

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Vienna, Austria



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# ***Scientific Program***

## 4<sup>th</sup> International Conference on **Applied Science and Engineering**

Day 1 June 27, 2024

Meetings Hall: Wien 1-5

8.00 - 8.40 Registrations

08:40-9:00 Introduction

### Keynote Presentations

9.00 - 9.35 Title: Contribution to Digital Multipoint Deformation of Sheet Metal with Application in Prototyping Manufacturing

**Viorel PAUNOIU**, Dunarea de Jos University of Galati, Romania

9.35 - 10.10 Title: Impact of Bioactive Coatings on Mg-Based Alloy Surface

**Karol Kyzioł**, AGH University of Krakow, Poland

### Oral Presentations

Session Chair **Jörg M.Hoffmann**, UAS Osnabrück and EUIL, Germany

Session Chair **Karol Kyzioł**, AGH University of Krakow, Poland

Session Chair **Xiaohong Han**, Institute of Refrigeration and Cryogenics, Zhejiang University, China

### Sessions:

Applied Nanosciences and Nanotechnology | Environmental Sciences | Chemical Engineering | Materials Science and Engineering | Computer Applications and Information Sciences | Applied Science | Applied Thermal Engineering | Food Science | Biotechnology & Biological Sciences | Neurosciences | Energy Science and Technology | Biomedical Engineering | Polymer Engineering | Applied Physics | Mechanical Engineering | Earth Sciences and Geography | Civil Engineering | Electrical, Electronics and Communications Engineering

10.10 - 10.35 Title: Implementing a Novel Design Methodology Using 3D Surface Models in The Early Vehicle Concept Creation Phase

**Maximilian Schmitz**, Ilmenau University of Technology, Germany

10.35 - 11.00 Title: Analysis of Cardiovascular and Cerebral Interactions in Response to Cognitive Tasks

**Verónica Janeth Martínez-Hernández**, Autonomous University of San Luis Potosí, Mexico

11.00 - 11.25 Title: A Forgery Detection System for Palm Vein RGB Image Recognition Based on ResNet

**Shi-Jinn Horng**, Asia University, Taiwan

### Networking and Refreshments @ Foyer (11:25-11:45)

11.45 - 12.10 Title: Calibration of a Fine Dust Concentration Measurement Device Using Neural Networks

**Jörg M. Hoffmann**, UAS Osnabrück and EUIL, Germany

12.10 - 12.35 Title: Advances and Prospects of Liquid Immersion Cooling for High-Performance Computing

**Xiaohong Han**, Institute of Refrigeration and Cryogenics, Zhejiang University, China

12.35 - 13.00 Title: A Machine Learning-Based Estimation of Anthracnose Occupancy Ratio by Conversion from Volumetric to Planar Mango Fruit Image

**Roy Chaoming Hsu**, National Chiayi University, Taiwan

## 4<sup>th</sup> International Conference on **Applied Science and Engineering**

**Group Photo (13.00 - 13.15)**

**Lunch @ Restaurant Westside (13:15 - 14.00)**

14.00 - 14.25	Title: Cooperative and Coordinated Mobile Femtocell Technologies in High-Speed Vehicular Environments <b>Rand Raheem</b> , Middlesex University, United Kingdom
14.25 - 14.50	Title: Atrial Fibrillation and Sinus Rhythm Detection Using Tiny ML (Embedded Machine Learning) <b>Guilherme Vilas Boas Ferreira da Silva</b> , Federal University of Itajubá, Brazil
14.50 - 15.15	Title: Complex Access Scenarios (CAS) Service Request <b>Rahmira Rufus</b> , University of North Carolina, USA
15.15 - 15.40	Title: New Perspectives in Coupled Stability Analysis, Design and Refurbishment of Retaining Structures in Steep Slopes <b>Jörg-Martin Hohberg</b> , IUB Engineering AG, Switzerland
15.40 - 16.05	Title: Statistical Inference of the Beta Generalized Inverse Rayleigh Distribution <b>Rana Ali Bakoban</b> , University of Jeddah, Saudi Arabia
16.05 - 16.30	Title: Walsh Functions, Dyadic Analysis <b>Rodolfo Toledo</b> , Eötvös University of Budapest, Hungary
<b>Refreshments @ Foyer (16.30 - 17.00)</b>	
17.00 - 17.25	Title: Use of OWWO Solution (Degassed Highly Ozonated Water) on The Pilot Plants and The Technological Implementations in The Industry <b>Bogumiła Winid</b> , AGH University of Krakow, Poland
17.25 - 17.50	Title: Transformative Tech: Exploring the Impact of AI on Biomedical Engineering Practices <b>Elena-Anca Paraschiv</b> , National Institute for Research & Development in Informatics - ICI, Romania
17.50 - 18.15	Title: Creation of Conceptual Solution Environments for Specific Design Tasks <b>Hrayr Darbinyan</b> , G-Coder LLC, Armenia
18.15 - 18.40	Title: Improved Design Topology for PLC Performance Using System Generator <b>Kasim Karam Abdalla</b> , University of Babylon, Iraq
18.40 - 19.05	Title: XPS++: A Publish/Subscribe System with Built-in Security and Privacy by Design <b>Noor Ahmed</b> , Air Force Research Laboratory/RIS, USA
19.05 - 19.30	Title: Development of Safe, Environmentally – Friendly and Sustainable Small Scale Gold Mining Methods in Ghana <b>Akuba Bezeba Yalley</b> , University of Mines and Technology, Ghana

**Day 1 Concludes followed by Award Ceremony**

## 4<sup>th</sup> International Conference on **Applied Science and Engineering**

Day 2 June 28, 2024

Meetings Hall: Wien 1-5

Keynote Presentations

8.30 - 9.05	Title: Relationship Between Doping and Intrinsic Defects in UWBG Semiconductors The Case of Zn Doping in -Ga <sub>2</sub> O <sub>3</sub> Grown by MOCVD <b>Georges BREMOND</b> , CNRS, ECL, UCBL, CPE, Institute des Nanotechnologies de Lyon, France
9.05 - 9.40	Title: A Hybrid Cost Model for Evaluating Query Execution Plans <b>Verena Kantere</b> , University of Ottawa, Canada

Oral Presentations

Session Chair	<b>Jörg M.Hoffmann</b> , UAS Osnabrück and EUIL, Germany
Session Chair	<b>Karol Kyzioł</b> , AGH University of Krakow, Poland
Session Chair	<b>Xiaohong Han</b> , Institute of Refrigeration and Cryogenics, Zhejiang University, China

**Sessions:** Applied Nanosciences and Nanotechnology | Environmental Sciences | Chemical Engineering | Materials Science and Engineering | Computer Applications and Information Sciences | Applied Science | Applied Thermal Engineering | Food Science | Biotechnology & Biological Sciences | Neurosciences | Energy Science and Technology | Biomedical Engineering | Polymer Engineering | Applied Physics | Mechanical Engineering | Earth Sciences and Geography | Civil Engineering | Electrical, Electronics and Communications Engineering

9.40 - 10.05	Title: Environmental Factors Action on The Products Used for Wood Substrates Protection <b>Andreea Mihaila</b> , Gheorghe Asachi Technical University, Romania
10.05 - 10.30	Title: The New Technological Era and New Needs to be Qualified in the Labour Market <b>Anabela Simoes</b> , Lusofona University, Portugal
10.30 - 10.55	Title: Potential of Smart TTIs Ecolabeling for Fresh Food Products as a Component Development of Toolkit for Cross Sectoral Benefit in the Water-Energy-Food-Environment (WEFE) Nexus <b>Vladimir Kitanovski</b> , University Mother Teresa in Skopje, North Macedonia

Networking and Refreshments @ Foyer (10.55 - 11.15)

Oral Presentations

11.15 - 11.40	Title: Simulator for Cardiovascular Procedures <b>Jesus Moises Martinez Buendia</b> , National Institute of Cardiology, Mexico
11.40 - 12.05	Title: Study of Solar Photovoltaic System Applied to Wine Farm in Portugal <b>Ana Isabel Palmero Marrero</b> , University of Porto (FEUP), Portugal
12.05 - 12.30	Title: The Effectiveness and Privacy Preservation of IoT on Ubiquitous Learning: Modern Learning Paradigm to Enhance Higher Education <b>Albandari Fahad Abdulrahman Alsumayt</b> , Imam Abdulrahman Bin Faisal University, Saudi Arabia
12.30 - 12.55	Title: Magnetization Plateaus, Susceptibility, Super-Stable Points, and Cycles of Spin 1 Antiferromagnetic Materials on Diamond Chains with Biquadratic Interactions <b>Gayane Amatuni</b> , CANDLE Research Institute, Armenia

## 4<sup>th</sup> International Conference on **Applied Science and Engineering**

### Lunch @ Restaurant Westside (12.55 - 14.00)

14.00 - 14.25	Title: The Novel Ideas Housing Models for Green Architecture, Sustainability, the Pandemic and the Recent Come-Back of the Garden-Cities <b>Hülya Coskun</b> , Mimar Sinan University, MSGSU, Turkey
14.25 - 14.50	Title: Analysing the City Water-Energy-Food Sustainability Indicators: A Systematic Review <b>Bahar Feizollahbeigi</b> , University of Minho, Portugal
14.50 - 15.15	Title: Sustainable HVAC Solutions: Decarbonizing Through Optimal High-Efficiency Unit Selection <b>Shahid Ali Khan</b> , Military Technological College, Oman

### Poster Presentations 15.15 - 16.15

Poster Judge	<b>Jörg M. Hoffmann</b> , UAS Osnabrück and EUIL, Germany
Poster Judge	<b>Karol Kyzioł</b> , AGH University of Krakow, Poland
ASE-P01	Title: Non-invasive Fuel Consumption Measurement for Internal Combustion Engines Based on Otto Cycle <b>Emerson Alves da Silva</b> , Federal University of Minas Gerais, Brazil
ASE-P02	Title: GABA Prevents Sarcopenia through Regulation of Protein Turnover and Inflammaging in 21-25-month-old C57BL/6J Mice <b>Boo Yong Lee</b> , CHA University, South Korea
ASE-P03	Title: Preparation of Perspective Sorbents for Purification/Decontamination of Different Source Waters <b>Lusine Harutyunyan</b> , Armenian National Agrarian University, Armenia
ASE-P04	Title: Metal-Containing Monomers As Single-Source Precursors of Metal-Polymer Nanocomposites <b>Igor E. Uflyand</b> , Southern Federal University, Russia
ASE-P05	Title: Assessment of Thermal Decomposition Processes of Some Symmetric Derivatives with Two Ferrocenyl Units <b>Cerasela-Ionela Cleminte</b> , Gheorghe Asachi Technical University, Romania
ASE-P06	Title: Ultrasonic Detection of Spall Damage Induced by Low-Velocity Repeated Plate Impact Test <b>Naoya Nishimura</b> , Meijo University, Japan
ASE-P07	Title: An Ellipsoidal Helmholtz Pair in Contrast with A Square Coil for Magnetic Resonance Imaging <b>Khalid Abdullatif Alsnaie</b> , Al Imam Mohammed ibn Saud Islamic University, Saudi Arabia
ASE-P08	Title: Some Novel Peptides Containing a Modified Pyrazolopyrimidine Moiety: Design, Synthesis, and <i>in vitro</i> Antibacterial Screening <b>Mohamed Ge. Zayda</b> , Dar Al Uloom University, Saudi Arabia

4<sup>th</sup> International Conference on  
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ASE-P09

Title: How Different Preparation Techniques Affect MRI-Induced Anxiety of MRI Patients:  
A Preliminary Study

**Mohammed Awad Alharbi**, King Abdullah bin Abdulaziz University Hospital, Princess  
Nourah bint Abdulrahman University, Saudi Arabia

Day 2 Concludes followed by Vote of Thanks & Awards Ceremony



# ***Virtual Program***

## 4<sup>th</sup> International Conference on **Applied Science and Engineering**

### Virtual Presentations

Day 1 June 27, 2024 | 11:00 BST

11:00-11:15 Opening Ceremony and Introduction

### Keynote Presentation

11:15-11:50 Title: Behavior of Surface Optical Phonons in Dilute Magnetic Semiconductors Based on ZnO

**Branka Hadžić**, University of Belgrade, Serbia

11:50-12:25 Title: The Convergence of Technology, AI, and Engineering in Digital Biomechanics for Enhanced Healthcare

**Zartasha Mustansar**, National University of Sciences and Technology (NUST), Pakistan

### Oral Presentations

12:25-12:50 Title: Indigo – Development of Chemical Synthesis Procedures

**Michaela Kröppl**, University of Applied Sciences, Upper Austria

12:50-13:15 Title: Historical and Structural Analysis of The Lintel Fracture Over The Monastery of El Escorial Main Door

**Rubén Rodríguez Elizalde**, Universitat Oberta de Catalunya (UOC), Spain

### Lunch @ (13:15-13:45)

13:45-14:10 Title: Boundary Element and Sensitivity Analysis of Anisotropic Thermoelastic Metal and Alloy Discs with Holes

**Mohamed Abdelsabour Fahmy**, Umm Al-Qura University, Saudi Arabia

### Poster Presentation

14:10-14:30 Title: Using 3D Printing Technology to Manufacture Microneedle Patches for Veterinary Medicine

**Justyna Kornicka**, Wrocław University of Science and Technology, Poland

### Oral Presentations

14:30-14:55 Title: On the Control of the Final Speed for a Class of Finite-Dimensional Linear System: Controllability and Regulation

**Issam Khaloufi**, Hassan II University Casablanca, Morocco

14:55-15:20 Title: Deep Learning Based Approach for Precision Marketing

**Nouhaila ELKOUFI**, Hassan II University, Casablanca, Morocco

15:20-15:45 Title: New Diving Sites Discover in The Bay of Bengal, Bangladesh Part: A New Hope for Marine Ecosystem and Tourism

**Md. Hashibul Islam**, Bangladesh Oceanographic Research Institute, Bangladesh

15:45-16:10 Title: Integrating Numerical and Experimental Topology Optimization: Application Studies Across Varied Domains

**Avilasha BG**, Dayanandasagar College of Engineering India

## 4<sup>th</sup> International Conference on **Applied Science and Engineering**

16:10-16:35	Title: Extraction of Cellulose Nanocrystals from The Stem of Arundo Donax L. and Characterization of Its Physiochemical Attributes <b>Abhishek Gaikwad</b> , Sam Higginbottom University of Agriculture, India
16:35-17:00	Title: Quantum Cone - Nano Source of Light with Dispersive Spectrum, Separated in Time and Space <b>Arturs Medvids</b> , Riga Technical University, Latvia
17:00-17:25	Title: The medical device industry in a Kaizen environment in the year 2050 Costa Rica Case Study <b>Johan Rojas Rojas</b> , Medical Device Industry, Costa Rica
17.25 - 17.50	Title: Determination of Groundwater Potential Zones on The Eastern Slope of Mount Cameroon Using Geospatial Techniques and Seismoelectric Method <b>Lionel Junior Ngome Njumbe</b> , University of Buea, Cameroon Alexander Drilling Company, Cameroon
17:50-18:15	Title: Restoration of the Moorish Pavilion and Architectural Complex of Manguinhos, in Rio de Janeiro, Brazil <b>Benedito Tadeu de Oliveira</b> , Oswaldo Cruz Foundation- Fiocruz, Brazil
18.15 - 18.40	Title: Experimental Research of The Desorption Process with the CO <sub>2</sub> /acetone Mixture in a Plate Heat Exchanger for Compression/Resorption Heat Pumps <b>Paúl Sebastián Dávila Aldás</b> , International University of Ecuador, Ecuador
<b>Keynote Presentation</b>	
18:40 - 19:15	Title: The Sourcing of Leaflets to Manufacture Percutaneous Heart Valves: Priority to Restoring A Durable Function <b>Robert Guidoin</b> , Université Laval, Canada

Day-1 Concludes followed by Vote of Thanks



***Day-1***  
***Keynote Presentations***



## CONTRIBUTION TO DIGITAL MULTIPOINT DEFORMATION OF SHEET METAL WITH APPLICATION IN PROTOTYPING MANUFACTURING

**Viorel PAUNOIU**

*Dunarea de Jos University of Galati, Romania*

### Abstract

In digital multipoint deformation technology, the deformation surfaces of the punch of the die plate or both are divided into a number of pins, positioned vertically according to the geometry of the part to be obtained. The reconfiguration consists in carrying out a controlled axial displacement of each pin using computer-controlled mechanical or hydraulic systems. In digital multipoint deformation of the sheet metal, the deformed part, the deformation plan, the operating program of the technological system, as well as the control of the sheet metal deformation are configured, formalized and operationalized digitally. The paper presents after the characterization of the digital multipoint deformation technology, algorithms for configuring and reconfiguring multipoint dies. From this point of view, two stages are identified in the reconfiguration process, a virtual stage of the piece's execution and a real one, the two being closely related. In the virtual stage, the contact points model between the surface of the part and the hemispherical ends of the pins is designed. Having determined these points, the CAD model of the die is built and then the simulation model. There are presented the simulation results of the digital multipoint deformation process to reduce the spring back. Having as a criterion for assessing the quality, the part spring back, depending on the error admitted by the designer, either the process of building the virtual model is resumed, or it is passed, to the second stage of real manufacturing, by configuring the real deformation die. After the manufacture of the part, depending on the value of the spring back, it is possible to proceed either to the reconfiguration of the real die or to the manufacture of the respective part. Some experiments to implement multipoint die deformation in prototyping manufacturing are presented. Finally new solutions for digital reconfigurable multipoint dies are pointed out.

