoretical provisions of the concept of innovative development of economic systems, justifying the need for the transformation of human capital, the format of intersectoral interaction and the choice of effective forms and methods of technological modernization. The characteristics of the external environment that form modern challenges that influence the substantiation of fundamental approaches to the formation of the neo-industrialization paradigm as a formula for the development of the domestic economy are studied.

Keywords: *neo-industrialization paradigm, innovation trajectory, economic systems, economic development, modern conditions*

DEVELOPMENT OF THE RAW MATERIAL SECTOR OF THE RUSSIAN INDUSTRY IN THE POST-COVID AND SANCTIONS PERIOD

Viktoriia Riapukhina [1]
[1] *Belgorod State Technological University named after V.G. Shukhov, Institute of Economics and Management, 308012 Belgorod, Russian Federation*

Viktoriia Riapukhina

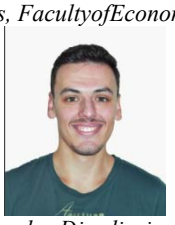
ABSTRACT:
This paper presents the results of study of development of the raw materials industry sector of the Russian economy. The research was carried out on the changes caused by the sanctions policy of the collective West immediately after the corona crisis. On the one hand, large-scale industrial production was not affected as much by the pandemic as, for example, the service sector. On the other hand, external pressure is radically increasing on the Russian economy. At the same time, the raw materials industry is being actively modernized and rebuilt in the conditions of Industry 4.0. The analysis of results was performed on the official and internal statistic. A review showed that the diversification has allowed Russia to move away from raw material dependence. According the share of this industry is still large, the issue of its modernization is a state priority. The samply from the metallurgy sector showed that the current innovative activity level of industrial enterprises in actual conditions is different, and the implemented transformations make it easier to adapt.

Keywords: *Russian economy, Consequences of the COVID-19 pandemic, Western sanctions, Innovation, Industrial development.*

THE POTENTIAL OF SOCIAL ENTREPRENEURSHIP FOR REGIONAL DEVELOPMENT AND IMPROVEMENT THE POSITION OF MARGINALIZED CATEGORIES OF THE POPULATION

POTENCIJAL SOCIJALNOG PREDUZETNIŠTVA ZA REGIONALNI RAZVOJ I UNAPREĐENJE POLOŽAJA MARGINALIZOVANIH KATEGORIJA STANOVNIŠTVA

Aleksandar Djordjevic[1], Aleksandra Djordjevic[2]
[1]Technological University, V.G. Shukhov,308012 Belgorod, Russian Federation
[2] UniversityofNis, FacultyofEconomics, 18000 Nis, Republic of Serbia



Aleksandar Djordjevic

Aleksandra Djordjevic

ABSTRACT:
Social enterprises represent the basis for solving social problems in an economy. They are formed and function in situations where there are certain social and ecological problems that prevent further growth and development, and which the state is unable to solve with its measures and activities. The importance of this type of company is the similarity with profit and non-profit organizations, but due to their focus on a certain group of people (marginalized groups, the poor, members of minority groups), efforts to develop them and the specificity of business, these companies differ. The aim of the work is to point out the problems that the regions and certain sensitive groups of people are facing in the Republic of Serbia, possible directions of state aid and intervention in the function of encouraging and developing social entrepreneurship, and all in the function of ensuring better living and working conditions for oppressed groups of people.
Keywords: *social entrepreneurship, regional problems, social problems, regional development*

REZIME:
Socijalna preduzeća predstavljaju osnovu za rešavanje socijalnih problema u privredi. Oni dobijaju na značaju u situacijama kada postoje određeni društveni i ekološki problemi koji sprečavaju dalji rast i razvoj, a koje država svojim merama i aktivnostima nije u mogućnosti da reši. Značaj ovog tipa preduzeća je sličnost sa profitnim i neprofitnim organizacijama, ali zbog njihove usmerenosti na određenu grupu ljudi (marginalizovane grupe, siromašni, pripadnici manjinskih grupa), kao i specifičnosti poslovanja, ove kompanije se razlikuju od profitnih preduzeća i neprofitnih organizacija. Cilj rada je da ukaže na probleme sa kojima se suočavaju regioni i pojedine osetljive grupe ljudi u Republici Srbiji, moguće pravce državne pomoći i intervencije u funkciji podsticanja i razvoja socijalnog preduzetništva, a sve u cilju obezbeđivanja boljih uslova života i rada osetljivim kategorijama stanovništva..
Ključne reči: *socijalno preduzetništvo, regionalna nejednakost, socijalni problemi, regionalni razvoj*