### Biography

Viorel PAUNOIU, Professor of Mechanical Engineering, graduated Faculty of Mechanical Engineering at Dunarea de Jos University of Galati (1984), PhD in Industrial Engineering, at Dunarea de Jos University of Galati (1998), Habilitation in Industrial Engineering 2023. His main academic competences are design of CAD technologies and equipment's for plastic deformation; numerical simulation of plastic deformation processes; unconventional technologies for plastic deformation; control and inspection in sheet metal forming. He is Director of the Research Center in Manufacturing, CCITCM from 2013 and Head of Cold Plastic Deformation Laboratory, Faculty of Engineering, Dunarea de Jos University of Galati. Prof. Paunoiu participated in over 35 research projects supported by Romanian Ministry of Education and Science; author/co-author of over 10 scientific or didactic books; over 120 scientific papers written or co-authored, published in indexed Journals and International Conferences proceedings; author/co-author of 6 patents. He was editor of the journal The Annals of Dunarea de Jos University of Galati, Fascicle V, Technologies in Machine Building. He is founder of the International Conference NEWTECH – New Technologies in Manufacturing. Member and local responsible of some important professional and scientific associations, from Romania and abroad.



## IMPACT OF BIOACTIVE COATINGS ON Mg-BASED ALLOY SURFACE

**Karol Kyzioł**

*AGH University of Krakow, Poland*

### Abstract

Magnesium alloys cover a wide range of applications in tissue engineering due to their low density, durability as well as biodegradation. The main advantage of Mg-based materials is that they avoid the additional surgical procedure to remove the implants after the tissue is healed. However, durability of these implants under the physiological environment depends on the interaction at the tissue-implant interface and generally leads to many complex physicochemical and biological processes. In this case, the application of intentional surface modification appears to be a practical approach to control the rapid degradation rate.

The research presents precise and prospective studies on the influence of bioactive coatings (chitosan enriched with caffeic acid or based on high-calcium glass) on functional properties of selected Mg alloy surfaces (AZ91D). The carried-out modifications aimed to improve these properties of the alloy (including reduction of the rate of biodegradation and improvement of the bio-functionality of the surface), finally increasing its applicability in implantology. The proposed research methodology was based on three following technological steps: (i) mechanical treatment of the surface alloy, (ii) chemical activation of the surface in Piranha solution and (iii) obtaining of bioactive coatings by immersion technique. The resulting functionalized substrates were precisely characterized by SEM-EDS analysis, optics profilometry, IR and Raman spectroscopy, wettability, ICP-MS and scratch tests. Special attention was also paid to the biological activity of the surface in vitro - cell cytotoxicity was determined on the MG-63 cell line along with SEM visualization. It has been shown, in the case of surface coatings based on bioactive glasses, the release rate of Al<sup>3+</sup> and Mg<sup>2+</sup> ions was ca. twice higher than for unmodified alloy. While surface deposition of chitosan with caffeic acid, after fourteen days of incubation in SBF solutions resulted in a positive effect on reducing the release rate of aluminum ions in an environment mimicking the physiological conditions.

**Acknowledgements:** This work was supported from the subsidy of the Ministry of Education and Science for the AGH University of Krakow (Project No 16.16.160.557).

### Biography

Karol Kyzioł is Professor at AGH in the field of Materials Engineering, Head of the Department of Physical Chemistry and Modelling and Head of Laboratory of Vapour Deposited Materials. His academic achievements consist of 121 published scientific publications, including 36 from the base of Journal Citation Reports (including 35 which were published after gaining his doctoral degree), the total IF is ca. 107. Prof. Kyzioł is also the co-author of two book chapters, "Handbook of Composite from Renewable Materials", Vol 4, Functionalization (2017, Wiley Scrivener) and "Surface functionalization with biopolymers via plasma-assisted surface grafting and plasma-induced graft polymerization - materials for biomedical application" in vol. "Biopolymer Grafting: Applications" (2018, Elsevier). Additionally, the results of his research were presented at 45 scientific conferences (including 34 international ones). He is a co-author of two patents (PL - 221932 B1, 2016) concerning a method of improving the mechanical properties of Al alloys and PL 236571 B1, 2021) which includes the use of a plasma chemical method to modify on lays for bumpers.





***Day-1***  
***Oral Presentations***

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## IMPLEMENTING A NOVEL DESIGN METHODOLOGY USING 3D SURFACE MODELS IN THE EARLY VEHICLE CONCEPT CREATION PHASE

**Maximilian Schmitz**

*Ilmenau University of Technology, Germany*

### Abstract

Worldwide, major upheavals can be observed in the automotive industry. Global trends such as electrification, automation of driving functions, digitalization, sharing services and sustainability are shaping the image of the future automobile and creating new forms of use. The battery-electric vehicle drive system as well as other alternative drive concepts also require the development of a new or adapted vehicle architecture. A smaller number of powertrain components plus a more compact design compared to combustion engines enable new interior concepts. Fully or highly automated vehicles allow the elimination of classic control elements, thus also enabling new interior concepts and types of use.

The development of future vehicle architectures in line with requirements, especially in the early concept phase, requires linked digital representations and validation of the vehicle. In this way, multiple concepts can be pursued and evaluated in parallel, allowing for a higher level of maturity at an earlier stage and reducing iterative loops. This results in a first digital twin in the concept phase, which is used for later digital twins of downstream disciplines.

This paper presents the implementation of a development methodology that uses an early three-dimensional generation of surface models already in the concept phase. These parametric surface models enable the rapid design of vehicle concepts of different vehicle classes through simple manipulation. Geometric parameters are assigned functional relationships by taking the requirements of downstream disciplines into account, which span solution spaces and make the model more differentiated to evaluate. The use of the single-source principle for the documentation of the requirements, the storage of model statuses and the validation of the models enables a collaborative way of working. Artificial intelligence methods can process this data and thus support future concept developments.

### Biography

Maximilian Schmitz MSc has completed his master studies in mechanical engineering with extensive courses in design and simulation at the Ilmenau University of Technology. After that he was part of the PhD program of the Daimler AG in Stuttgart, Germany, in cooperation with the Ilmenau University of Technology starting in the Engineering IT. He was working on internal methods and tools providing advantages in the very early phase of the vehicle concept phase. Afterwards he moved over to the Research and Development Unit of Mercedes Benz AG. There, he conducts research on calculation models and tools that enable a linked design of vehicle concepts. In particular, the requirements for the system as well as the interfaces within the various software tools are a central component.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## ANALYSIS OF CARDIOVASCULAR AND CEREBRAL INTERACTIONS IN RESPONSE TO COGNITIVE TASKS

**Verónica Janeth Martínez-Hernández**

*Universidad Autónoma de San Luis Potosí, Mexico*

### Abstract

Any stimulus, whether physical or mental, that disrupts in homeostasis and triggers its readiness to confront or escape a threat is considered a stressor. However, when it occurs frequently or for a prolonged period, it can cause cardiovascular alterations and maladaptive reactions. Due to the physiological changes associated with stress, various systems are involved in this process. First, the hypothalamus integrates information from sensory and visceral pathways, activating two classical stress pathways known as the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic-adreno-medullary (SAM) axis. Given the significant consequences of chronic stress, it is important to employ stress management techniques such as controlled breathing could be helpful to decrease the physiological alterations caused by prolonged stress levels. With the use of transfer entropy (TE), we can assess the interactions between the cardiovascular and cerebral systems and assess whether these interactions are affected by the application of controlled breathing. In this study, a test protocol was conducted consisting of the stages of rest, first cognitive task (mental arithmetic+Stroop), controlled breathing, second cognitive task (mental arithmetic+Stroop) and recovery. The goal was to evaluate changes in TE between maneuvers in 17 healthy volunteers. The results showed that most interactions were from brain to heart in both cognitive tasks and that the sympathetic pathway was the most affected. In addition, a higher number of significant interactions from the heart to the brain in the second cognitive task after applying controlled breathing, specifically from the vagal part. This suggests that controlled breathing is indeed influencing task, but further training in the breathing technique is needed to find possible significant differences between the tasks.

### Biography

Verónica Janeth Martínez-Hernández has completed her bachelor's degree in biomedical engineering from the Autonomous University of San Luis Potosí and is currently pursuing a Master's in Life Sciences at the same university, in the final semester of the program. She has experience in biomedical signal processing and clinical engineering. She has published 2 articles in reputable journals and has participated in various biomedical engineering conferences in Mexico organized by the Mexican Society of Biomedical Engineering (SOMIB).

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## A FORGERY DETECTION SYSTEM FOR PALM VEIN RGB IMAGE RECOGNITION BASED ON RES NET

Shi Jinn Hong<sup>1</sup> and Tien Yu Tai<sup>2</sup>

<sup>1</sup>Asia University, Taiwan

<sup>2</sup>National Taiwan University of Technology and Science, Taiwan

### Abstract

Currently, biometric technology is widely used, including face recognition in mobile phones, fingerprint recognition and finger vein recognition in ATM. MPSnet is a low-cost mobile phone palm vein recognition system using RGB images, which enhances palm vein texture using the saturation channel instead of the red channel. To address non-contact smartphone capture challenges, it employs an improved ROI extraction method based on convex hulls and a new key vector approach.

However, we propose an alternative using ResNet for palm vein recognition, a widely adopted deep learning architecture known for its speed and accuracy. Our experiments show that using ResNet18 and ResNet34 significantly speeds up palm vein recognition, by 7.8 times and 4.17 times, respectively, compared to MPSnet.

Furthermore, we address security concerns by simulating potential attacks, such as stealing low-resolution palm images and using Super Resolution technology to compromise the system. To defend against this, we use the Tongji dataset and the SwinIR Super Resolution model to create a synthetic palm vein database and train a deep learning model to detect Super Resolution usage, enhancing system security while keeping costs low.

**Acknowledgment:** This work was supported in part by the National Science and Technology Council under contract numbers 111-2221-E-011 -134 -, 111-2218-E-011 -011 -MBK, 112-2221-E-468 -023 -.

### Biography

Shi-Jinn Horng (also known as Hsi-Chin Hung) received the B.S. degree in Electronics Engineering from National Taiwan Institute of Technology, Taipei, the M.S. degree in Information Engineering from National Central University, Taiwan and the Ph.D. degree in Computer Science from National Tsing Hua University, Taiwan, in 1980, 1984 and 1989, respectively. He was a Professor and Dean of the College of Electrical Engineering and Computer Science, National United University, Miaoli, Taiwan from 2006 to 2009. He was the department head and also Chair Professor of the Department of Computer Science and Information Engineering, National Taiwan University of Science and Technology from 2013 to 2016 and currently, he is a Chair Professor in the Department of Computer Science and Information Engineering, Asia University. He spent his sabbatical years as a Visiting Professor at the School of Computer Science in University of Technology Sydney, Sydney, in 2019; Department of Computational Intelligence and Systems Science, Tokyo Institute of Technology in 2008; Department of Computer Science at Georgia State University in 2007; Computer Science Department, University of Dayton, Ohio, in 2000; Institute of Information Science, Academia Sinica, in 2001; National Mongolia University, in 2004; Institute of Mobile Communications, Southwest Jiaotong University, in 2004. He also worked as a PMTS at AT&T Bell Laboratories from 1990 to 1991. His research interests include Deep learning, Biometric recognition, Multi-medium, Image processing, Information security. He has published more than 300 research papers and received many awards; especially, the Distinguished Research Award between 2004 and 2006 from the National Science Council in Taiwan; Outstanding I.T. Elite Award, in 2005; Outstanding EE Prof. Award, the Chinese Institute of Electrical Engineering; The Best Paper Award from IEEE Transactions on Industrial Informatics, in 2011; and the Outstanding Research and Invention Award between 2006 and 2008 from National Taiwan University of Science and Technology. Also he was promoted to the Chair professor in National Taiwan University of Science and Technology in 2016.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## CALIBRATION OF A FINE DUST CONCENTRATION MEASUREMENT DEVICE USING NEURAL NETWORKS

**Jörg M. Hoffmann**

*UAS Osnabrück and EUIL, Germany*

### Abstract

Devices available on the market to measure particulate matter are too expensive to deploy them with high spatial resolution. Here we present a particulate matter measurement device, which is based on low-cost sensors and low-cost electronic, but calculating the results with Artificial Intelligence. In the past, the particle concentration was determined by primary gravimetric working measurement devices. This devices are slow and expensive. Current available devices are based on optical principles. They are fast and much more cheaper. But they determine primary the number concentration and not the mass concentration. We show that a calibration with a Neural Network from the number concentration to the mass concentration is possible for a comparable particle population. The influence of humidity and temperature to the size of the particles is also included in the calibration. The replacement of expensive Hardware by Artificial Intelligence makes it possible to achieve a high spatial and time resolution when monitoring particulate matter concentrations.

### Biography

Jörg M. Hoffmann, Studies of Technical Cybernetics and Automation Technologies with the degree Dipl.-Ing., Doctorate in the field of particle measurement technology with the degree Dr.-Ing. for Metrology, Measurement and Instrumentation. Professor for Electrical Measurement Techniques, Industrial Measurement Techniques and Analysis Measurement Techniques. Focus: Particle measurement techniques. President of the "European Institution for Air Quality". Head of the Laboratory for Metrology and Measured Data Processing (LMM) at the University of Applied Sciences of Osnabrueck. Guest professorships at the University of Sunderland (UK) the University of Angers (France), the Nanjing Xiaozhuang University (China) the Yuncheng University (China) and the UTHM (Malaysia). Professor of honours (Prof. h.c.) at the University of Mechanical Engineering (MAMI) Moscow, Russia. Head of the working group Measurement and Automation Technologies of the Osnabrueck-Emsland section of the German Engineers Association (VDI). Medal of Honours of the VDI. Numerous publications and scientific expertise, among others for all instances of the patent jurisdiction including the Federal Patent Court. Published 5 books, among others the Handbook- and the Pocketbook of Metrology, Measurement and Instrumentation and holds 12 patents.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## ADVANCES AND PROSPECTS OF LIQUID IMMERSION COOLING FOR HIGH-PERFORMANCE COMPUTING

**Xiaohong Han**

*Institute of Refrigeration and Cryogenics, Zhejiang University, China*

### Abstract

The digital economy has led to a growing demand for high heat flux and high-performance electronic devices in the data center industry. However, this also brings thermal management issues that need to be addressed. Similarly, in the field of new energy vehicles, electric vehicles use batteries with high specific power and high specific energy density. These batteries require efficient thermal management methods for energy storage applications. Another area that relies on effective thermal management is the development of new energy storage technologies, such as lithium-ion battery energy storage. Immersion liquid cooling technology is a promising thermal management method that has many advantages, such as strong heat dissipation capability, high temperature uniformity, safe and reliable operation. Therefore, this technology has attracted a lot of attention in data centers, power batteries, new energy storage and other fields. In this report, the development history of immersion liquid cooling systems is reviewed and their capabilities and application potential in two scenarios are given: data center thermal management and power battery thermal management.

### Biography

Han Xiaohong is a full professor at Institute of Refrigeration and Cryogenics, Zhejiang University. Research interests are within the areas of refrigerant replacement, refrigerant leakage, refrigerant recovery and reclamation; high heat flux cooling technology (heat pipe, microchannel cooling and immersion cooling technology for data centers, power batteries and energy storage).

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## A MACHINE LEARNING-BASED ESTIMATION OF ANTHRACNOSE OCCUPANCY RATIO BY CONVERSION FROM VOLUMETRIC TO PLANAR MANGO FRUIT IMAGE

**Hsiao-Wen Wang, Yao-Cheng Chan, Yi-Jo Shen, Yu-Jen Shiau, Xin-Yun Jiang, Yu-Ting Fu and Roy Chaoming Hsu**

*National Chiayi University, Taiwan*

### Abstract

To improve the efficiency and accuracy of estimating the Anthracnose occupancy ratio (abbreviated as AOR, hereafter) of Mango fruit in real-time, this study employed a machine learning method and used 'Wan Li Shiang' mango as the model mango. The whole fruit is photographed first and then it is cut in half, the flesh is removed and the pericarp is set flat for photo taking. The actual AOR on the pericarp of both the photo-taken whole fruit and the flatten one are first calculated using image processing to develop a training set and the linear regression of machine learning is employed by training with the AOR training set to establish the regression model applicable to the 'Wan Li Shiang' mango in estimating the AOR of a testing whole fruit photo. Experimental results exhibited that by employing the proposed machine learning method, the AOR error between the photo of the real and the estimated flatten pericarp is less than 1% and is satisfactory by the horticulture scientists. If the proposed method is designed into an App on the smartphone, it not only will be a valuable supporting tool for the commodity trading in real-time, but it also can be an intelligent assistant tool for the horticultural researchers to enhance the efficiency of the research.

### Biography

ROY CHAOMING HSU received the M.S. and Ph.D. degrees in electrical engineering from the Pennsylvania State University, PA, USA, respectively in 1991, 1995. He also received the M.S. degree in engineering management from National Tsing Hua University, Hsinchu, Taiwan in 2001. His expertise is in machine learning, image processing, pattern recognition, embedded system and engineering management. He is currently a professor in the Electrical Engineering Department and serves as the Dean of the College of Science and Engineering, National Chiayi University, Chiayi City, Taiwan.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## COOPERATIVE AND COORDINATED MOBILE FEMTOCELL TECHNOLOGIES IN HIGH-SPEED VEHICULAR ENVIRONMENTS

**Rand Raheem**

*Middlesex University, United Kingdom*

### Abstract

In forthcoming networks, the predominant users accessing wireless broadband are anticipated to be those in vehicles and public transportation. Assuring an uninterrupted high Quality of Service (QoS) of railway communications between onboard users and base stations creates challenges for the service provider. This is partly explained by the inherent mobility and the high penetration loss of carriages. Thus, Addressing the cost-effective service provision and enhancement of signal quality for these users has been a focal point in numerous studies. Deploying Mobile Femtocell (Mobile-Femto) technology on public transportation emerges as a promising solution to improve the coverage performance of public transportation passengers. These small cells work efficiently in areas that suffer from high penetration loss that goes up to 40 db and high path loss as QoS on board can be dramatically affected and worsened within the railway transportation systems. However, despite the advantages this technology offers for its users; Mobile-Femto introduces challenges related to mobility and interference. Therefore, the primary objective of this work is to address the elimination of Vehicular Penetration Loss (VPL) and interference with the presentence of the new femtocell technology, concurrently enhancing signal quality and mobility for passengers on trains. The initial assessment at the system level demonstrated that dedicated Mobile-Femto deployment holds significant potential for enhancing user experiences within public transportation by improving the throughput and communication link quality. In addition, to address the interference challenges, the Downlink (DL) results from the Proposed Interference Management Scheme (PIMS) that accompany the proposed Mobile-Femto exhibited substantial improvements in Mobile-Femto Users gains, reaching up to 50%, without detrimentally affecting the performance of Macrocell Users. Conversely, the Uplink (UL) results showcased noticeable gains for both Macrocell Users and Mobile-Femto Users. This work has won the United Nations Prize where it is seen to tackle some of the world's greatest challenges.