THE CONCEPT OF VALUE IN KNOWLEDGE-BASED ORGANIZATIONS

Aurel Mihail Titu[1],Madalina Maria Pana[2], Constantin Oprean[3]

[1]"Lucian Blaga" University of Sibiu, 10 Victoriei Street, Sibiu, Romania,
[2]University POLITEHNICA of Bucharest, Faculty of Industrial Engineering and Robotics, Splaiul Independenţei nr. 313, 6th District, Bucharest, Romania
[3]Lucian Blaga University of Sibiu, 10 Victoriei Street, Sibiu, România



Aurel Mihail Titu Madalina Maria Pana Constantin Oprean

ABSTRACT:
The present scientific paper aims to study the concept of value and the ways in which today's organizations carry out activities having as their final purpose the creation of value. Since the earliest times, human activities have had as their goal the creation of value. Whether we are discussing about tangible values that serve physiological purposes, for example, hunting, which was aimed at providing food, up to objectives related to the satisfaction of higher needs, such as the need for education, the need for self-knowledge, human activities have as their main goal the value creation. This paper will address the ways in which companies approach concepts such as "value", "resources" and how these concepts contribute to the achievement of economic objectives within knowledge-based organizations.

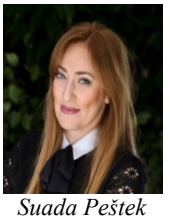
Keywords: *Value, Organization, Resources, Knowledge-based organizations*

HOW DO WE USE OUR SOCIAL NETWORKS? A STUDY FROM BOSNIA AND HERZEGOVINA

KAKO KORISTIMO NAŠE DRUŠTVENE MREŽE? STUDIJA IZ BOSNE I HERCEGOVINE

Kožo Amra[1], Peštek Suada[2]
[1,2]University of Sarajevo, School of Economics and Business, Sarajevo, Bosnia and Herzegovina


Amra Kožo


Suada Peštek

ABSTRACT:
This study observes the use of social networks among employees in companies in Bosnia and Herzegovina. The survey conducted online on a sample of 526 employees provides an overview of the most popular and frequently used social networks and the use of social networks at work for personal and work purposes. In addition, the paper treats the habits of checking social networks and the relationship with employees' well-being. Also, differences in the habits of checking social networks based on gender, age, level of education, and position in the organization were observed. The results of the research confirmed that employees most often access social networks via mobile phones, that some companies do not approve the social networks use during work, and that there are differences in the habits of using social networks in terms of gender and age.

Keywords: *social media, social networks, social networks checking habits, well-being*

REZIME:
Ovaj rad posmatra korištenje društvenih mreža među zaposlenima u kompanijama u Bosni i Hercegovini. Istraživanje sprovedeno online putem na uzorku od 526 zaposlenih donosi pregled najčešće korištenih društvenih mreža, intenziteta njihovog korištenja, te upotrebe društvenih mreža na poslu za lične i poslovne svrhe. Dodatno, rad tretira navike provjeravanja društvenih mreža te odnos sa ličnim blagostanjem zaposlenika. Posmatrane su i razlike u navikama provjeravanja društvenih mreža po osnovu spola, dobi, stepena obrazovanja te pozicije u organizaciji. Rezultati istraživanja su potvrdili da zaposleni društvenim mrežama najčešće pristupaju putem mobilnog telefona, da pojedine kompanije ne odobravaju korištenje društvenih mreža tokom radnog vremena, te da postoje određene razlike u navikama korištenja društvenih mreža u pogledu spola i starosne dobi.

Ključne riječi: *društveni mediji, društvene mreže, navike provjeravanja društvenih mreža, well-being*

AVATAR CONSUMPTION IN VIDEO GAMES: A SYSTEMATIC LITERATURE REVIEW

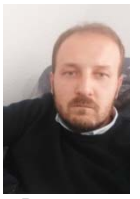
AVATAR POTROŠNJA U VIDEO IGRAMA: SISTEMATSKI PREGLED LITERATURE

Berberović Denis[1], Alić Adi[2], Činjarević Merima[3], Mešanović Benjamin[4]
[1,2,3,4]University of Sarajevo, School of Economics and Business,71000 Sarajevo, BiH


Denis Berberović


Adi Alić


Merima Činjarević


Benjamin Mešanović

ABSTRACT:
This study presents state-of-the-art avatar consumption research in business as a scientific field. We used a systematic literature review to provide answers to these research questions. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement served as the foundation for conducting a systematic literature review. We decided to extract the data for this study from the Web of Science (WoS) database. The final search yielded 50 peer-reviews articles by searching the query mentioned above by abstract in WoS records. The results indicate that the scholarly work related to avatar consumption is still nascent. We focused on the theory of self-determination to explain how avatar usage is related to the expression of identity and the construction of multiple consumer identities.

Keywords*: avatar, consumer identities, avatar consumption, video games, consumer behavior*

REZIME:
Ova studija predstavlja najsavremenije istraživanje potrošnje avatara u biznisu kao naučnoj oblasti. Koristili smo sistematski pregled literature da bismo dali odgovore na ova istraživačka pitanja. Izjava o preferiranim izvještajnim stavkama za sistematske preglede i meta-analizu (PRISMA) poslužila je kao osnova za sprovođenje sistematskog pregleda literature. Odlučili smo da izvučemo podatke za ovu studiju iz baze podataka Web of Science (WoS). Konačna pretraga je dala 50 članaka sa recenzijom pretragom gore pomenutog upita po sažetku u WoS zapisima. Rezultati pokazuju da je naučni rad vezan za potrošnju avatara još uvijek u nastajanju. Mi smo se fokusirali na teoriju samoodređenja kako bismo objasnili kako je upotreba avatara povezana sa izražavanjem identiteta i konstrukcijom višestrukih identiteta potrošača.

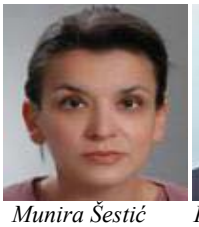
Ključne riječi*: avatar, identiteti potrošača, potrošnja avatara, video igre, ponašanje potrošača*

ASSESSMENT OF THE READINESS OF COMPANIES FOR THE APPLICATION OF INDUSTRY 4.0 WITH THE HELP OF AN EXPERT SYSTEM

PROCJENA SPREMNOSTI KOMPANIJA ZA PRIMJENU INDUSTRIJE 4.0 UZ POMOĆ EKSPERTNOG SISTEMA

Mirha Bičo Ćar[1], Savo Stupar[1], Munira Šestić[1], Isak Karabegović[2]
[2]University of Sarajevo, School of Economics and Business, Bosnia and Herzegovina
[1]Academy of Sciences and Arts of Bosnia and Herzegovina, Sarajevo, Bosnia and Herzegovina






Mirha Bičo Ćar *Savo Stupar* *Munira Šestić* *Isak Karabegović*

ABSTRACT:
The main goal of this paper is to show how to create and use a tool (a model with a knowledge base, which consists of a large number of IF -THEN rules and attributes) for assessing the readiness of companies to implement Industry 4.0 technologies, using one of the questionnaires used to make that assessment. In order to perform this procedure as quickly and simply as possible, a deductive approach was used to build an expert system with the help of the Doctus Knowledge Based System Shell.It should be noted that this approach, where Artificial Intelligence in the form of an expert system helps the faster application of other forms of Artificial Intelligence, will be used more and more often in practice. The secondary goal of this paper is to show the procedure of building and applying an expert system, i.e. a tool that will be used to assess the readiness of companies for Industry 4.0.