### Biography

Rand Raheem has completed her PhD in Vehicular Environments from Middlesex University. She is also presuming a position as a lecturer and researcher at the Faculty of Science and Technology at Middlesex University. Dr. Raheem has developed a comprehensive research portfolio encompassing various areas, such as Future Trends of Wireless Networks, Performance Analysis of Vehicular Environments, Networks Management, Internet of Things and Wireless Sensor Networks. Her prolific work in these fields is reflected in numerous publications. Recognizing her outstanding contributions. Dr. Raheem was honored with the Academic Staff Member of the Year Award in 2018 and again in 2021. She has also won the United Nations prize and her research continues to attract researchers/organizations from around the world. Finally, she is an active research member in many research groups and an active reviewer for well-known journal publishers. She is willing to continue to take part in the research community to solve the world's most critical challenges.



# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## ATRIAL FIBRILLATION AND SINUS RHYTHM DETECTION USING TINY ML (EMBEDDED MACHINE LEARNING)

**Guilherme Vilas Boas Ferreira da Silva**

*Federal University of Itajubá, Brazil*

### Abstract

Given the various technologies used to measure and detect cardiac arrhythmia, this project proposes using Tiny ML (Embedded Machine Learning) for atrial fibrillation and normal sinus rhythm classification. The machine learning model is going to be deployed in a microcontroller to bring a small, efficient and straightforward prototype for the desired purpose. The proposed architecture of the neural model was composed of convolutional networks (CNN), where the input data from the PTB-XL database went through some pre-processing steps, such as filtering and dividing the temporal records into individual heartbeats. The prototype execution in the embedded environment was developed and carried out using the ESP32 development board. The results obtained verified that the model reached an overall accuracy of 94.1% and 94.04% in the training and test stages, respectively. In contrast, it got an overall accuracy of 99.33% in the microcontroller prototype inference, with data extracted from an advanced patient simulator that reproduces different cardiac signals.

The main point confirmed by the work was the use of the Tiny ML technique that allows the classification algorithm to be embedded in a small processor. Despite being a new technology, it already shows its potential mainly in the medical area, in applications where processing and memory are critical. At the same time, it remains operating with a high degree of accuracy and classification speed. Furthermore, this solution can offer other benefits such as low latency, reduced bandwidth, reliability and greater security. It was concluded that obtaining an efficient, small and simple machine learning prototype that works successfully in a microcontroller such as ESP32 is not only feasible but also viable, even for a critical issue that involves human health.

### Biography

Guilherme Vilas Boas Ferreira da Silva he has completed an electronic engineer graduated from Federal University of Itajubá, working as a software developer in R&D of automation projects at Samsung Electronics. Olympic medalist in applied mathematics, I participated in social projects to teach electronics to needy communities and I had worked in a junior technology company. I had the article "Atrial Fibrillation and Sinus Rhythm Detection Using TinyML (Embedded Machine Learning)" published in volume n° 100 of IFMBE (International Federation for Medical and Biological Engineering) Proceedings, covering the ninth Latin American Congress of Biomedical Engineering and twenty-eighth Congress Brazilian Biomedical Engineering, whose theme was biomechanics, biomedical devices and assistive technologies.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## COMPLEX ACCESS SCENARIOS (CAS) SERVICE REQUEST

**Rahmira Rufus**

*Florida University of North Carolina, USA*

### Abstract

A complex access scenario (CAS) is an access event-modeling scheme that focuses on contextual and situational awareness addressing the service concerns arising for complex systems. The CAS is structured in the form of a service request establishing the following criteria: (1) satisfies classification for complexity, such as properties, characteristics, conditions, etc.; (2) concatenates the access criteria to the complexity class; otherwise, downgrades the class to complicated; and (3) confirms that the request is system generated. The significance of this work involves maturing the request analysis process within CAS to identify an effective knowledge representation scope for how to develop schemas that are applicable to the associations described in given operating environments. The scope of this work is associating CAS to human-computer interaction (HCI), where the human-in-the-loop element of this use case begins to play a factor in the complexity of the system service request. Our method surveys HCI usability factors to identify CAS service requests applicable to usage scenarios in the HCI space that address system complexity. The goal is that with increased CAS comprehension and application, networking components and their specific utilization are used effectively and securely in complex computing operating environments, which still suffer from ambiguous workload requirements. The purpose of this work and future iterations that follow are to place more emphasis on the CAS topic by demonstrating how CAS addresses access scenarios specific to complex computing environments like HCI.

### Biography

Rahmira Rufus holds a Ph.D. in Computer Science from North Carolina A&T University and is the visionary founder of AWT Solutions LLC, a dynamic cyber-R&D venture. Her dissertation, "Intrusion Detection via Neuroception for an Autonomic Internet of Things," paved the way for her multifaceted role as CEO, professor and Post-Doc Fellow at UNC Wilmington. Dr. Rufus wears multiple hats, juggling an adjunct professor position for four years at North Carolina A&T and currently as a Post-Doc Fellow at UNC Wilmington, developing and increasing cybersecurity utilization as an interdisciplinary study and improving the pipeline between the cyber industry and academy.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## NEW PERSPECTIVES IN COUPLED STABILITY ANALYSIS, DESIGN AND REFURBISHMENT OF RETAINING STRUCTURES IN STEEP SLOPES

**Jörg-Martin Hohberg**

*IUB Engineering AG, Switzerland*

### Abstract

According to Kurrer's «History of the Theory of Structures», Georg Rebhann from Vienna was the first to distinguish in 1850 between active and passive earth pressure, i.e. the dependability of mobilized earth wedges on wall kinematics. A slope stability analysis by the «Method of Slices» also requires an a-priori guess of the slip surface with subsequent variation for determining the limit equilibrium state.

In nonlinear Finite Element Analysis (NLFEA), in contrast, the critical failure mode for arbitrary kinematics is found automatically by reducing the strength parameters in the slope. The idea to model a retaining structure as hard inclusion seems obvious and provides an uniform approach to reinforced earth. The retaining structure is no longer dimensioned with characteristic soil properties and multiplication of loads by a safety factor, but rather the soil properties are reduced to explore the ultimate limit state directly, with ensuing sectional forces in the retaining structure. Since this involves highly nonlinear analysis at the verge of instability, this so-called «input factoring» is computationally much more demanding than conventional analysis («output factoring»).

On the plus side, this approach can also deal with very steep slopes, where conventional analysis fails. Because retaining structures in mountainous regions are rarely erected on a horizontal plane but by cutting back the existing hillside, a potential slip surface will cross both the backfill and the in-situ ground. Assessing the stress state around a retaining structures requires to establish first the primary stress state in the natural slope, followed by the simulation of human interventions to date (man-made or secondary stress state). The present configuration is then used to validate the soil parameters and to compare the current strength utilization to that of planned refurbishment, which should increase and not reduce the slope stability. The NLFEA model thus serves as digital twin.

### Literature

- J.-M. Hohberg, Rehabilitation of earth retaining wall for slope failure due to strength reduction and seismic acceleration, considering nonlinear soil-structure interaction. IABSE Symp. *Challenges for Existing and Oncoming Structures*, Prague/Czech Republic (May 2022). IABSE Report Series.
- J.-M. Hohberg, Computing retaining structures in steep slopes by reducing M-C strength parameters to failure. Invited lecture, Internat. Conf. on *Geosynthetics and Environmental Engineering* (ICGEE), Jeju Island / Sth. Korea (March 2023). SPRINGER Lecture Notes in Civil Engineering.

### Biography

Jörg-Martin Hohberg studied Structural Engineering at TU Berlin and Imperial College London. After two years with Dyckerhoff & Widmann AG in Munich he joined the IBK at ETH Zurich for a PhD on the nonlinear seismic behaviour of concrete arch dams. Since 1991 he has been working with IUB Engineering AG in Berne on hydropower caverns, the Lötsch-berg railway base tunnel, flood relief galleries and retaining walls, where he developed the methodology presented here. He is a long-time member of DGGT (AK 1.6 Numerics in Geotechnics) and joined the IABSE and FIB groups on Forensic Engineering. He was invited speaker at the ICGEE2023 in South Korea and lectures in a current webinar series on case studies by the Indian Association of Structural Engineering (IAStructE). He chairs the TG Quality of the FIDIC Business Practise Leadership Committee and serves also at the European Monitoring Committee of Engineers Europe, responsible for vetting study programmes and awarding the EUR ING certificate.

## STATISTICAL INFERENCE OF THE BETA GENERALIZED INVERSE RAYLEIGH DISTRIBUTION

**Rana Ali Bakoban and Ashwag Mohammad Al-Shehri**

*University of Jeddah, Saudi Arabia*

### Abstract

Modeling and analysis of lifetime phenomena are important aspect of statistical work in a wide variety of scientific and technological fields. In the context of modeling the real-life phenomena, continuous probability distributions and many generalizations or transformation methods have been proposed. These generalizations obtained either by adding one or more shape parameters or by changing the functional form of the distribution, it makes the models more sufficient for many applications. A new generalization of the inverse Rayleigh distribution is presented in this article. The new model is called the beta generalized inverse Rayleigh distribution, which belongs to the lifetime distributions. The estimation of the parameters by the method of maximum likelihood and the Bayesian method under complete samples are discussed. Also, The estimation of the reliability and hazard functions are considered. Maximum likelihood estimators for the four unknown parameters of BGIRD are obtained. The Fisher information matrix for the maximum likelihood estimators is derived. Further, the Bayes estimators are studied using two techniques; standard Bayes and importance sampling. The estimators obtained under two types of loss functions; squared error loss function and linear exponential loss function. A simulation study is presented to study the performance of the estimated parameters. The performance of the estimators has considered in terms of their absolute relative bias and mean square error. The simulation shows consistency for the estimators of the parameters. Finally, the distribution was applied to five real data in different fields. Our applications are carried out in medicine, physics, industrial and engineering fields. As well, the distribution is compared with other models using information criteria. Our model shows the best fitting for the real data.

### Biography

Rana A. Bakoban has completed his PhD in Mathematical Statistics by King Abdulaziz University. She has worked as a professor of Mathematical Statistics at University of Jeddah. She has published more than 40 papers in reputed journals and has been serving as a vice president of University of Jeddah for the Economic Impact Program.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## WALSH FUNCTIONS, DYADIC ANALYSIS

**Rodolfo Toledo and Ferenc Schipp**

*L. Eötvös University, Hungary*

### Abstract

A hundred years ago, N.J. Walsh published a paper in which he constructed, in today's modern parlance, a digital version of the trigonometric system. He defined an orthogonal system, taking only the values 1 and -1, which is identical to the systems  $\cos(nx)$ ,  $\sin(nx)$  in the number of sign changes. The Walsh functions can be represented in computers with absolute precision and the signals can be reconstructed from coefficients based on this system by fast and efficient algorithms. This feature has encouraged researchers to replace the use of the trigonometric system by the Walsh system in data transmission. From the 1970s onwards, several conferences were organized on this subject and numerous books have been published on the applications. In this process, the Austrian researchers H.F. Harmuth and F. Pichler played a decisive role.

The Walsh functions correspond to the trigonometric functions on the dyadic field constructed from bits, the research on this topic is usually referred to as dyadic analysis. These studies influenced several areas within mathematics (such as the theory of martingales and logic functions, and the construction of wavelets) and also applications such as computer science and signal and image processing. Dyadic analysis includes all the basic concepts and techniques that are used in trigonometric Fourier analysis and its applications. These include Fourier series, Fourier transform, dyadic convolution, dyadic derivative, FFT algorithms, continuity, the dyadic analog of important function spaces, and summation methods that play an important role in filtering signals. In this regard, besides Hungarian researchers, the works of American, Russian, German and Serbian researchers have also made a major contribution.

In our talk we will show some applications. Beside the dyadic field, we will also deal with another field (the 2-series field) which can be obtained from the dyadic rational numbers (based on the usual addition and multiplication). We will discuss its applications in numerical mathematics.

### Biography

Ferenc Schipp studied mathematics and physics at the L. Eötvös University, Budapest and graduated in 1962. He received the Doctor of Science degree in 1976 with a dissertation on expansion with respect to multiplicative systems. He was the head of the Department of Numerical Analysis at the L. Eötvös University in Budapest and the head of the Department of Mathematics at the University in Pécs. He is currently Professor Emeritus at the L. Eötvös University. He has published papers in the areas of harmonic analysis, martingale theory, approximation theory, numerical methods and functional analysis. He has written (jointly with W.R. Wade, P. Simon, and J. Pál) a research monograph, "Walsh Series; An introduction to dyadic harmonic analysis" (Adam Hilger, Ltd., 1990).

Rodolfo Toledo studied mathematics at the University of Debrecen and graduated in 1990. He received his PhD degree in harmonic analysis in 2005 with a dissertation on representative product systems (a generalization of Walsh functions). He was the head of the Department of Mathematics and Computer Science at the University of Nyíregyháza, and he is currently an associate professor of the Department of Numerical Analysis at the L. Eötvös University in Budapest.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## USE OF OWWO SOLUTION (DEGASSED HIGHLY OZONATED WATER) ON THE PILOT PLANTS AND THE TECHNOLOGICAL IMPLEMENTATIONS IN THE INDUSTRY

**Bogumiła Winid**

*AGH University of Krakow, Poland*

### Abstract

The growing public awareness stimulated, inter alia, by advances in analytical methods, has caused the rising demand for better-quality water- both in terms of micro-biological, physico-chemical and organoleptic parameters. The predominant and widely applied disinfection agent is still chlorine, mostly used in the form of sodium hypochlorite or chlorine dioxide, though water disinfection with ozone is becoming increasingly popular. Local water treatment plants (WTPs) treating low-quality source waters need to apply high doses of disinfection agents. To reduce chlorine dosage, the ozonation step as the OWWO solution is introduced concurrent to chlorination at the end of the water treatment line. The OWWO technology is widely used in water management. This chlorine alternative was awarded in 2021 on the Bled Water Festival as a water innovation.

This paper summarises the studies undertaken at the water treatment plant in Skawina (WTP Skawina) where the disinfection process was modified by introducing a mobile ozonation system and at other pilot plants that used this technology for determining the optimal parameters of processes, such as the concentration of residual ozone in highly ozonated water, the duration of the processes and the reduction of microorganisms.

Application of a small-size, fully-automated ozonation installation adds only a minor complication to the water treatment process, without the need to re-design the water treatment line and with relatively low investment costs. Thus treated water had excellent quality and seasonal variations of raw water parameters (variable organic matter contents) did not result in elevated THM and bromate concentrations.

### Biography

Bogumiła Winid graduated from AGH University of Krakow, Faculty of Geology and Prospecting. Since 1987 she has worked at the Faculty of Drilling Oil and Gas in Department of Petroleum Engineering. Her research interests have focused on mineral waters, salt and mine waters, quality and chemistry of water, particularly the role of bromine as a water quality indicator of aquatic environment. In addition to those mentioned, her scientific activities have included: environmental aspects of exploration and exploitation of hydrocarbon deposit and ground water wellhead protection zones and analytical methods for their delineation. Her doctoral thesis was on brine leaks encountered in salt deposits from Wieliczka Salt Mine (AGH University 2003). She received her postdoctoral degree in 2019 ("The role of bromine as a water quality indicator of aquatic environment") AGH University. She has published more than 80 research papers.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## TRANSFORMATIVE TECH: EXPLORING THE IMPACT OF AI ON BIOMEDICAL ENGINEERING PRACTICES

**Adrian Victor VEVERA, Lidia BĂJENARU and Elena-Anca PARASCHIV**

*National Institute for Research & Development in Informatics - ICI, Romania*

### Abstract

In the digital era, the convergence of artificial intelligence (AI), digital transformation and biomedical engineering is seen to forge new pathways in healthcare. Biomedical engineering, a leader in healthcare innovation, enhances diagnostic accuracy, therapeutic interventions and patient outcomes. The integration of AI into this field is catalyzing unprecedented advances across various domains, including medical diagnostics, personalized medicine and healthcare accessibility. This transformative impact is driven by AI technologies such as machine learning, deep learning or natural language processing techniques which significantly improve the accuracy of diagnostic imaging and the customization of treatment plans. This paper examines how digital tools enable the seamless integration of diverse data sources, fostering the creation of sophisticated AI models that accurately predict disease trajectories and treatment efficacies. Key case studies are presented to demonstrate AI's role in enhancing real-time monitoring and decision-making in clinical settings, markedly reducing errors, and elevating the quality of patient care. Furthermore, it is shown that AI-augmented biomedical devices refine their functionality and provide healthcare professionals with adaptive tools tailored to individual patient needs. Such adaptability is pivotal for advancing predictive, personalized and precise medicine. Despite the promising advancements, it is essential to address the ethical implications of AI in biomedical engineering, including concerns over data privacy, security and the necessity for comprehensive regulatory frameworks to ensure responsible technological innovation. In conclusion, the analysis demonstrates that the merger of digital transformation with AI in biomedical engineering is indispensable. It is depicted as a fundamental shift that promises to catalyze future innovations and enhance the sustainability of health systems. Through this exploration, it is argued that embracing this technological confluence is essential for realizing the next generation of medical breakthroughs and achieving more effective healthcare solutions.