Keywords*: Industry 4.0 Technologies, Artificial Intelligence,Expert Systems, Companies' readiness to apply Industry 4.0 technologies, Doctus*

SAŽETAK:
Osnovni cilj ovog rada je pokazati kako se kreira i koristi alat (model sa bazom znanja, koja se sastoji od velikog broja IF –THEN pravila i atributa) za procjenu spremnosti kompanija za implementaciju tehnologija Industrije 4.0., koristeći jedan od upitnika kojim se vrši ta procjena. Da bi se taj postupak obavio što brže i što jednostavnije, korišćen je deduktivni pristup izgradnji ekspertnog sistema uz pomoć ljuske Doctus Knowledge Based System Shell. Treba zapaziti da će se ovakav pristup, gdje Vještačka inteligencija u formi ekspertnog sistema pomaže bržoj primjeni drugih formi Vještačke inteligencije, sve češće koristiti u praksi. Sekundarni cilj ovog rada je da pokaže postupak izgradnje i primjenu ekspertnog sistema, odnosno alata kojim će se procjenjivati spremnost kompanija za Industriju 4.0.

Keywords*: Tehnologije Industrije 4.0, Vještačka inteligencija,Ekspertni sistemi, Spremnost kompanija za primjenu tehnologija Industrije 4.0, Doctus*

THE IMPACT OF DIGITALIZATION AND DIGITAL CONSUMPTION ON SOCIAL DEVELOPMENT

Ilda Kashami[1], Arjan Çuri[2]
[1,2] “Mediterranean University of Albania”
[1]Department of Education, Communication and Competence Skills,Tirana, Albania
[2]Department of Psychology and Social Sciences, Tirana, Albania

Ilda Kashami

Arjan Çuri

ABSTRACT:
The present article aims to explore and investigate a relatively recent occurrence within digital media and the impact social networking has on journalism and society.
The methodology of the present work is a mixed one that combines quantitative and qualitative research through the dissemination of 100 interviews of early career digital-media journalists who are engaged in social-media news and the qualitative method of content analysis.
Results revealed that there is a real concern and a growing interest by both media makers and journalists in the new Social Mass- Media. From the selected sample, directors of selected web media responded 42% positively and 58% negatively to whether there was a Code digital for media workers to follow when posting information on social networks. Regressive analyses of the qualitative interviews found that Management of digital Profile ($\beta = .37$, $t(89) = 6.01$, $p < .001$), Communication, and writing style in the new routines in the newsroom ($\beta = .40$, $t(89) = 5.0$, $p < .001$), Use of Social Networks and Object Relations ($\beta = .32$, $t(89) = 3.8$, $p < .001$) and Media Identity ($\beta = .24$, $t(89) = 2.96$, $p < .001$) produced an $R2 = .94$, indicating that all components from the factor weight accounted for 91% of the variance in the Social Media content analysis.
Conclusions revealed that the strong relationship between the offline and online world, the profile of the media worker, communication and writing style, social relationships, and media identity significantly impact success in the social media world. Training in social networks is highly recommended as an enhancement for the image of media and journalism professionally within the universities for journalists.

Keywords: *social media, digitalization, digital communication, training, social development*

Autors Index – Indeks autora

A
Abazović, Ensar 64
Abramenko, Ivan 104
Ademovic, Amir 116
Alagić, Ismar 46
Alić, Adi 145
Alrefaee, Mohammad Adnan Diab 55
Antić, Aco 17
Avdagić, Admir 107, 108
Avdagić-Golub, Elma 70, 73
Avdic, Faruk 117
Avdić, Subha 105

B
Bagdasaryan, Armen 79
Bagoyo, Alyssa 2
Bajrić, Alen 105
Bajrić, Hadis 45
Balić, Besim 107, 108
Balić, Tarik 87
Banjanović-Mehmedović, Lejla 49
Bartáková, Gabriela Pajtinková 114
Beganović, Omer 41
Begic-Hajdarevic, Derzija 38, 47
Behadarević, Ismir 37
Bektešević, Jasmin 29, 97, 98
Belšak, Rok 1, 11
Berardi, Valentino Paolo 31
Berberović, Denis 145
Berus, Lucijano 1, 6, 11
Bevz, Oleh 10
Bičo Ćar, Mirha 44, 63, 146
Blagojević, Mladenka 82
Blanuša, Vladimir 39
Bodnaruk, Iryna L. 93
Bogorin-Predescu, Adrian 20
Boskovic, Bojana 71
Brajlih, Tomaž 11
Bratovcic, Amra 99
Brezočnik, Lucija 52
Brezočnik, Miran 11
Buljan, Stipo 19

C
Cattani, Piercarlo 54, 56, 60
Causevic, Amir 117
Cekic, Ahmet 38, 47
Celenta, Giampieto 26, 27, 62, 101, 102, 115
Cero, Mehmed 112
Cheredarchuk, Natalia 13
Chihvintseva, Olga 113
Cohodar Husic, Maida 47
Curcio, Maria 5
Çuri, Arjan 147

Č
Čabaravdic, Malik 48
Čaušević, Samir 78
Čičak, Mirjana 57
Činjarević, Merima 145
Čizmić, Elvir 132, 133, 134
Čobo, Mehmed 48
Čubrić, Goran 109

Ć
Ćatović, Fuad 118
Ćećez, Marko 118
Ćubela, Diana 34

D
Dašić, Predrag 9
Davidsson, Paul 85
De Leone, Renato 52
De Simone, Marco Claudio 25, 26, 27
Dedić, Luka 66
Delić, Amel 138
Destović, Fatih 98
Dimitrov, Lubomir 12, 13
Dimovski, Tome 50
Djordjevic, Aleksandr 142
Djordjevic, Aleksandra 142
Djukanovic, Milena 40
Doicin, Cristian Vasile 21, 28
Doroshenko, Yuri 140
Dorozhka, Tetiana N. 84
Dragomir, Mihai 59
Držečnik, Mateja 122
Dudić, Branislav 18, 114
Dzidic, Sanin 116, 117

Dž
Džaferović, Ejub 42, 86
Džakmić, Šejla 55
Džananović, Ajdin 74, 76
Džubur, Žana 125
Džubur, Damir 124

Đ
Đonko, Danija 123
Đorđević, Luka 17
Đukanović, Borislav 137
Đukić, Himzo 35
Đurđev, Mića 17

E
Egbert, Spencer 2
Eitler, Sandra 67
El Sayed, Ahmed 116, 117, 102, 121
Eljazović, Maida 80
Ezgeta, Drago 74, 78

F
Fakić, Belma 34, 41
Ficko, Mirko 6, 11, 47
Fišer, Zrinka 58
Formato, Andrea 101, 102
Franco, Carmela 3

G
Gubíniová, Katarína 114
Genel, Ömer Ekim 30
Gomes, Eduarda 19
Gotlih, Janez 1, 6, 11
Grujic, Ivan 71
Guercio, Vincenzo 54, 56
Gusan, Vasile 21

H
Hadžalić, Mustafa 41
Hadžiabdić, Vahidin 29, 97, 98
Hadžiahmetović, Halima 91
Hadžić, Emina 92
Hadžidervišagić, Dino 107
Hadžiselimović, Venan 134
Hadžistević, Miodrag 39
Hajdar, Amir 53, 64
Hajdarević, Edina 105
Halač, Almin 42
Halilović, Emir 45
Halilović, Velid 103
Hasečić, Amra 86
Hernavs, Jernej 6
Hodžić, Elmin 103
Hodžić, Nihad 90, 94, 96
Holofieieva, Maryna 23, 24
Howell, Bryan 2
Hozdić, Elvis 36
Hristoski, Ilija 50
Hruska, Matej 4
Hupfer, Christoph 69, 95
Husak, Ermin 33
Husaković, Anel 49
Husetić, Aida 130, 131
Husić, Lejla 49
Husika, Azrudin 91

I
Ionescu, Nicolae 21, 28
Isić, Safet 91
Isola, Giuseppe 31
Ivanković, Dalila 106
Ivanov, Viktor 12, 13
Ivanova, Svitlana 12, 13