### Biography

Adrian Victor VEVERA, Eng. Ph.D., with 3 PhDs in Military and Information Sciences, Information and National Security and Industrial Engineering, has extensive experience in the fields of national security, critical infrastructure protection, cybersecurity, cyber diplomacy, IoT, Metaverse, blockchain technology, digital transformation, TLD, HPC. Mr. Vevera is General Director at ICI Bucharest. He managed 11 research projects and 80+ research papers. He is Editor-in-chief of Romanian Journal of Information Technology and Automatic Control and Romanian Journal of Cyber Security, member of Senior Editorial Board of Studies in Informatics and Control, Founder Editor of International Journal of Cyber Diplomacy, and Vice Chair in the Board of International Council for Information Technology in Government Administration (ICA). Mr. Vevera is also a member of the Advisory Board of the European Security and Defense College and he is the national representative in: ICA, European Open Science Cloud, Ad Hoc Committee on Artificial Intelligence, ICANN

Lidia BĂJENARU, Eng. Ph.D., Senior Researcher at "Communication, Digital Applications and Systems" Department of ICI Bucharest. She also is as Senior Researcher at the Research Infrastructure – PRECIS and is a member of the Artificial Intelligence and Multi-Agent Systems Laboratory, Faculty of Automatic Control and Computers at the National University of Science and Technology POLITEHNICA Bucharest. She received a B.S. Eng. in Computer Science from "Gheorghe Asachi" the Technical University of Iași, Faculty of Electrotechnics, Automation and Computer Science. She received the PhD degree from Bucharest University of Economic Studies, Faculty of Cybernetics, Statistics, and Informatics. She has relevant experience in the field of e-Health, e-Learning, Internet of Things, Artificial Intelligence, Computer Ontologies, E-Services, Cloud Computing, Web Applications, Software Development, Data Management, Human-Computer Interaction (HCI). Her publication record includes more than 120 peer-reviewed papers. She coordinated and was a member in research teams in more than 40 national and international projects.

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# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

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Elena PARASCHIV serves as a scientific researcher within the Artificial Intelligence (AI) Laboratory at the National Institute for Research and Development in Informatics - ICI Bucharest, Romania. She is also a PhD candidate at the Faculty of Electronics, Telecommunications and Information Technology from the National University for Science and Technology Politehnica Bucharest and she has a particular interest in the healthcare sector, focusing on integrating AI technologies within the eHealth domain. Her work encompasses the development and application of advanced AI methodologies, including large language models and deep learning, across various sectors. She actively engages in both national and international research projects with the aim of advancing knowledge and fostering innovative solutions within the field of AI in Romania.



# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

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## CREATION OF CONCEPTUAL SOLUTION ENVIRONMENTS FOR SPECIFIC DESIGN TASKS

**Hrayr Darbinyan**

*G-Coder LLC, Armenia*

### Abstract

Design tasks in mechanical engineering vary significantly for each industry and production. Except for the terminology and specific design tasks and objectives, the environments also vary structurally, defining completely different functional targets for the mechanical structures based on the same mechanical subsets. The core idea of the task-based conceptual design method, which is based on the task required decomposition or integration of the structural components of conceptual design, allows to guide the necessary modifications for both structural and functional subsets for drawing them into the needed formats suitable for specific industries and productions. The paper presents the detailed methodology of such modification and validates the approach by setting the structural and functional environments for a medical and homeowner utility design environment.

### Biography

Hrayr Darbinyan completed his PhD in Mechanical Engineering at the Moscow University of Railway Engineers in 1989. He has worked as a professor of the Machine Building Department at the State Engineering University of Armenia and as a Guest Lecturer at Shanghai Jiaotong University. Dr. Darbinyan is a long-term industrial engineer, inventor, researcher and new product development and industrial implementation professional in Yerevan Machine Building Research Enterprise and Shanghai Hand-tool and Hardware Kunjek Company. He has published over 30 papers and book chapters in reputed journals and is the author of over 80 international patents. Dr. Darbinyan has been a technical director at G-Coder LLC, Yerevan, Armenia.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## IMPROVED DESIGN TOPOLOGY FOR PLC PERFORMANCE USING SYSTEM GENERATOR

**Kasim Karam Abdalla**

*Florida University of Babylon, Iraq*

### Abstract

The power line media has been used for transmitting information that named Power Line Communication (PLC). This paper proposed topology based on field programmable gate array (FPGA) by using System Generator and Vivado for improving the design and implementation of the PLC system based orthogonal frequency division multiplexing (OFDM) and Turbo code. The design implements OFDM and Turbo code using Matlab and Very High Speed Integrated Circuit Hardware Description Language (VHDL) programming language generated from System Generator, also are synthesized in a (FPGA) that acts as a design core processor. Simulation analyses of the system have been done which show flexible and good performance design. All the hardware result summaries of synthesis, implementation, time, power, utilization, size and package of the FPGA show reasonable usage from gates and times are 3ns in the worst case, while 0.008ns in the best case as well as less power consumption that produces 0.257W. By comparing with previous works, the proposed PLC system has better speed and reliable performance. The software implementation is made by Matlab/ System generator and Vivado programs, while the hardware implementation is achieved by FPGA and PLC boards, where the internal frequency source achieved with 220 MHz.

### Biography

Kasim Karam Abdalla received B.Sc. in electrical engineering and M.Sc. in Communication Engineering from University of Technology, Baghdad, Iraq and Ph.D. from Jamia Millia Islamia, Delhi, India. He has been with Department of Electrical Engineering, Engineering College, University of Babylon, Iraq since 2006. His scientific degree is Professor and research interests include communication electronics, analog and digital signal processing and analog integrated circuit design.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## XPS++: A PUBLISH/SUBSCRIBE SYSTEM WITH BUILT-IN SECURITY AND PRIVACY BY DESIGN

**Noor Ahmed**

*Air Force Research Laboratory/RIS, USA*

### Abstract

Publish/Subscribe (pub/sub) is an information dissemination paradigm that has emerged as a popular means of disseminating time-sensitive filtered messages across large number of clients mediated by a broker(s). The loosely coupled abstraction nature of pub/sub systems requires both the filters and the data in clear text to be brokered efficiently. This poses security and privacy challenges for many applications, especially when it's deployed in public cloud platforms. This article presents a content-based pub/sub middleware system designed to securely broker/filter XML data/events over insecure computing platforms without the complexities of the traditional cryptographic approaches (i.e., homomorphic encryption). A combination of Micro-services-based pub/sub service implementation and hashed filters and metadata is employed to simultaneously achieve security and privacy objectives by design. To illustrate the practicality of the solution scheme, we discuss the design and implementation of a system prototype, dubbed XPS++ and show a preliminary performance result.

### Biography

Noor Ahmed is a Senior Computer Scientist at the Air Force Research Laboratory's Information Systems Division (AFRL/RIS) in Rome, NY since 2003. Dr. Ahmed received his bachelor's degree from Utica College in 2002, master's degree from Syracuse University in 2006, and PhD from Perdue University in 2014, all in computer science. His research area is in Computer and Information Security with special emphasis on Cloud Computing Security and Privacy, Network Security, Peer-to-Peer, Publish/Subscribe, Micro-Services, Blockchain, and Internet of Things (IoT) Security. He has published over 50 papers and journal articles on these research areas and has been serving TPC for conferences and a reviewer for IEEE and ICM journals.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## DEVELOPMENT OF SAFE, ENVIRONMENTALLY – FRIENDLY AND SUSTAINABLE SMALL SCALE GOLD MINING METHODS IN GHANA

**Akuba Bezeba Yalley**

*University of Mines and Technology, Ghana*

### Abstract

The economics, safety and environmental sustainability of a mining operation depends on the choice of a suitable mining method. Mining method is the general approach employed in exploiting the orebody whereas mining method selection is the multi-criteria decision making process involving the matching of the characteristics of an orebody to the attributes of a mining method. In Large Scale Gold Mining (LSGM) operations, different mining methods have been developed based on engineering, science and technological principles that account for the geological, mineralogical and geotechnical attributes of the ore and country rocks. In Small Scale Gold Mining (SSGM) operations, mining methods employed typically exclude engineering judgements with no accountability of the orebody and country rock properties. This situation accounts for low ore recovery, environmental degradation and safety hazards. The miners employ any abecedarian method to exploit the ore which result in ground failures and subsequently lead to fatalities. Thus, this paper aims to develop suitable mining methods for the SSGM sector to improve socio-economic, environmental and safety outcomes. The paper employed the use of Geovia Surpac to design five mining methods for the deposit types identified to be exploited for SSGM operations in Ghana.

### Biography

Akuba Bezeba Yalley is a Lecturer at the Mining Department of the University of Mines and Technology, Ghana. She holds an MPhil in Mining Engineering and a BSc in Mining Engineering from the same university. She is currently a PhD Mining Engineering student at the same university. She has over seven years working experience in Large Scale Gold Mining operations in Ghana with majority of her experience being in underground operations. Her research interests are in mine planning and design and sustainable small scale mining operations, where she has some publications to her credit.

***Day-2***  
***Keynote Presentations***



## RELATIONSHIP BETWEEN BOPING AND INTRINSIC DEFECTS IN UWBG SEMICONDUCTORS THE CASE OF ZN DOPING IN B-Ga<sub>2</sub>O<sub>3</sub> GROWN BY MOCVD

**Georges BREMOND<sup>1</sup>, C Sartel<sup>2</sup>, Z Chi<sup>2</sup>, E Chikoidze<sup>2</sup>, G Guillot<sup>1</sup> and J M Bluet**

<sup>1</sup>Univ. Lyon, INSA Lyon, CNRS, ECL, UCBL, CPE, Institut des Nanotechnologies de, France

<sup>2</sup>Université Paris-Saclay, France

### Abstract

In the last decade, researchers and commercial companies have paid great attention to ultrawide band-gap semiconductors (UWBG) especially gallium oxide (Ga<sub>2</sub>O<sub>3</sub>). Ga<sub>2</sub>O<sub>3</sub> has very interesting properties such as a bandgap higher than 4.9 eV, high electrical breakdown field and easy control of the doping density for n-type. For example, vacancies and impurities play an important role in controlling the n type conductivity of this material and hence improving device performance as in power transistors technology. This paper want to discuss mostly the point defects in Ga<sub>2</sub>O<sub>3</sub> and the sources of majority and minority deep levels (traps) in Ga<sub>2</sub>O<sub>3</sub> characterized using different methods such as deep level transient spectroscopy (DLTS), optical DLTS (ODLTS), deep level optical spectroscopy (DLOS), photo-induced current transient spectroscopy (PICTS), Hall effect measurement and Electron paramagnetic resonance (EPR).

The case of Zn doping in Ga<sub>2</sub>O<sub>3</sub> is discussed. The deep defect energy levels were determined by DLTS technique on p/n junction or Pt/Ti/Au Schottky barrier obtained on a low p-type layer grown by MOCVD on a n-type substrate. Five-hole traps (H1 to H5) and one electron trap E1 were determined using appropriate DLTS bias conditions. Considering their concentration and energy, H3 (Ev + 06 ± 0.06 eV) and H4 (EV + 071 ± 06 eV) could be attributed to Zn<sub>Ga</sub><sup>0/-</sup> acceptor levels in octahedral and tetrahedral sites. The H5 level (Ev+1.05 ± 0.05 eV) could be tentatively attributed to the deep acceptor level V<sub>Ga</sub>(0/-) or its complexes. The origin of the E1 electron trap at Ec-0.94 ± 0.05 eV is relatively close to the Ti<sub>Ga</sub><sup>0/+</sup> donor level around 0.95 eV. However, so far neither Ti have been detected in MOCVD layers, so, E1 could be the same level of unknown origin detected at Ec-1eV in unintentionally doped (UID) substrates or plasma assisted molecular beam epitaxy (PAMBE) layers. Finally, all the results confirm the p-type behaviour of the epitaxial layer of Zn-doped Ga<sub>2</sub>O<sub>3</sub>.

### Biography

Georges BREMOND has completed his PhD in Material Science from University of Lyon in France in 1988. He has worked as CNRS research investigator at INSA Lyon, in the Laboratoire de Physique de la Matière up to 2001. Then he has worked as professor from INSA Lyon and at the Institut des nanotechnologies de Lyon. He has published more than 270 papers in reputed journals and international conference proceedings. He has been involved in more 30 technical and scientific regional, national and European projects in relation with electronic and microelectronic industry.



## A HYBRID COST MODEL FOR EVALUATING QUERY EXECUTION PLANS

**Verena Kantere**

*University of Ottawa, Canada*

### Abstract

Query optimization aims to select a query execution plan among all query paths for a given query. The query optimization of traditional relational database management systems (RDBMSs) relies on the estimation of the cost of the alternative query plans in the query plan search space provided by a cost model. The classic cost model (CCM) may lead the optimizer to choose query plans with poor execution time due to inaccurate cardinality estimations and simplifying assumptions. A learned cost model (LCM) based on machine learning does not rely on such estimations and learns the cost from runtime. While learned cost models are shown to improve the average performance, they may not guarantee that optimal performance would be consistently achieved. In addition, the query plans generated using the LCM may not necessarily outperform the query plans generated with the CCM. In this paper, we propose a hybrid approach to solve this problem by striking a balance between the LCM and the CCM. The hybrid model uses the LCM when it is expected to be reliable in selecting a good plan and falls back to the CCM otherwise. The evaluation results of the hybrid model demonstrate promising performance, indicating potential for successful use in future applications.

### Biography

Verena Kantere is a Full Professor in the School of Electrical Engineering and Computer Science at the University of Ottawa. Before she was an Assistant Professor in the School of Electrical and Computer Engineering (ECE) at National Technical University of Athens (NTUA), as well as a Maître Assistante and later a Maître d'Enseignement et de Recherche, at the Centre Universitaire d' Informatique (CUI) of the University of Geneva (UniGe), where she started working after winning the interdisciplinary competition for young researchers "Boursière d' Excellence". Before coming to (UniGe) Dr Kantere was a tenure-track junior assistant professor at the Department of Electrical Engineering and Information Technology at the Cyprus University of Technology (CUT). Dr Kantere has been working towards the provision of data management and services in large-scale systems, including cloud computing systems distributed systems and hybrid systems, focusing on properties of Big Data, the performance of Big Data analytics and multi-objective optimization. She has developed methods, algorithms and fully fledged systems. Dr Kantere has been a member of more than 130 program committees and served as member of editorial board or guest editor in many journals.





***Day-2***  
***Oral Presentations***

## ENVIRONMENTAL FACTORS ACTION ON THE PRODUCTS USED FOR WOOD SUBSTRATES PROTECTION

Andreea Mihăilă<sup>1</sup>, AM Ipate<sup>2</sup>, MF Zaltariov<sup>2</sup>, D Rusu<sup>2</sup>, R Constantinel<sup>1</sup> and G Lisa<sup>1</sup>

<sup>1</sup>Gheorghe Asachi Technical University, Romania

<sup>2</sup>Petru Poni Institute of Macromolecular Chemistry, Romania

### Abstract

In this study were analyzed two wood protection products: an acrylic impregnant which role is to enter in the wood fiber, delaying or even stopping the action of microorganisms and an alkydic protective laquer, which, after drying, ensures the formation of a glossy film and a long-lasting protection. The two types of analyzed products were applied on fir tree wood boards in one and two layers.

The painted wooden boards, were exposed in laboratory conditions and also to external conditions in 4 areas (IS, CT, PN and OL) with different climatic characteristics for 18 months. In order to quantify the thermal stability, the temperature at which a percentage of 5% of the sample mass is lost was considered. It was observed that the thermal stability of acrylic impregnant is influenced by the exposure duration and by climatic conditions. In the case of the LPM lacquer, for the samples exposed in PN, there is a constant decrease of the thermal stability with the increase of the exposure time.

It was evaluated in this study also the water contact angle. It was observed that in the case of the LPM samples the initial contact angle value it is greater than 90° and after 18 months, its value is around 65° regardless of the exposure area; and for the IAC samples the initial values of the contact angle have values higher than 120° and decrease more strongly regardless of the climatic conditions for a single layer.

To quantify the action of the environmental factors were calculated the ratios between the percentages of oxygen and carbon (O/C). It was observed that after a exposure of 18 months in the 4 areas, an increase in the O/C ratio was found, except for the LPM sample applied in a single layer and exposed in OL for 18 months.

### Biography

Andreea Mihaila has completed her PhD in Chemical Engineering Domain at the Doctoral School of the "Cristo for Simionescu Faculty of Chemical Engineering and Environmental Protection", Technical University "Gheorghe Asachi" from Iasi, Romania. During the PhD studies were published three articles in publications included in the ISI category according to the International Scientific Indexing with good values of the impact factor and four articles in publications included in the BDI category. Also it can be mentioned five participations at international and national conferences with posters and oral presentations.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## THE NEW TECHNOLOGICAL ERA AND NEW NEEDS TO BE QUALIFIED IN THE LABOUR MARKET

**Anabela Simoes**

*Lusofona University, Portugal*

### Abstract

The nowadays society, being characterized by a fast technological development, is imposing new educational needs at all educational levels. Thus, the human resources for a demanding labour market must: (1) be prepared for a throughout life learning, adapting each one's activity to the technological development; and (2) have digital skills, be creative, adaptable to technological advances and the related changes, as resources to anticipate, adapt, react, create and improve in their working context.