J
Jakšić-Stojanović, Anđela 139
Japić, Emina 130
Ješić, Dušan 18
Jevremović, Vladeta 84
Jovanovic, Jovana 129
Jovanovic, Mihailo 40
Jugović, Gojko 119
Jurčević, Marinko 81
Jurković, Zoran 36

K
Kačmarčik, Josip 37
Kadić, Kenan 90, 94, 96
Kalača, Nejla 107
Kalampakas, Antonios 79
Kalinina, Tetiana 9, 84
Kamenjašević, Nedim 77
Karabegović, Edina 33
Karabegović, Isak 33, 44, 146
Karakatič, Sašo 52
Karner, Timi 1, 6, 11
Kashami, Ilda 147
Katerynych, Stanislav 10
Katnic, Ivana 139
Katnić, Milorad 139
Kazagic, Anes 90

Khliebnikov, Anton V. 84
Kilbourn-Barber, Grace 2
Klančnik, Simon 6, 47
Klanšek, Uroš 122
Klimov, Sergii 23, 24
Knežević, Jelena 103
Kochmanski, Pawel 4
Kogoj, Dušan 119
Konoplov, Anatolii 13
Konjicija, Samim 53
Kopei, Bogdan 7
Kopei, Ihor 7
Kopei, Volodymyr 7, 8
Kos, Goran 66
Kosovac, Amel 70, 73, 75, 82
Kostiuk, Olha 15
Kovač, Pavel 18
Kozadra, Amar 138
Kožo, Amra 144
Kujundžić, Kosara 126
Kuk, Andrii 15
Kusyi, Yaroslav 8, 15

L
La Regina, Rosario 3,5, 30, 31, 32
Lemeš, Samir 41
Lenza, Tony Luigi Leopoldo 26
Leonova, Olga 140
Lesyk, Dmytro 4
Leto, Alma 100, 111
Levynskyi, Oleksandr 24
Lijun, Jia 101
Lindov, Osman 68
Liu, Yafei 56
Lojo, Ahmet 108
Lök, Sefika Ipek 32
Lorusso, Angelo 62,115
Lovrec, Darko 135, 136
Lukić, Dejan 17
Lungu, Florin-Alexandru 14
Lysenko, Oleksandr 9, 84

M
Mahmić, Mehmed 33
Malekian, Reza 85
Malgaca, Levent 32
Malykhina, Irina 140
Mandryk, Oleg M. 93
Mandžuka, Bia 81
Mandžuka, Sadko 66
Maric, Anita 40
Mašić, Adnan 29, 97, 98
Medić, Adisa 75
Medin, Andrea 40
Mehanović, Mustafa 77, 78
Mehičić, Haris 75
Mehuljić, Midhat 29, 97, 98
Melin, Kristian 45
Memić, Belma 70, 73
Mešanović, Benjamin 145
Metović, Sadjit 29
Mičijević, Alma 100, 111
Milišić, Hata 92
Milosavljević, Milan 113
Milošević, Mijodrag 17
Mordyuk, Bohdan 4
Mostarlić, Kenan 118
Movrin, Dejan 39
Muhamedagic, Kenan 38
Muhamedagić, Fatima 112
Muharemović, Ermin 70, 73, 80, 82
Mulahusić, Admir 119
Muminović, Adis J. 83
Muminović, Branka 41
Murali, Supraajha 16
Murri, Isaac 2
Musić, Jusuf 103, 108
Mykhailiuk, Vasyl 7

N
Nalli, Giacomo 52
Nazdrajić, Sanela 100
Nechitailo, Yuliia 104
Neimarlija, Ermin 45
Novaković, Borivoj 17
Novalić, Adnan 120, 121
Nožić, Mirna 35

O
Olefir, Olena 12
Olteanu, Constantin Dorin 28
Omerhodžić, Adnan 68, 76
Onysko, Oleh 7, 8, 15
Oprean, Constantin 143

P
Pal, Snehashis 11
Palalija, Haris 132, 133
Palazhchenko, Yevhen 51
Pana, Madalina Maria 143
Pappalardo, Carmine Maria 3,5, 30, 31, 32
Paravlić, Armin 64

Pavlyshko, Andrii 23
Perekrest, Andriy 89
Peršak, Tadej 6, 47
Pervan, Nedim 83, 97
Peštek, Suada 144
Petrov, Antonija 109
Petrušić, Irena 137
Pituley, Lolita 8
Pleitz, Maximilian 86
Podgorelec, Vili 52
Popil, Oleg 9
Popovac, Maja 120, 121
Potočnik, David 6
Powalka, Bartosz 4

R
Rahimić, Zijada 132
Ramdedović, Amel 55
Ramić, Mesud 86
Ramljak, Amina 38
Ranisavljev, Miloš 39
Ritchie, Ethan 2
Rolich, Tomislav 109
Romano, Raffaele 101, 102
Riapukhina, Viktoriia 141

S
Saburov, Mansoor 79
Salčin, Merima 125
Saletović, Vedad 83
Salkić, Redžo 131
Salopek Čubrić, Ivana 109
Sarajlić, Mirzet 74, 76, 77
Sarajlić, Nermin 49
Sarles, Meghan 2
Savković, Borislav 18
Schodl, Reinhold 67
Serdarević-Kadić, Sabina 22
Shendryk, Sergii 51, 89
Shendryk, Vira 51, 85, 89, 104
Shepelenko, Ihor 10
Shlapak, Lubomur S. 93
Shramenko, Natalya 69, 95
Shuai, Zhou 102
Skenderović, Isat 105
Smajlović Orman, Nerma 120, 121
Softić, Almira 22
Softić, Senad 133
Solohub, Bohdan 15
Solovuch, Andrey 10
Solovykh, Evhen 10
Stamatović Vučković, Slavica 126
Stanovska, Iraida 23
Stanovskyi, Oleksandr 24
Stojanovic, Nadica 71
Stupar, Savo 44, 63, 146
Sućeska, Suad 65
Sydorenko, Valeriy 89

Š
Šabić, Muharem 88, 123
Šabić, Said 88
Šahinagić-Isović, Merima 118
Šarac, Dragana 82
Šarić, Isad 83
Šašić, Đevad 134, 138
Šertović, Edina 112
Šestan, Almir 106
Šestić, Munira 44, 63, 132, 133, 146
Šimić, Edvin 88, 123
Škorput, Pero 72
Špago, Azra 123
Špago, Damir 87, 91
Štrbac, Branko 39
Šukalić, Aida 100, 111
Šulić, Muharem 75
Šunjić, Darko 19

T
Tanović, Merima 138
Taras, Iryna 8
Tarić, Mirsad 18, 125
Tatarević, Adnan 76
Tertereanu, Petrica 59
Tič, Vito 61, 136
Tiro, Dragi 43
Titu, Aurel Mihail 14, 20, 21, 28, 59, 143
Titu, Stefan 20
Tokar, Andrey 113
Tonkonogyi, Volodymyr 23, 24
Torlo, Lamija 111
Torlo, Miron 87
Trgo, Adil 134
Tuno, Nedim 119
Tuts, Oleh M. 93
Tymchuk, Sergii 104

U
Ungureanu, Andreea Maria 14
Urum, Galyna 12

V

Val, Sonia 52
Varda, Kenan 22, 41
Veeraraghavan, Venkatakrishnan 16
Veneziano, Salvio 25, 27
Vidović, Krešimir 66, 72, 81
Villecco, Francesco 54, 56, 60
Viswanathan, Varsha 16
Viteškić, Nađa 55
Vrce, Azra Mahinić125
Vrvić, Miroslav 110

W
Wang, Tonghao 54

Z
Zaarir, Yousef 127, 128
Zagorulko, Iryna 9
Zaimović-Uzunović, Nermina 22
Zeba, Gordana 57
Zejak, Dejan 114
Zhyla, Viktor 104

Ž
Žiga, Alma 37, 48

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.

Adrress:
Petog Korpusa br. 3,
77 000 Bihać,
Bosnia and Herzegovina
www.robotika.ba
E-meil: robotikabih@yahoo.com

President Society for Robotics B&H
Prof. Safet Isić, PhD.