In this era of change, the human capital needs are evolving quickly, imposing new challenges and perspectives to the new generations to be qualified in the current labour market. The most advanced industries, like the Automotive and the Transport Sector, need to attract and keep a skilled and creative workforce, with the motivation and ability to learn throughout life, being comfortable with fast change and able to work on an interactive and collaborative environment to design and manage highly complex sociotechnical systems. The new challenges of 4.0 and 5.0 industry, in both the automotive industry and transport sectors, call for educational areas and models that optimize and value soft skills, like cognitive flexibility, intellectual curiosity, critical thinking, adaptability to change, initiative, creativity and efficient communication in a digital environment. These are competencies and skills for project management and problem solving, allowing for understanding the human-system interaction and cooperation, communication skills in multidisciplinary teamwork, adaptability to changes and an enormous motivation to keep learning throughout life. Thus, education deepening knowledge on Human Factors, developing simultaneously social skills, and enhancing personal development, have success guarantee on an open labour market. The interdisciplinary approach imposes, both on research and practice, a need for multidisciplinary teams, which are now a reality.

We are no longer at the turn of the century or the millennium, but we have committed the error of being passively looking at the changes taking place around us, not understanding their scope, or understanding, but regretting without changing anything in the educational offer. With technological advances and economic recovery, the demands of the labour market are also different. Furthermore, demographic projections point out to an extension of the working life duration, which requires, more than ever, a change in the management of human resources, to promote people's motivation through the updating of skills (training throughout life), stimulate creativity, listen and give the opportunity to express opinions, assign responsibilities as a way of expressing trust, in short, valuing people. It is, therefore, an important change in attitudes and behaviours in parallel with the development of new skills and new knowledge throughout life.

So far, National educational systems involve different levels until achieving the high education choices. Thus, there is a gap that should be bridged. As an example, it should be referred that the truck driver's profession is disappearing, even in the most developed countries once the freight industry is fighting to hire new truck drivers. However, they are necessary, but a set of competencies that seem to be out of their function, is missing as their profession is generally assumed as just driving a truck. Vehicles

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

equipped with connectivity and cooperative technology, as modern trucks and particularly, truck platooning systems, require truck drivers with competences to deal with the in-vehicle and infrastructure integrated technologies. If we compare the truck drivers' profession with the aviation since its history, there are similarities despite a strong difference. The recruiting social environment for a pilot or a truck driver are very different since the beginning of both professions. Nowadays, driving a vehicle requires just a specific driving licence, but an aviation pilot must perform a specific course for 2 years full time, get the corresponding certificate and follow other training periods depending on the aircraft model and each air company. If we compare both salary levels, young people having some digital skills don't want to embrace the truck driver profession. Thus, it is necessary to act immediately and find solutions toward the development of a young generation of truck drivers offering new skills and being prepared for a demanding labour market. This requires the development of a new education or training model to certificate future truck drivers with the new required skills and knowledge.

## Biography

Anabela Simões she is completed PhD on Ergonomics by the Technical University of Lisbon, now Lisbon University (1991) Full Professor from Technical University of Lisbon, now Lisbon University, Ergonomics Section until 2007. Full Professor at LUSOFONA University since 2010. President of the Portuguese Ergonomics Society (APERGO) from 1997 to 2003. Council member of the International Ergonomics Association (IEA) between 2000 and 2018. Former Member of the Accessible Transportation and Mobility Committee AME50 from the Transportation Research Board (TRB) until 2016, becoming a Friend due to the members rotation. Member of the HUMANIST Association (Human-Centred Design for Information Society Technologies) since its foundation in 2008 as a Research Network resulting from the European Network of Excellence Project (FP6). HUMANIST Association acts today as a Virtual Centre of Excellence in the European space. Research activity developed within HUMANIST in the frame of European Funded Projects between 1992 to 2018. Most European projects developed between 1992 to 2018: EDDIT (Elderly and Disabled Drivers Information Telematics) – DRIVE II Programme (1992/1995). TELSCAN (TELEmatic Standards and Coordination of ATT systems in relatioN to elderly and disabled) – Horizontal project from the TELEMATICS Programme. CeMVocAS Project (Centralised Management of VOCal interfaces aiming at a better Automotive Safety) project n°25589 supported by the ESPRIT Programme. INFOPOLIS 2 Project (Advanced Passenger Information for European Citizens of 2000. HUMANIST Network of Excellence (NoE) - Human Centered Design for Information Society Technologies (2004-2008). CAST Project (Campaigns and Awareness-Raising Strategies in Traffic Safety). ADAPTATION (Drivers' behavioural ADAPTATION over the time in response to ADAS use) (Marie-Curie ITN) (2009-2013). ASK-IT (2004-2008). Ambient Intelligence System of Agents for Knowledge-based and Integrated Services for Mobility Impaired users. ACCESS2ALL (Mobility Schemes Ensuring Accessibility of Public Transport for All Users) (2007-2009). INTERACTION (Differences and similarities in driver INTERACTION with in- vehicle technologies) (2009-2012). DECOMOBIL (Support action to contribute to the preparation of future community research programme in user centred Design for ECO-multimodal MOBILity). RESOLUTE (RESilience management guidelines and Operationalization applied to Urban Transport Environment) (2015-2018).

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## POTENTIAL OF SMART TTIS ECOLABELING FOR FRESH FOOD PRODUCTS AS A COMPONENT DEVELOPMENT OF TOOLKIT FOR CROSS SECTORAL BENEFIT IN THE WATER-ENERGY-FOOD-ENVIRONMENT (WEFE) NEXUS

**Vladimir Kitanovski**

*University Mother Teresa in Skopje, North Macedonia*

### Abstract

The increase in socio-economic standards worldwide has led to a significant expansion of the Reference Daily Intake (RDI). The growing demand for food production, both in the animal and agriculture sectors, has had a negative impact on the environment and the utilization of natural resources. A crucial aspect of this cycle is the generation of food waste at each link in the chain, including production, transport, household storage and proper waste management (with the possibility of reusing). The Food Waste Index report, prepared by the United Nations Environmental Programme (UNEP) reveals that 931 million tons of edible food are wasted annually worldwide, accounting for 17% of the food available to consumers in 2019. Furthermore, it estimates that 8-10% of greenhouse gas (GHG) emissions are attributed to food waste. We believe that an intelligent and intensive communication tool in food packaging can serve as a big data carrier, contributing to the environmental awareness of consumers. Therefore, the aim of our work is to evaluate the potential of smart time-temperature indicator (TTI) labels on food products as a component for transboundary benefits within the Water-Energy-Food-Ecosystems (WEFE) Nexus. TTIs can measure the temperature history of a food product during the supply chain. With a small upgrade, such as coupling with scanning technology, they can become big data carriers essential for communication with suppliers and consumers. The assessment of the potential of TTIs as tools to reduce food waste and enhance the environmental awareness of consumers was conducted using a future scenario simulation module for reducing food waste percentage, socio-economic analyses for outcomes associated with the scenario and the main resources used in food production systems (land, water and energy).”

### Biography

Vladimir Kitanovski has completed his PhD in Food Science at University of Food Technologies in Plovdiv R. Bulgaria in 2017. He has worked as professor of Packaging technology at the Mother Teresa University in Skopje at Faculty of technological Sciences with lectures for bachelors and master students. He has published more than 15 papers in reputed journals and has been serving as a reviewer in several international journals among: Horizons; Journal of Aquatic Sciences; Turkish Journal of Fisheries; Food Science and Applied Biotechnology. He has worked on several reserach based projects at his university, but as a leader of one PoC project for development of smart time temperature indicator as external package label supported by EU4TECH project platform.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## SIMULATOR FOR CARDIOVASCULAR PROCEDURES

**Jesus Moises Martinez Buendia, Tomás Efraín Sánchez Pérez, Raúl Martínez Ruiz, Iliana González Pérez, Carlos Alberto Gallegos Hernández, Efraín Muñoz Montero, Luis Antonio Jiménez Salinas and Arturo Abundes Velasco**

*National Institute of Cardiology, Mexico*

### Abstract

This simulation system for transcatheter procedures addresses crucial challenges in conventional medical training by overcoming limitations associated with a shortage of practical opportunities and the inherent complexity of these procedures. The evolution of medical simulation has emerged as an alternative, providing a controlled and safe environment to acquire specialized skills. Focusing on transcatheter procedures, characterized by high demand and specialty, this system positions itself as a comprehensive solution by offering anatomical representation through advanced segmentation and enhanced models.

It provides a training environment that faithfully simulates the complexity of real clinical situations, allowing healthcare professionals to refine their skills repetitively and safely, providing physical feedback and handling a fluoroscopy simulation system without the use of ionizing radiation. Additionally, a complementary approach was explored, proposing additional improvements to the system. Among these enhancements, research focused on more advanced models exhibiting desirable properties such as flexibility and transparency. These features are essential for the effective implementation of a contrast medium simulation system.

The research aimed to find materials and techniques that allow the faithful reproduction of conditions under which a contrast medium is used during medical procedures, making this technique more accurate. These innovations seek to further elevate the simulator's effectiveness, anticipating the changing demands of the medical field. This comprehensive approach not only addresses current limitations in medical training but also establishes this system as an essential tool for the continuous improvement of competence and safety in transcatheter procedures.

### Biography

Biomedical Systems Engineer graduated from the National Autonomous University of Mexico (UNAM), with a focus on the convergence of biological and technological systems, aiming to drive innovations that enhance current healthcare. Throughout their professional trajectory, they have actively participated in research projects, project management, as well as the design and implementation of medical devices, collaborating with multidisciplinary teams. Noteworthy is their contribution during a research stay at the National School of Higher Studies (ENES) Campus Juriquilla.

Currently, they hold the position of Biomedical Systems Engineering Intern at the National Institute of Cardiology in Mexico. Their work reflects a strong passion for innovation in the field of biomedicine, reinforced by a continuous commitment to advancing research and developing solutions that positively impact medical practice.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## STUDY OF SOLAR PHOTOVOLTAIC SYSTEM APPLIED TO WINE FARM IN PORTUGAL

**Ana I Palmero-Marrero, Adriana de Souza Nascimento, Mário Mata and Armando Oliveira**

*University of Porto (FEUP), Portugal*

### Abstract

Portugal stands out globally in the transition to a cleaner energy matrix, focused on renewables and energy efficiency, with a focus on the consumer. The wine sector In Portugal faces socioeconomic and environmental challenges, demanding more sustainable practices due to its relevance as a producer and consumer of wines worldwines. This article aimed to analyze the feasibility of implementing a photovoltaic (PV) system in a Portuguese vineyard farm located in a wine region with designation of origin. To verify the viability of the Self-Consumption Production Unit, economic performance indicators were used. Through a literature review, on-site visits, analysis of energy consumption and use of the Size Pro software, it was possible to simulate and carry out a sizing of the system to be implemented. It was found that the wine farm has higher electricity consumption peaks during the harvest season, totaling an annual electricity consumption of 330 MWh. The PV plant with an area of 262 m<sup>2</sup> would have an energy coverage of almost 25 % of total consumption The estimated initial cost of the installation was around 54 k€. The financial indicators, such as payback of approximately 5.6 years, the IRR (Internal Rate of Return) of 19.65%, the NPV (Net Present Value) of 229 k€ for the 20-years useful life of system, demonstrated the economic viability of the project. This research aims to encourage companies in the sector to adopt sustainable solutions, contributing to reducing the use of non-renewable energy sources and promoting a more sustainable economy.

### Biography

Ana Isabel Palmero Marrero completed her PhD in Physics in Spain in 2004 and is currently a Senior Researcher at Faculty of Engineering of the University of Porto (FEUP), Portugal and at the INEGI (Institute of Science and Innovation in Mechanical and Industrial Engineering). She is also an invited auxiliary professor at FEUP, lecturing at both undergraduate and post graduate courses. Her research activities are related to Solar Energy Systems (thermal and photovoltaic, including their application to agriculture) Energy in Buildings, polygeneration technologies. She was involved in several European research projects funded through the Joule, Energy, PRIMA programs concerning Sustainable Energy Systems. She has published more than 60 scientific papers in books, international journals and conferences. She has reviewed papers for several scientific journals. She is a member of scientific committee in the conferences International Conferences on Energy and Environment Research (ICEER).

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## THE EFFECTIVENESS AND PRIVACY PRESERVATION OF IOT ON UBIQUITOUS LEARNING: MODERN LEARNING PARADIGM TO ENHANCE HIGHER EDUCATION

**Albandari Fahad Abdulrahman Alsumayt**

*Imam Abdulrahman Bin Faisal University, KSA*

### Abstract

The progress made in Information and Communication Technologies (ICT) has played a crucial role in turning the Internet of Things (IoT) into a reality. IoT is an emerging technology that refers to networks of interconnected and Internet-enabled objects equipped with sensors, processors, and actuators that interact with each other to create significant collaboration and interaction environments. The field of education is one of the areas where IoT can be applied. However, the implementation of IoT poses security and privacy risks, such as unauthorized access, denial-of-service (DoS) attacks and interference with wireless signals where IoT devices collect a significant amount of data, including user's personal information like identity, location and daily behavior. Therefore, it is crucial to protect users' privacy in IoT applications. The innovative Ubiquitous Learning Environments (ULEs) have been created by ubiquitous computing technologies (mobile, wireless, network), which provide learners with learning experiences beyond the traditional classroom in both the real and virtual worlds. Ubiquitous learning (U-learning) is an emerging technology as a result of the tremendous technological revolution of ICT. U-learning is a novel learner-centered approach that aims to enhance learning, motivation and creativity by utilizing innovative technology and IoT. U-learning enables learners to access the appropriate learning content, collaborate with the right learning partners and engage in self-learning at the right time and place in a ubiquitous computing environment. To support learners in developing their social skills, in this study a framework for implementing the ULE based on the Internet of Things is designed, which consists of three main layers: perception, network and application. The article explores the effects of IoT on education and how U-learning, which incorporates IoT to enhance learning experiences, has the potential to replace traditional classroom learning. Furthermore, the article addresses privacy preservation measures for different layers within the IoT environment and ULE. A framework for implementing the ULE model is in progress, which is a part of our future work.

### Biography

Albandari Fahad Abdulrahman Alsumayt completed her PhD in cyber security and network security studies from Nottingham Trent University in the UK in 2017. She has worked as an assistant professor at Imam Abdulrahman bin Faisal University in Saudi Arabia and as head of the computer science department. She has published many papers in reputed journals.



# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## MAGNETIZATION PLATEAUS, SUSCEPTIBILITY, SUPER-STABLE POINTS, AND CYCLES OF SPIN 1 ANTIFERROMAGNETIC MATERIALS ON DIAMOND CHAINS WITH BIQUADRATIC INTERACTIONS

**Gayane Amatuni**

*CANDLE Research Institute, Armenia*

### Abstract

In paper represents magnetization plateaus, magnetic susceptibility, super-stable points and cycles in nanostructure antiferromagnetic Ising and Ising-Heisenberg models with spin 1 on diamond chains with biquadratic nodal-nodal interactions. We investigate connections of super-stable points and cycles with magnetization plateaus and susceptibility, which are critical indicators of the model's characteristics, in the case when temperature  $T \rightarrow 0$ . The study is based on the recurrence relations technique for obtaining multidimensional rational mappings, which give insights about the statistical properties of the models. Examining the stability properties of these mappings, in particular, by analyzing the maximum Lyapunov exponent, we have revealed the relationship between the magnetization plateau and dynamic properties. The existence and behavior of super-stable points and cycles for various parameter configurations in spin-1 models on diamond chains with biquadratic nodal-nodal interactions was fully studied.

### Biography

Gayane Amatuni has completed her PhD in Physics by A. Alikhanyan National Laboratory She has worked as senior researcher at CANDLE Research Institute. She has published more than 35 papers in reputed journals and has been serving as a team leader.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## THE NOVEL IDEAS HOUSING MODELS FOR GREEN ARCHITECTURE, SUSTAINABILITY, THE PANDEMIC AND THE RECENT COME-BACK OF THE GARDEN-CITIES

**Hülya Coskun**

*MSGSU, Mimar Sinan University, Turkey*

### Abstract

The research focuses on novel housing models in the context of green architecture and sustainable design, prompted by concerns about the climate crisis and recent pandemic. These concerns have led to rapid changes in architecture and urban planning, with a resurgence of old methods. At the beginning of the 20<sup>th</sup> century, E. Howard's book on Garden Cities of To-morrow and his idealized garden-city models regained popularity. However, with the onset of climate change and the recent Covid-19, people began to question the old planning theories and doctrines that created the modern cities metropolitan life model imposed throughout the 20<sup>th</sup> century. Covid-19 has indeed marked a significant turning point in urban and housing planning, reshaping people's needs and preferences in a profoundly. The prolonged periods of confinement experienced during the pandemic have led to a shift focused the new healthy living and working environment and patterns. People started to search sunnier, airier residences, preferably low-rise buildings access to gardens in suburban areas reminiscent of the old garden-cities emphasis on healthy and living distance heightened by disease. With the increasing new awareness of green architecture and renewed interest, this old design rhetoric, E. Howard's garden-city models have recently made a come-back as a research object after the pandemic. Thus, after the pandemic, England took the lead initiated short distance, pedestrian oriented arrangements in old garden-city Welwyn with new walking and bicycle ways also similar principles with sustainability. The English Garden-city models, which originated in the interwar years and were widely adopted throughout Europe, were introduced in France as cité-jardins in Germany and Austria as Garten-stadts or Siedlungs. In the early 20th century, the French architect-urbanist Henri Prost developed some models that were uniquely implemented in Istanbul by Turkish architects in the post-Prost period. Since the 2000s, innovative housing models planned in Istanbul favored the English country life originated from specifically English garden-cities. Finally, recently new projects launched based on this model that newly developed as healthy-houses planned in green-areas after the pandemic also in line with sustainability.