Secretery general
Society for Robotics B&H
Prof.Isak Karabegović, PhD.

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.

Adresa:
Petog Korpusa br. 3,
77 000 Bihać,
Bosna i Hercegovina
www.robotika.ba
E-meil: robotikabih@yahoo.com

Predsjednik Društva za robotiku
Prof.dr.sc.Safet Isić

Generalni sekretar
Društva za robotiku
Prof.dr.sc. Isak Karabegović

Nacionalni park Una bosanskohercegovačka i svjetska prirodna vrijednost

Štrbački buk, najviši vodopad na rijeci Unu i najposjećenija atrakcija u Parku

Martinbrodski slapovi, prostorno najveći kompleks slapova u Parku, nominirani su za uvrštavanje na Listu svjetske baštine UNESCO-a

Sportsko rekreativne aktivnosti

Stari grad Ostrovica

Fauna Nacionalnog parka Una

Kanjon Unca

New Technologies, Development and Application

Proceedings of the International Conference on New Technologies, Development and Application,
NT-2018, June 28-30, 2018, Sarajevo, Bosnia and Herzegovina
Editor: Isak Karabegović
https://www.springer.com/gp/book/9783319908922

New Technologies, Development and Application II

Proceedings of the International Conference on New Technologies, Development and Application,
NT-2019, June 27-29, 2019, Sarajevo, Bosnia and Herzegovina
Editor: Isak Karabegović
https://www.springer.com/gp/book/9783030180713

New Technologies, Development and Application III

Proceedings of the International Conference on New Technologies, Development and Application,
NT-2020, June 25-27, 2020, Sarajevo, Bosnia and Herzegovina
Editor: Isak Karabegović
https://www.springer.com/gp/book/9783030468163

New Technologies, Development and Application IV

Proceedings of the International Conference on New Technologies, Development and Application,
NT-2021, June 24-26, 2021, Sarajevo,
Bosnia and Herzegovina
Editor: Isak Karabegović
https://www.springer.com/gp/book/9783030752743

New Technologies, Development and Application V

Proceedings of the International Conference on New Technologies, Development and Application,
NT-2022, June 23-25, 2022, Sarajevo, Bosnia and Herzegovina
Editor: Isak Karabegović
https://link.springer.com/gp/book/10.1007/978-3-031-05230-9

New Technologies, Development and Application VI

Proceedings of the International Conference on New Technologies, Development and Application,
NT-2023, June 22-24, 2023, Sarajevo, Bosnia and Herzegovina
Editor: Isak Karabegović
https://link.springer.com/book/10.1007/978-3-031-31066-9?page=1#toc

CONFERENCE PARTNERS / PARTNERI KONFERENCIJE

CHAMBER OF COMMERCE FEDERATIONS OF BOSNIA AND HERZEGOVINA
http://www.kfbih.com

FOREIGN TRADE CHAMBER OF BOSNIA AND HERZEGOVINA
https://komorabih.ba/

INTERNATIONAL ASSOCIATION FOR TECHNOLOGICAL DEVELOPMENTAND INNOVATIONS UKRAINA
http://iatdi.org/

TEHNOLOGY PARK INTERA MOSTAR BOSNIA AND HERZEGOVINA
http://www.intera.ba/

FANUC Adria d.o.o. Celje, SLOVENIA
https://www.fanuc.co.jp/en/service/europe/adria.html

SAVEZ INŽENJERA I TEHNIČARA TEKSTILACA SRBIJE

ТЕХНИЧАРСКА ДРУЖИНА 1868 2018

Кнеза Милоша 7 11000 Београд

https://www.sits.org.rs/

Europen Network on High Performance and Embedded Architecture and Compilation UGENT - ELIS Technologiepark-Zwijnaarde 126 9052 Gent, Belgium

Bosnia and Herzegovina
https://www.hipeac.net/

BASTE
Balkan Society of Textile Engineers

BALKAN SOCIETY of TEXTILE ENGINEERS

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

70 GODINA
ANU BiH АНУ БиХ