### Biography

Hülya Coskun, BArch., (MSGSU), MSci., (MSGSU), Phd, (ENSA-PB Paris,& MSGSU, Istanbul, Turkey). (Dual Education and Degree on Architecture& Urbanism) Received her B.Arch. and M.Sci. Degrees in Architecture from Faculty of Architecture, MSGSU, (Mimar Sinan Fine Arts University), Istanbul, Turkey and educated Urban Planning at ENSA-PB, École Nationale Supérieure d'Architecture de Paris-Belleville, Paris, France during her doctoral studies. She earned her Ph.D. degree in Architecture from MSGSU, Faculty of Architecture, İstanbul, Turkey with the Doctoral Thesis of "The Housing Problem in the First Half of the 20th Century in Europe and Henri Prost Example". She has participated more than 20 Conferences globally, and many of them Invited Speaker, she has 22 published Book Chapters and Conference Book Chapters and more than 15 published articles. She is currently working as an Ass. Prof. Dr., Department of Architecture in Rumeli University, Istanbul, Turkey.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## ANALYSING THE CITY WATER-ENERGY-FOOD SUSTAINABILITY INDICATORS: A SYSTEMATIC REVIEW

**Bahar Feizollahbeigi<sup>1,2</sup>, Luis.P. Dias<sup>2</sup> and Julia Seixas<sup>2</sup>**

<sup>1</sup>University of Minho, ISISE, ARISE, Portugal

<sup>2</sup>CENSE – Center for Environmental and Sustainability Research, NOVA University Lisbon, Portugal

### Abstract

The complex interlinkages among water, energy and food (WEF) resources in cities presents notable challenges for urban sustainability. Highlighting the necessity of integrated approaches, the WEF Nexus framework has become an adequate tool for understanding and addressing these challenges. City Selfy project focus on WEF resources use within the city boundaries, explicit its interlinkages, to show how and at what extent healthy food, safely managed water and affordable, reliable and modern energy services can be provided endogenously to its inhabitants, without hamper the city sustainability in the future. Sustainability indicators, as fundamental elements for assessing the resource system planning, governance and resources management to enhance human wellbeing, from both short-term and long-term perspectives. This study conducts a systematic review to analyse the indicators used for WEF systems sustainability assessment at the local scale. Through a holistic literature review, both qualitative and quantitative studies were investigated to identify and key performance indicators and indexes used in assessing the WEF sustainability in a European city scope. The review highlights the diversity of indicators employed across different urban settings (along 195 number of different indicators) reflecting the multi-dimensional nature of the WEF nexus. Our research demonstrates that 61% of the extracted indicators were attributed to the supply-based, 21% to the demand-based and 19% were associated with both phases. However, it also shows the limitations of these indicators on the total representation of sustainability dimension and the applicability within the specificity of European cities context. Finally, a comprehensive list of WEF sustainability indicators we categorised and selected through PSR model and attributes criteria based on the suitable application to the CitySelfy project case study – Cascais municipality. The results can be used to other European cities WEF sustainability assessments. The assessment results contribute with valuable insights to interdisciplinary fields of city sustainability and complex connections of WEF systems in urban environments toward achieving sustainability.

**Key words:** WEF Nexus, sustainability assessment, indicators, urban sustainability.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## SUSTAINABLE HVAC SOLUTIONS: DECARBONIZING THROUGH OPTIMAL HIGH-EFFICIENCY UNIT SELECTION

**Shahid Ali Khan<sup>1,2</sup> Asala Yousuf Mohammed Al Wardi<sup>1</sup> and Abdullah Al Shibli<sup>1</sup>**

<sup>1</sup>*Military Technological College, Oman*

<sup>2</sup>*Heriot Watt University, United Kingdom*

### Abstract

HVAC (Heating, Ventilation and Air Conditioning) systems ensure optimal indoor temperature and humidity levels, creating comfortable living and working environments regardless of external weather conditions. This comfort contributes to improved productivity, well-being and overall quality of life. However, HVAC Systems significantly contributes to global energy consumption and greenhouse gas emissions, primarily due to the prevalent use of fossil fuels for heating and cooling purposes. The energy consumption of HVAC systems is substantial due to their continuous operation to maintain indoor comfort levels and often contribute significantly to carbon footprints. HVAC systems typically account for approximately 40%-60% of the total energy used in buildings. This percentage can vary depending on factors such as climate, building design, energy efficiency measures and occupant behavior. Decarbonization in the Heating, Ventilation and Air Conditioning (HVAC) industry is imperative for mitigating climate change by reducing or eliminating carbon emissions associated with heating, cooling and ventilation systems within buildings and intending to create more environmentally friendly and energy-efficient HVAC systems. Reducing the carbon footprint in HVAC buildings and equipment involves adopting energy-efficient practices and sustainable technologies. This paper investigates the potential of sustainable HVAC solutions in decarbonizing buildings by focusing on the optimal selection of high-efficiency units. The paper emphasizes significant savings in operational costs, estimated at around 60%, based on the optimal selection of high-efficiency air conditioning units and significant reduction in carbon footprint.

### Biography

Shahid Ali Khan is Senior Fellow Higher Education Authority (SFHEA) and Charter Engineer (CEng) UK, Pearl Qualified Professional (PQP) Estidama, UAE and currently working as a Sr. Lecturer and HVACR Engineering Pathway leader in the System Engineering Department, Military Technological College Oman. He has more than 15 years of experience in HVAC industry & teaching and undertaken various research-based engineering problems and resolved effectively.

He is a professional member of IMechE, ASHRAE, MEI, GHGMI, and published several research papers in reputed international journals and attended numerous international and national conferences/seminars.

***Day-2***  
***Poster Presentations***

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## NON-INVASIVE FUEL CONSUMPTION MEASUREMENT FOR INTERNAL COMBUSTION ENGINES BASED ON OTTO CYCLE

**Emerson Alves da Silva Federal**

*University of Minas Gerais, Brazil*

### Abstract

The growing demand for reduced fuel consumption and increased energy efficiency in internal combustion engines underscores the need for continuous advancements in engine technologies. In this sense, the accurate estimation of fuel consumption is a fundamental prerequisite for the applications of control and measures on fuel consumption. Although most modern vehicles offer fuel consumption data assessed by the electronic central unit, this information is primarily designed to provide users with an estimate of their momentary average consumption, without any assurance from manufacturers regarding the reliability of this data. Most of the initiatives aimed at measuring fuel consumption require invasive approaches and there is still a lack of studies addressing non-invasive methods to evaluate the total fuel consumption, especially for Otto cycle engines operating with pure ethanol and a mixture of gasoline and ethanol. In this regard, the objective of this work is to develop a non-invasive method for the real-time fuel measurement of internal combustion engines based on the Otto cycle with a common rail fuel injection system. The proposed technique requires only the measurement of the electrical signal pulses sent from the engine control unit to the fuel injector and does not affect the performance or operation of the engine in any way. The measurement system was built using low-cost electronic components and its accuracy was evaluated using a single-cylinder research engine (SCRE). A series of 32 tests were performed, considering four different engine loads, four different speeds and two different fuels, ethanol (E100) and gasoline and ethanol blend (E27). The results achieved were superior to those obtained with electromechanical sensors. The results obtained by measuring the fuel consumption with the proposed methodology showed a maximum percentage error of  $\pm 2.85\%$  for ethanol (E100) and  $\pm 3.30\%$  for a blend of gasoline with 27% ethanol (E27).

### Biography

Emerson Alves da Silva completed his master's degree in Automation and Control from the mechanical engineering department at the UFMG (Federal University of Minas Gerais). Currently, he works as a permanent professor in the department of electronics and computing at the CEFET-MG (Federal Center for Technological Education of Minas Gerais), where he also serves as the coordinator of the electronics course. Graduated in electrical engineering from CEFET-MG and with a postgraduate degree in software engineering from FASAM (South American College), he has developed various products in embedded electronics for different market areas, particularly in the automotive sector. In this field, he holds several patent applications for monitoring and measuring automotive parameter devices.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## GABA PREVENTS SARCOPENIA THROUGH REGULATION OF PROTEIN TURNOVER AND INFLAMMAGING IN 21-25-MONTH-OLD C57BL/6J MICE

**Boo Yong Lee**

*CHA University, South Korea*

### Abstract

Sarcopenia is age-related muscle atrophy not only decreases the mobility and the exercise capacity but also increases the risks of complications, falls and mortality, consequently deteriorating the quality of the individual's life and health. Muscle mass and muscle strength reach their maximum around the age of 30, begin to decrease by more than 1% every year after the age of 40, decrease twice as fast after the age of 70. Here, Gamma-aminobutyric acid (GABA) is a naturally occurring neurotransmitter synthesized from glutamate by the enzyme glutamic acid decarboxylase. In this study, we investigated the effect of GABA on improving sarcopenia by suppressing muscle protein degradation. GABA (10 or 30 mg/kg/day) was administered orally daily to young (3-5 months) and old (21-25 months) C57BL/6 mice for 7 weeks. The administration of GABA increased gastrocnemius and quadriceps muscle strength, mass and muscle fiber size in old mice. In addition, we found that GABA inhibits sarcopenia by improving muscle protein turnover, which was imbalanced due to aging, through activation of Akt/mTOR/FoxO3a signaling pathways. GABA also regulated the inflammaging that is hallmarks of age-related muscle atrophy, such as the imbalance of M1/M2 macrophage ratio and pro-inflammatory cytokine levels. Thus, GABA can be used in the development of a functional health food customized for the elderly to improve sarcopenia.

### Biography

Boo Yong Lee has completed his PhD in Dept. of Food Technology of Korea University and postdoctoral studies from University of Georgia. He has worked as principal researcher of Korea Food Research Institute and is professor of Dept. of Food Sci. and Biotech. of CHA university. He has published more than 250 papers in reputed journals and has been serving as president of The Korean Society of Food Science and Nutrition.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## PREPARATION OF PERSPECTIVE SORBENTS FOR PURIFICATION/ DECONTAMINATION OF DIFFERENT SOURCE WATERS

**Lusine Harutyunyan, Hakob Sargsyan, Alla Manukyan and Khachik Nazaretyan**

*Armenian National Agrarian University, Armenia*

### Abstract

The purification/decontamination of the different sources waters is actual problem of nowadays since the clean water resources are limited. One of the largely applicable, non-expensive and ecofriendly technological solution for purification/decontamination of waters is usage of sorbents based on natural aluminosilicate clays. Within discussed framework the armenian, georgian and khazakh natural clinoptilolites/heulandites, modified both physically and chemically, are suggested as effective removal agents regret to both inorganic and organic contaminants. Moreover, the studies shown that silver and copper ion-exchange samples of chemically modified natural clinoptilolites/heulandites have bactericidal activity regret to *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Candida albicans*, *Aspergillus brasiliensis* and *Salmonella* bacteria, thus the prepared sorbents also can be used as disinfection agents. The joint studies have shown that the BET specific surface area, microporous volume, microporous surface, as well as the sorption (removal) ability of studied clinoptilolites/heulandites increases with increase of treatment temperature up to  $\sim 350^{\circ}\text{C}$  and acid concentration up to 2 N. Due to both temperature treatment and acid modification the microporous structure of clinoptilolites/heulandites becomes more developed and at the same time the crystal structure of clinoptilolites/heulandites stay unchanged, which is an important parameter for their advance as perspective sorbents. The presented results stats by complete studies by XRD, FTIR and low-temperature nitrogen adsorption/desorption methods. The studies of the chemical composition of clinoptilolites/heulandites due to modification under the mentioned conditions established that Si/Al ratio becomes higher mainly as a result of dehydration under temperature treatment and ammonium, sodium and calcium ions removing due to acidic modification.

**Funding:** This work was supported by the International Science and Technology Center (ISTC) under the project GE- 2506 “Scientific substantiation of the possibility of creating new bactericidal zeolite filter materials for purification- decontamination of water from various sources”.

### Biography

Lusine Harutyunyan has completed his PhD and also earned degree of Doctor of Sciences in Chemistry by Yerevan State University, where she has worked long years. Now she is Head of Chair of Biosciences and General Chemistry at Armenian National Agrarian University. Also, she works as professor of Physical Chemistry at Armenian State Pedagogical University. She has published more than 60 papers in reputed journals, participates in different international projects. Dr. Lusine Harutyunyan scientific interests include studies of possibility of use plants as sorbents and local natural aluminosilicate clays for purification wastewaters by the way of their physical and chemical modification.



# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## METAL-CONTAINING MONOMERS AS SINGLE-SOURCE PRECURSORS OF METAL-POLYMER NANOCOMPOSITES

Igor E Uflyand<sup>1</sup>, Vladimir A Zhinzilo<sup>1</sup> and Gulzhian I Dzhardimalieva<sup>2</sup>

<sup>1</sup>*Southern Federal University, Russia*

<sup>2</sup>*Russian Academy of Sciences, Chernogolovka, Russia*

### Abstract

In this work, we have developed procedures for the synthesis of a wide range of metal-containing monomers (MCMs) based on unsaturated metal carboxylates and polypyridine ligands. The obtained MCMs were used as single-source precursors for the preparation of metal-polymer nanocomposites by the conjugated thermolysis method. This method consists in the simultaneous occurrence of the processes of thermal polymerization of monomers and the formation of metal-containing nanoparticles during thermal transformation. The general scheme of conjugated thermolysis includes three successive stages: dehydration (desolvation), polymerization and thermolysis of the formed metallopolymers. Particular attention is paid to the composition of the solid-phase products of conjugated thermolysis. Kinetic schemes and reactions of thermal transformation of metal-containing monomers are analyzed. The use of the obtained metal-polymer nanocomposites as magnetic materials, sensors, catalysts and tribological materials is generalized.

### Biography

Igor E. Uflyand, Dr. Sci. (Chem.) is the Head of the Analytical Chemistry Department, Southern Federal University, Rostov-on-Don, Russia. He was born in 1956 and graduated from Rostov State University, Department of Physical and Colloid Chemistry. Prof. Uflyand received his Ph.D. in 1981 and his Doctorate in Chemistry in 1996 from the Rostov State University, where he became a professor in 1996. The scope of his scientific interest is coordination and organometallic chemistry, polymers, and nanomaterials.

**Funding:** This work was financially supported by the Russian Science Foundation (Project No. 22- 13-00260).

## ASSESSMENT OF THERMAL DECOMPOSITION PROCESSES OF SOME SYMMETRIC DERIVATIVES WITH TWO FERROCENYL UNITS

Cerasela-Ionela Cleminte<sup>1</sup>, Daniela Ionita<sup>2</sup>, Nita Tudorachi<sup>2</sup>, Mariana Cristea<sup>2</sup> and Gabriela Lisa<sup>1</sup>

<sup>1</sup>Gheorghe Asachi Technical University, Romania

<sup>2</sup>Petru Poni Institute of Macromolecular Chemistry, Romania

### Abstract

Ferrocene derivatives are precursor organometallic compounds for chemical vapor deposition (CVD). In order to increase the efficiency of the use of organometallic compounds as precursors for chemical vapor deposition (CVD), it is imperative to study mass and heat transfer in sublimation. The optimization of the experimental conditions of the deposition processes involves both the knowledge of the vapor pressure and the thermodynamics of the sublimation of the precursors as well as the mechanisms of their thermal decomposition. In this work, the complex thermal analysis technique was applied: thermogravimetric analysis (TGA) coupled with mass spectroscopy (MS) and Fourier transform infrared spectroscopy (FTIR) to elucidate the thermal decomposition mechanism of some ferrocene derivatives. A STA 449F1 Jupiter type equipment (Netzsch –Germany) coupled with a mass spectrometer model QMS 403C Aëolos (Netzsch-Germany) and a FTIR spectrophotometer model Vertex-70 (Bruker-Germany) was used. Work was done in an inert atmosphere (nitrogen), in the temperature range 25-700°C, with a rate of 10°C/min. The mass of the analyzed samples was between 9.5 and 11.8 mg. The thermal decomposition mechanism is complex and takes place in four distinct stages. A significant amount of residue remains at the end of the test at 700°C, ranging from 53 to 69 mass percent. It was concluded that ferrocene derivatives with the flexible section in the middle have higher thermal stability than those in which the flexible section is at the margin. Intense peaks for the ionic fragments  $m/z=65$  and  $m/z=66$  are shown in the MS spectra at about 240°C and 309°C, respectively. This is also supported by the peak at  $673\text{ cm}^{-1}$  occurring in the FTIR spectra, which corresponds to the vibration of the cyclopentadienyl ion. This behavior is due to the destabilization of the retroactive  $\pi$  bond between the iron atom and the two ferrocene cycles.

### Biography

Cerasela-Ionela Cleminte is doing her PhD thesis “Mass and Heat Transfer in the Sublimation of Organometallic Compounds” under the guidance of Professor PhD Gabriela Lisa in the field of chemical engineering, at Gheorghe Asachi Technical University in Iași City, Romania. From the beginning of her doctoral studies she has published one paper in an ISI-index journal (Q1 area) and she has attended four national and international conferences. She holds a Bachelor’s and a Master’s degree from ‘Cristofor Simionescu’ Faculty of Chemical Engineering and Environmental Protection, Iași City, Romania.

## ULTRASONIC DETECTION OF SPALL DAMAGE INDUCED BY LOW-VELOCITY REPEATED PLATE IMPACT TEST

**Naoya Nishimura**

*Meijo University, Japan*

### Abstract

Repeated plate impact testing with impact stress well below the threshold spall-stress (2.6GPa) on medium carbon steel was carried out to the identical target plate by impacting the flyer plate. Occurrence of spall damage under low-velocity repeated impact was evaluated nondestructively with a low frequency scanning acoustic microscope. We observed the spall damage distribution by the B- and C-scan images. In order to initiate the spall damage (voids in a ductile material or cracks in a brittle one) the particular value of threshold spall-stress should be exceeded what already belongs to a commonly accepted knowledge. Generally, the spall damage development is dependent on the amplitude and the duration of the stress pulse. If the stress is high and duration is long enough to create tensile failure of material, the voids or cracks nucleate along the spall plane and consequently, they form macrocracks. Therefore, the spall damage does not create when the first impact stress is less than the threshold spall-stress. However, after the fifth low-velocity repeated impact test, the generation of the spall damage was detected, even if the impact stress (1.1-1.7GPa) was lower than the threshold spall-stress (2.6GPa).

Traditionally the spall damage has been examined with an optical or a scanning electron microscope on samples which were cut and polished. With these destructive methods, we can not evaluate the spall damage in actual structural parts or not investigate the spall damage evolution during repeated impact. The change in B- and C-scan images, which give us damage distribution at an arbitrary depth in a plane parallel to the impacted plane and in a longitudinal cross section, give us an advanced means to evaluate nondestructively the spall damage and to make clear the mechanisms of the spall damage initiation and growth under repeated impact.

### Biography

Naoya Nishimura has completed his doctor in Engineering by Nagoya Institute of Technology. He has worked as professor of Mechanics of Material at Department of Vehicle and Mechanical Engineering, Meijo University.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## AN ELLIPSOIDAL HELMHOLTZ PAIR IN CONTRAST WITH A SQUARE COIL FOR MAGNETIC RESONANCE IMAGING

**Khalid Abdullatif Alsnaie**

*Imam Mohammed Ibn Saud Islamic University, Saudi Arabia*

### Abstract

In this paper, the design and the testing of a symmetrical ellipsoidal and square radiofrequency prototypes coils with high B1 magnetic field homogeneity are presented. The developed coils comprise two tuned coaxial ellipsoidal loops that can produce a relatively homogeneous radiofrequency field. In comparison with a square Helmholtz pair that provides 2<sup>nd</sup>-order homogeneity, it aims to provide better homogeneity of the B1 field while preserving the simplicity of implementation. Electrical modeling of the probe, including all couplings, is used to ensure these requirements. Results of comparison tests, in free space and in a spectro-imager, between a square Helmholtz pair and the ellipsoidal prototype coil are introduced. In terms of field homogeneity, an improvement of 10% is observed. Moreover, the ellipsoidal prototype coil possesses a better-quality factor (+7% on average) and a noticeable improvement in sensitivity (+6%). Overall, this work, which includes both theoretical and experimental aspects, aims to contribute to the study and understanding of two-element radio frequency (RF) systems derived from Helmholtz coils for Magnetic Resonance Imaging

### Biography

Khalid Al-Snaie is an Associate Professor at Electrical Engineering Department, College of Engineering, Al Imam Mohammad Ibn Saud Islamic University. Holds a Ph.D. in Electrical Engineering University of Arkansas, Fayetteville, Arkansas USA 2005,. He is the director of the reaserch center at the college of engineering. He works on Telecommunication Network, Instrumentation, RF Coils, ECT Sensors. His focus is on Telecommunication Network, ECT Sensors and RF coils. He is the co-author of many publications. He received one grant in 2019 from King Abdulaziz City of Scientific Research KACST. He received three grants in 2014, 2016 and in 2018 from Deanship of Academic Research in Al Imam Mohammad Ibn Saud Islamic.

## SOME NOVEL PEPTIDES CONTAINING A MODIFIED PYRAZOLOPYRIMIDINE MOIETY: DESIGN, SYNTHESIS AND *IN VITRO* ANTIBACTERIAL SCREENING

**Mohamed Ge Zayda**

*Dar Al Uloom University, King Saudi Arabia*

### Abstract

Numerous peptide drugs are currently undergoing advanced phases of clinical testing to determine their efficacy in combating antibiotic-resistant bacterial pathogens. Our aim was to prepare some novel peptides containing a modified pyrazolopyrimidine moiety and assess their activity against a set of selected bacteria in comparison to a widely used antibiotic, ciprofloxacin. In this study, eight new peptide compounds incorporating a modified pyrazolopyrimidine moiety were synthesized. Our results revealed that compounds 4 and 5, which contained only the pyrazolopyrimidine scaffold were less active than the peptide-conjugated pyrazolopyrimidines 10, 11, 13, 14, 15 and 17. The antibacterial activities of the eight novel compounds 4, 5, 10, 11, 13, 14, 15 and 17 were evaluated against a panel of bacterial strains. All the novel compounds exhibited potent antibacterial activity against *Staphylococcus aureus*, *Enterococcus faecalis* and *Pseudomonas aeruginosa* strains compared to the reference antibiotic ciprofloxacin. The tested *Escherichia coli* strain displayed resistance against the newly synthesized compounds. Moreover, *P. aeruginosa* strain displayed resistance against ciprofloxacin and six of the newly synthesized compounds. Compounds 15 and 17 effectively inhibited the growth of the *P. aeruginosa* strain at MIC<sub>1</sub> µg/mL. Our results are encouraging and urge additional biological and pharmacological screening of the most active compounds against drug-resistant microbial strains.

### Biography

Mohamed Zayda has completed his Ph.D. in Organic Chemistry at Menoufia University, Egypt. He has worked as an assistant professor of Organic Chemistry at the College of Medicine, Dar AlUloom University, Kingdom of Saudi Arabia. He is a member of the American Chemical Society. He was granted a Chemical Abstracts Service (CAS) Registry Innovator to design novel chemical compounds with remarkable biological activities.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## HOW DIFFERENT PREPARATION TECHNIQUES AFFECT MRI-INDUCED ANXIETY OF MRI PATIENTS: A PRELIMINARY STUDY

**Mohammed Awad Alharbi**

*King Abdullah bin Abdulaziz University Hospital, Princess Nourah bint Abdulrahman University, Saudi Arabia*

### Abstract

Magnetic resonance imaging (MRI) exams may cause patients to feel anxious before or during the scan, which affects the scanning outcome and leads to motion artifacts. Adequate preparation can effectively alleviate patients' anxiety before the scan. We aimed to assess the effect of different preparation methods on MRI-induced anxiety: We conducted a prospective randomized study on MRI patients between March and May 2022. We divided 30 patients into two groups: the control group, which received routine preparation (RP) and the experimental group, which received video preparation (VP). We used the State-Trait Anxiety Inventory (STAI) to measure anxiety levels before and after the interventions. We assessed patients' self-satisfaction after the scan: After preparation, VP (STAI mean = 10.7500) and RP (STAI mean = 12.7857), we observed a significant association between the pre- and post-STAI results in VP ( $p = 0.025$ ). The effects of both methods in decreasing anxiety were more significant for first-timers ( $p = 0.009$  in RP/0.014 in VP). We noted high satisfaction levels for both forms of preparation. The VP technique was superior in reducing patient anxiety, especially in first-time MRI patients. Hence, VP techniques can be used in different clinical settings to reduce anxiety and facilitate patients' understanding of the instructions given.

### Biography

Mohammed Awad Alharbi has completed his Clinical and research fellowships in neuro-imaging from University of Toronto and university of health network. She has work as consultant of neuro-imaging and chairperson of medical imaging at King Abdullah bin Abdulaziz University Hospital, Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia. He is teach at college of medicine Princess Nourah bint Abdulrahman University. He supervise and guid residents and fellows as well as juinor consulatant at several saudi radiolgoy program. He finished of Master of Science in Health at University of Alabama at Birmingham, USA at December, 2016. He did alot of lectures and sevceral publications in feild of neuro-imaiging with main interst in MRI iamigng.

***Virtual - Day 1***  
***Keynote Presentation***

## BEHAVIOR OF SURFACE OPTICAL PHONONS IN DILUTE MAGNETIC SEMICONDUCTORS BASED ON ZnO

**Branka Hadžić**

*University of Belgrade, Serbia*

### Abstract

The existence of Surface optical phonons (SOP) modes is characteristic of polar crystals with large surface-to-volume ratios. The state of surface atoms has a vital role in defining their properties since when the dimension becomes extremely small only modes that persevere are the surface ones. Particle dimension, presence of imperfection and impurity are some of the crucial characteristics that lead to the breakdown of phonon momentum selection rules and the appearance of SOP modes. SOPs are of particular interest in nanotechnology, surface chemistry and sensors, as they are highly sensitive to changes at the material's surface, including molecular adsorption, temperature variations and other factors. These properties make them key elements for understanding and harnessing surface interactions and phenomena in various applications. SOP in ZnO are a crucial aspect of its material properties. ZnO is a semiconductor with a hexagonal wurtzite structure, a wide "direct" bandgap of 3.4 eV and a relatively large exciton binding energy of 60 meV. Semimagnetic zinc oxide-based semiconductors have intrigued the scientific community for years due to their potential to achieve ferromagnetism at room temperature.

In this plenary talk primarily, focus will be on investigating the structural, optical and magnetic properties of zinc oxide based nanopowders, as well as the dependence of these properties on sample preparation methods, dopant concentration and type, formed phases, changes in the system's ordering, symmetry-breaking and the impact of laser irradiation.

One significant result is the observation of SOP in these structures due to symmetry-breaking, as well as their behavior with changing dopant concentration and type. Changes in the position and intensity of both SOP and characteristic modes of ZnO and the registered dopant phases were also examined. New and exciting changes in SOP modes behavior will be demonstrated. These results confirm high sensitivity of SOP modes especially with the temperature.

### Biography

Branka Hadžić has completed his PhD in Physics at the Faculty of Physics, University of Belgrade. She is working at Institute of Physics, University of Belgrade, Serbia. She has published more than 55 papers in reputed journals. She is currently engaged in the Laboratory for Research in Electronic Materials. She coordinates scientific collaboration with the Institute of Physics, Polish Academy of Sciences in Warsaw. Her scientific work is conducted within the field of materials physics, particularly in the area of semiconductor crystal physics, thin films, nanoparticles and nanostructures. Scientific activities encompass independent experimental work, data analysis, modeling, and theoretical analysis of the studied materials. Experimental work and data analysis are based on the examination of materials using Raman spectroscopy, IR spectroscopy and photoluminescence. She has made a significant contribution to the study of the influence of laser radiation on the optoelectronic properties of the examined materials.



## THE SOURCING OF LEAFLETS TO MANUFACTURE PERCUTANEOUS HEART VALVES: PRIORITY TO RESTORING A DURABLE FUNCTION

**Robert Guidoin<sup>1</sup>, Aisa Rassoli, Yiming Li, Ze Zhang, Eric Philippe and Jiaxuan Feng**

<sup>1</sup>Université Laval, Québec, Canada

<sup>2</sup>Khaje Nasir Toosi University of Technology, Iran

<sup>3</sup>Second Military Medical University, Shanghai, China

### Abstract

Percutaneous heart valve deployment has gained considerable acceptability over the last three decades. Number of developments are challenging the valves from the pioneers, Sapien and CoreValve. Restoring the organ to treat young patients is still not at hand but restoring the durability of the device becomes mandatory. The percentage of patients younger than 65 year old has increased dramatically and the durability of the device shall overpass the life expectancy of the patients.

#### 1) Restoring the function:

- The goal is to improve without delay the accessibility of patients to cure valve stenosis.
- The resulting percutaneous technique is promoted by cardiologist and preferred by the patients: surgical implantation vs percutaneous deployment.
- Chemically treated xenopericardia proved to be the most select materials to manufacture the leaflets of heart valves, thanks to the sinusoidal structure of the collagen bundles.
- Selection of synthetic polymers might be inappropriate based upon historical failures observed in surgical valves.

#### 2) Replicating the organs:

- Historical programs in regenerative medicine to reconstruct blood vessels, valves and hearts have been exponentially promising for more than 50 years, but the benefits for the patients are negligible.
- Regenerative medicine might replicate the organs based upon new concepts in tissue engineering and sound analysis of the myriads of attempts conducted worldwide in the absence of flag in the field.
- Supportive mechanical and biocompatible scaffolds likely to be replaced by a leaflet-like structure can be anticipated might be attainable. After complete analysis of the accumulated literature with the support of the Artificial Intelligence (AI), it might be possible to identify an approach likely to succeed.

In conclusion, percutaneous heart valve replacement is the way to go and deserves improvements of the durability: younger and younger patients preferred this technique compared to open surgery. Tissue engineered valves are unlikely to be available in a predictable future.



***Virtual - Day 1***  
***Oral Presentations***

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## INDIGO – DEVELOPMENT OF CHEMICAL SYNTHESIS PROCEDURES

**Michaela Kröppl**

*Florida University of Applied Science Upper Austria, Austria*

### Abstract

The dye Indigo, since the end of the 19th century produced synthetically through various chemical reactions, is widely known as the blue color used for coloring blue jeans trousers. Originally, in Europe the color was produced from dyer's woad (the "European Indigo" *Isatis tinctoria*) and later also from the imported "Indian Indigo" *Indigofera tinctoria*. As the obtaining of the color from the plants was very time intensive, it was one of the expensive dyes and was used for special purposes. One very popular usage started, when in the last quarter of the 19th century, Levi Strauss invented the jeans fabric for very hardwearing clothes – using the blue Indigo color for their coloration. From the usage of the blue dye from Genua, the word "Jeans" was derived from "Bleu de Gênes". The cotton used for the sturdy trousers came from the place "Nimes" in the South of France from which the designation "Denim" comes from. With the possibility for producing Indigo on an industrial scale via chemical synthesis procedures, its usage increased very fast. In the presentation, a historic overview of the traditional blue coloring with the dyer's woad *Isatis tinctoria* and the Indian Indigo *Indigofera tinctoria* will be given as well as the development of the chemical synthesis starting with the history of the determination of the chemical structure of the Indigo molecule and the first steps to reproduce Indigo from its parts. In the following, an overview of different approaches for chemical synthesis will be described. Important researchers and companies in this synthesis process will be presented, chemical reaction equations will give explanations for the development of finally the best synthesis way at the beginning of the 20<sup>th</sup> century.

### Biography

Michaela Kröppl studied Chemistry at the University of Vienna and the Technical University of Vienna. Since 2005 she is a lecturer at the University of Applied Sciences Upper Austria and teaches chemistry in various study degrees. Her special interest is the history of chemistry. One of her research topics dealt with Indigo and its chemical production processes. Further, she tries to pass on the spirit and interest of chemistry to her students and also in other settings to children (e.g. from school classes or at "kids university"). Therefore, she is also interested in gamification methods and is for example developing Chemistry Escape Rooms.

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## HISTORICAL AND STRUCTURAL ANALYSIS OF THE LINTEL FRACTURE OVER THE MONASTERY OF EL ESCORIAL MAIN DOOR

**Rubén Rodríguez Elizalde**

*Universitat Oberta de Catalunya, Spain*

### Abstract

Lintels are typical horizontal elements of the oldest buildings, especially in Egypt and Greece. Their presence has been constant throughout the centuries in countless buildings and constructions. When the lintels are masonry they have many limitations due to their low flexural strength, which can cause their fracture. Here we analyse a very relevant case in a very significant monument. This article conducts a historical analysis to diagnose the moment in which the fracture of the lintel of the main door of the Monastery of El Escorial occurred and a structural analysis to diagnose the causes and danger of this fracture.

### Biography

Rubén Rodríguez Elizalde is Geologist and Civil Engineer, PhD in Architecture and Heritage and Senior Occupational Health and Safety Degree. On professional level, he is specialized in pathology and structural rehabilitation. In addition, he has carried out preventive management tasks, fundamentally in construction, metal and entertainment sectors for the last twenty years: he has worked as execution director, health and safety coordinator on project phase and health and safety coordinator on execution phase. In this sense, he has been health and safety coordinator of great renown works in Spain. Currently, he is a professor at various university centers, such as Universitat Oberta de Catalunya (UOC). In addition, he is Member of the National Association of the Technical Inspection of Structures in Spain, member of the Geology Applied to Engineering Spanish Association and member of the International Association for Engineering Geology and the Environment. In addition, he is Technical Director at EIP, company specializing in structural rehabilitation and prevention management in the construction sector. As a final anecdote, it should be noted that Rubén is a Remote Piloted Aircraft (RAP) Pilot and a Pilot Instructor and Examiner.

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## BOUNDARY ELEMENT AND SENSITIVITY ANALYSIS OF ANISOTROPIC THERMOELASTIC METAL AND ALLOY DISCS WITH HOLES

Mohamed Abdelsabour Fahmy<sup>1,2</sup> and Mohammed O Alsulami<sup>1</sup>

<sup>1</sup>*Umm Al-Qura University, Saudi Arabia*

<sup>2</sup>*Suez Canal University, New Campus, Egypt*

### Abstract

The main aim of this paper is to develop an advanced processing method for analyzing of thermoelastic metal and alloy discs with holes subjected to a moving heat source. In the boundary element formulation, the heat impact is expressed as an additional volume integral in the corresponding boundary integral equation. Any attempt to integrate it directly will necessitate domain discretization, which will eliminate the BEM's most distinguishing feature of boundary discretization. This additional volume integral can be transformed into the boundary by using branch-cut redefinitions to avoid the use of additional line integrals. The numerical results obtained are presented graphically to show the effects of heat source and anisotropy on the thermal stresses of hollow disk with holes. The validity of the proposed technique is examined for one-dimensional sensitivity and excellent agreement with finite element results is obtained.

### Biography

Mohamed Abdelsabour Fahmy received his Bachelor's (1996), Master's (2001) and PhD (2008) degrees in Applied Mathematics. Currently Professor of Scientific Computations, Basic Sciences Department, Faculty of Computers and Informatics, Suez Canal University, Ismailia, Egypt & professor of Applied Mathematics and Computational Sciences, Mathematics Department, Adham University College, Umm Al-Qura University, Makkah, Saudi Arabia. He has authored more than 120 research papers in top-rank Journals and authored 25 books in addition to participating in 15 research projects at Umm Al-Qura University. He taught, supervised and judged master's and doctoral theses in the Department of Mathematics, College of Science, Umm Al-Qura University. He participated in research and as a speaker in many international conferences, seminars and workshops. He is a reviewer for several top-rank Journals. Won the Suez Canal University Prize for Scientific Publishing. He won the Umm Al-Qura University Award for Excellence in Scientific Publishing for the year 1443 AH. Ranked among the top 2% of influential scientists worldwide. He is certified trainer at the Deanship of Development and Quality at Umm Al-Qura University for scientific research and international publishing training programs for faculty members. He is a member of American Mathematical Society (AMS), European Mathematical Society (EMS), London Mathematical Society, Institute of Electrical and Electronics Engineers (IEEE) and IEEE Computer Society. His CV included in four Marquis Who's Who in the World Editions: 2009 (26th Edition), 2010 (27th Edition), 2012 (29th Edition) and 2013 (30th Pearl Anniversary Edition).

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## ON THE CONTROL OF THE FINAL SPEED FOR A CLASS OF FINITE-DIMENSIONAL LINEAR SYSTEM: CONTROLLABILITY AND REGULATION

**Issam Khaloufi, Mostafa Rachik, Youssef Benfatah, Hamza Boutayeb and Hassan Laarabi**

*Hassan II University Casablanca, Morocco*

### Abstract

In this article, we have extended the concept of controllability, traditionally used to control the final state of a system, to the exact control of its final speed. Inspired by Kalman's theory, we have established some conditions to characterize the control that allows the system to reach a desired final speed exactly. When the assumptions ensuring speed-controllability are not met, we adopt a regulation strategy that involves determining the control law to make the system's final speed approach as closely as possible to the predefined final speed, and this at a lower cost.

### Biography

Issam Khaloufi is a researcher in the field of applied mathematics, known for his dedication and contributions to the university world. He obtained his doctorate in applied mathematics from Hassan II University.

Mr. Khaloufi's research prowess is evidenced by an impressive number of publications, with over nine articles in the field of applied mathematics. His work in collaboration with other researchers has considerably enriched the knowledge base of the mathematical community, contributing to the development of practical solutions and theoretical advances in this constantly evolving field.

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## DEEP LEARNING BASED APPROACH FOR PRECISION MARKETING

**Nouhaila ELKOUFI and Abdessamad BELANGOUR**

*Hassan II University, Morocco*

### Abstract

The insurance sector plays a crucial role in fostering sustainable economic development within a country. As the customer base grows, insurance companies must prioritize transitioning to data-driven strategies to cut costs and make more informed marketing choices in today's digital era. This study proposes a new decision-making framework for precision marketing, based on a real case study from a Moroccan insurance company that aims to solve a practical problem. The proposed decision-making system consists of four components, with each component involving important steps. Firstly, data preparation was performed, consisting of four critical stages: data acquisition, data cleaning and filtering, feature selection and oversampling. Secondly, top 20% and top 50% consumers are taken as examples to present their customer persona in detail. Based on the processed data, we analysed consumer consumption behaviors using four ML algorithms and made a performance comparison of the four algorithms. Additionally, we conducted feature selection methods to identify the most relevant features and evaluate the system's performance. The aim of the proposed precision decision-making system is to assist managers in discerning the distinctive characteristics of potential customers and proposing tailored precision marketing strategies. This approach is expected to substantially reduce advertising expenses and enhance overall marketing efficiency. A case study using real-world data from a Moroccan insurance company was conducted to demonstrate the practical implementation of the proposed framework. The results of the study indicate that the proposed system yielded favourable outcomes.



# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## NEW DIVING SITES DISCOVER IN THE BAY OF BENGAL, BANGLADESH PART: A NEW HOPE FOR MARINE ECOSYSTEM AND TOURISM.

Md. Hashibul Islam<sup>1</sup>, Farzana Ahammad<sup>2</sup> and Md. Nurul Isalm<sup>2</sup>

<sup>1</sup>Bangladesh Oceanographic Research Institute, Bangladesh

<sup>2</sup>Sustainable Environmental management Consultants limited

### Abstract

This research creates an opportunity to identify the coral coverage sites in the Bay of Bengal and sustainable tourism, coral associated environment and blue economy activity. This will help to balance our coral healthy environment and coral bio diversities, pollution. We could create awareness among the people and entrepreneur. MOW's research and innovative modeling reveals that 70 million trips are supported by the world's coral reefs each year, making these reefs a powerful engine for tourism. In total, coral reefs represent an astonishing \$36 billion a year in economic value to the world. Of that \$36 billion, \$19 billion represents actual "on-reef" tourism like diving, snorkeling, glass-bottom boating and wildlife watching on reefs themselves.

Underwater tourism is an exciting form of tourist attraction. It opens a new frontier in tourism. Providing direct access to aquatic lives and ecosystem in underwater world, it creates immense pleasure for tourists. Underwater tourism has been developed in many countries.

The benefit of underwater tourism is impressive in terms of monetary value. Pascal & Seidl (2013) estimated the economic benefit of underwater tourism in Vanuatu and Fiji. They showed that around 12000 visitors participated in underwater tourism in Vanuatu a year contributing benefits for 10 businesses. Tourism is supporting the livelihoods of an estimated one in ten people worldwide. Coastal and marine tourism represents a significant share of the industry and is an important component of the growing, sustainable Blue Economy, supporting more than 6.5 million jobs. With anticipated global growth rates of more than 3.5%, coastal and marine tourism is projected to be the largest value-adding segment of the ocean economy by 2030, at 26%.

Through this study we have found three new sites for coral based tourism .

### Biography

Md. Hashibul Islam is at present working as Principal Scientific Officer at Bangladesh Oceanographic Research Institute, Bangladesh. He is working on Oceanography, Pollution, water, waste water treatment, solid waste processing sector for more than 22 years. He is the pioneer of Central Effluent Treatment plant (CETP) in Bangladesh having the capacity of 45000 cubic meter per day. Mr. Hasib leads more than 26 research projects including EIA 70 Projects. He has conducted some very important and good research on environment, resources, machine and methods, which he presented in different national and international journals and conferences. He has worked with different national and international organization like Department of Environment (DoE), GIZ, FAO, UN, British Council, IUCN, World Bank, US-AID, giz, BRAC University-Bangladesh, MVSTU, Pukyong University-South Korea, Taiwan National Cheng Kung University-Taiwan, Karachi University-Pakistan, Andhra University-India, University of Science Malaya, Patras University, Ruhr University-Germany, Ministry of Fisheries, Ministry of Planning, IDCOL, KOIKA, JICA, APN, IAS, EGU, AGU, PORSEC, SOLAS, IOC etc. He is a PADI certified scuba diver and trained in under water crime scene investigation from UN in 2010.

He started his career with Asia Pacific Network in 2000 as research assistant. After that he worked for FAO in 2003 in Bangladesh chapter. In 2004 he was involved in a research project of Thailand. In 2005 he conducted two research works of DoE. He was a scholar of UNESCO in 2006 and 2007. He joined as Visiting Lecturer at Bangladesh Marine Fisheries Academy in 2008. He was examiner and member of graduation and post graduation course development committee. For Research and training purposes he has visited different university and countries like USA, Germany, Italy, Greece, South Korea, Taiwan, India, Pakistan, Maldives, Thailand, and Malaysia. He is a Marine Science graduate and completed his M.Sc (Physical Oceanography), M. Phil on Oceanography. He is member of WEFTEC-USA, EGU,

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

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AGU, Pan Ocean Remote Sensing Committee (PORSEC)-USA, International Association of Sedimentologist (IAS) – Germany, Institute of Environmental Professionals in Bangladesh, Biodiversity Research Group of Bangladesh (BRGB), Bangladesh Fisheries Research Forum (BFRF), Chittagong Science Council, Bangladesh, National Oceanographic and Maritime Institute.

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## INTEGRATING NUMERICAL AND EXPERIMENTAL TOPOLOGY OPTIMIZATION: APPLICATION STUDIES ACROSS VARIED DOMAINS

Avilasha BG<sup>1</sup> and Ramakrishna DS<sup>2</sup>

<sup>1</sup>Dayanandasagar College of Engineering, India

<sup>2</sup>Jawaharlal Nehru College of Engineering, India

### Abstract

In response to resource constraints and the demand for lightweight and efficient structures, optimization procedures play a crucial role in design and development. Topology optimization, commonly executed through computational methods with finite element analysis, traditionally employs a density distribution approach assigning material presence based on stress levels. However, the potential of experimental methods, particularly photoelasticity, for topology optimization remains unexplored. This research explores the application of experimental photoelasticity in topology optimization, utilizing its whole-field technique for stress analysis through isochromatic fringe patterns, allowing accurate identification of high and low-stress regions. The sequential removal of material from low-stress regions leads to a topologically optimized model. The research compares results obtained through numerical methods, specifically Hyperwork's Optistruct software, with those obtained experimentally using the photoelasticity technique. The stress levels in the experimental model are validated through finite element analysis to find the stress magnitude at the lower order fringe locations.

The present study investigates the feasibility of using the photoelasticity method as a topology optimization tool in four diverse applications. The results demonstrate its effectiveness, In the crane hook application, a material reduction of 45.23% is achieved with 9.52% of increase stress level by photoelasticity method. For the linking plate of a rope drum used in cranes, a material reduction of 50.16% is achieved with 19.93% of increase in stress level by photoelasticity, The bell crank lever of the tandem vehicle exhibits a 32.45% mass reduction in single bell crank lever across four levers with 13.45% of increase in stress level. And the hand brake lever in racing cars exhibits 25.88% mass reduction with 18.65% of increase in stress level. The findings demonstrate that topology optimization, conducted through both numerical and experimental approaches, achieves significant weight reduction without compromising component strength and integrity. This research highlights the potential and advantages of employing the photoelasticity method for topology optimization, offering a valuable alternative to traditional computational methods in the pursuit of efficient and lightweight structures.

### Biography

Avilasha BG has completed her MTech in design engineering by JNNCE Shimoga and research student at VTU. She is working as Assistant Professor at Dayanandasagar College of Engineering, Bangalore. She has presented a paper at Joint Rail Conference Baltimore USA. Actively involved in research of topic topology optimization, stress analysis.

Ramakrishna D.S has completed his PhD in IISc Bangalore, he worked as professor and Head Mechanical Engineering Department JNNCE Shimoga, he has published more than 20 papers in reputed journals and attended many conferences at abroad.

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## THE CONVERGENCE OF TECHNOLOGY, AI AND ENGINEERING IN DIGITAL BIOMECHANICS FOR ENHANCED HEALTHCARE

**Zartasha Mustansar**

*National University of Sciences and Technology, Pakistan*

### Abstract

As technology advances, myths about its influence emerge, overshadowing the human intelligence that once drove machine intelligence. The true power of converging technologies lies in augmenting human capabilities, boosting efficiency and enabling engineering-driven insights. It is pivotal to demystify technology's role, emphasizing the convergence of technology, AI and engineering, particularly for innovative solutions in complex healthcare systems.

The human body is a marvel of intricate design, comprising multibody dynamics that interact miraculously to provide lifelike stability and flexibility. Biomechanics, a cornerstone of biomedical engineering, mimics nature's stability principles, enabling engineers to optimize performance and create reliable designs for human movement. However, navigating the nonlinear complexities of human biomechanics, especially in computational analysis, presents significant challenges.

The convergence of Computer-Aided Engineering (CAE) and AI has been instrumental in tackling these challenges. Bio-inspired technology combined with engineering has laid the foundation for modern biomechanics, playing a crucial role in real-time analysis of human performance. CAE has emerged as a game-changer, offering a non-invasive approach to studying biomechanics through simulations.

The integration of CAE in biomechanics has revolutionized our understanding of complex systems, facilitating rapid analysis, injury prediction and design optimization. However, this advancement comes with its set of challenges. Researchers grapple with ensuring simulation accuracy, managing computational complexities and addressing limitations in structural realism.

This talk will detail the grand challenges faced by researchers in biomedical engineering simulations using engineering and AI. This talk will cover journey from ensuring computational robustness to navigating system intricacies, in converging technologies for enhanced healthcare insights. Ultimately driving into digital biomechanics.

### Biography

Zartasha Mustansar has completed her PhD in Image based modeling & Biomechanical Engineering from the University of Manchester UK. She is currently working as Head of Department School of interdisciplinary Engineering and Sciences (SINES) AT National University of Sciences and Technology (NUST). She has published 40+ papers in reputed journals and International Conferences. At SINES, she bridges cross-disciplinary research and industrial partnerships, nurturing a robust research culture. She ensures that Industry partnerships and translational insights into real-world applications must drive impactful outcomes across the University. She practices transparent communication and strategic representation foster a research culture with societal impact. Notably, spearheading 4 funded projects, securing over 9 million in grants, and submitted 9 projects with potential funding of 297 million, showcasing her resource mobilization prowess.

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## EXTRACTION OF CELLULOSE NANOCRYSTALS FROM THE STEM OF ARUNDO DONAX L. AND CHARACTERIZATION OF ITS PHYSIOCHEMICAL ATTRIBUTES

**Abhishek Gaikwad**

*Sam Higginbottom University of Agriculture, India*

### Abstract

In the present investigation, the cellulose nanocrystals (CNC) were extracted from Arundo donax through a four-step treatment. The effects of the alkaline treatment (T1) acid hydrolysis (T2), soxhlet extraction (T3) and purification methods (T4) on the qualitative and quantitative attributes of the resultant cellulose nanocrystals were investigated. The results of the present study signify a positive correlation between chemical treatment and cellulose content. The overall yield conversion of cellulose was recorded as 136.0%, after T4. It was also observed that the moisture content, percentage of water absorption and ash mass fraction gradually declined after each treatment step. The comparative analysis of qualitative characteristics of cellulose emphasized that after each treatment, crystallinity index, crystallite size and d-spacing was enhanced. Moreover, Fourier transform infrared (FTIR) spectra also emphasized that the obtained cellulose nanocrystals was free from impurities after T4 extraction. The thermogravimetric analysis (TGA) confirms the purity of T4 by showing the minimum ash mass fraction in contrast with untreated and other treated samples (T1, T2 and T3) which signifies the stability of obtained cellulose nanocrystals. Simultaneously the derivative thermogravimetry (DTG) curve showed a low rate of derivatization in the extracted cellulose nanocrystals. The field emission scanning electron microscopy (FE-SEM) and energy dispersive spectroscopy (EDX) analysis illustrated that the cellulose nanocrystals was devoid of impurities as well as contamination of heavy metal ions. Moreover, the atomic % of carbon in T4 samples was increased by 64.8% as compared to untreated samples. The findings obtained from dynamic light scattering (DLS) analysis of cellulose nanocrystals confirmed that 63% crystal was obtained in 1.13 nm and 36% of 0.95 nm size.

### Biography

Abhishek Gaikwad is currently associated with the Department of Mechanical Engineering, Vaugh Institute of Agricultural Engineering and Technology at Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India and the National Institute of Technology, Meghalaya, India, where his group is working on the development of cellulose-based nanocomposite materials. He has a vast teaching experience of more than 13 years and a good command in composite materials. He has published more than 25 papers in a journal of international repute. He is also serving as a member of the editorial board in different journals.

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## QUANTUM CONE - NANO SOURCE OF LIGHT WITH DISPERSIVE SPECTRUM, SEPARATED IN TIME AND SPACE

**Arturs Medvids**

*Riga Technical University, Latvia*

### Abstract

A quantum cone is a structure consisting of a large number of quantum dots with a gradually decreasing diameter from the base to the top of the cone. This distribution of quantum dots leads to a dispersive radiated spectrum. The red edge of the spectrum is determined by the band gap of the bulk semiconductor and the blue edge by the quantum confinement of excitons on top of the cones. We observe the kinetics of photoluminescence, obeying the stretch exponential law, from quantum cones formed on the surface of Ge, Si and Diamond-like carbon crystals (DLC). They are explained by an increase in the lifetime of excitons along the height of the cone from the top to the base of the cone and an increasing concentration of excitons at the base due to their drift in the quasi-build-in electric field of the quantum cone. Such time dependence of the photoluminescence spectrum gives the possibility of its discrimination on time. The possible visualization of the quantum cones tops of DLC using irradiation by a UV light source is shown. A quantum cone is a new type of nano source of light because it substitutes for two elements in a conventional spectrometer – a source of light and a dispersive element. These features will make it possible to build a spectrometer to measure the absorption spectrum of individual molecules or viruses.

### Biography

Arturs Medvids, optics and spectroscopy physicist, graduated from the Physics department of Kyiv State University, Ukraine, in 1968. He worked for the Institute of Semiconductor Physics of the Ukrainian Academy of Sciences 1959-1969. In 1994 obtained the degree Dr. habil. Phys., with specialization: Solid State Physics at Latvian University, Riga. Since 1989 he has been the head of the Laboratory of Semiconductor Physics at Riga Technical University and since 1995 - Professor of Riga Technical University. In 2001 and 2017 he worked in Japan as an invited professor at Shizuoka University. He was awarded the title of Honourable guest professor of Shizuoka University, Japan, in 2009, 2014 and 2016. He has published more than 180 scientific publications in Scopus, 5 books and 100 patents.

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## THE MEDICAL DEVICE INDUSTRY IN A KAIZEN ENVIRONMENT IN THE YEAR 2050 COSTA RICA CASE STUDY

**Johan Rojas Rojas**

*Florida Medical Device Industry, Costa Rica*

### Abstract

The aim of this study is to provide a prospective analysis with focus Kaizen philosophy for decision making in the life sciences sector up to the year 2050. What is the projected market for medical devices in a kaizen environment in Costa Rica in 2050? In order to establish the strategic perspective, the parameters recommended by the European Commission for making decisions in the present that affect the future of a given context is followed. Knowing an industrial sector and carrying out a projection analysis of the future, based on the study of current trends in order to analyse the challenges to faced, allows the creation of panoramas to build the future of the company. The research method used mixed with megatrend analysis and Analytical surveys, allowing different perspectives on the object of study to be established in order to obtain projections. Keywords: Medical Devices; Management; Life Sciences; Costa Rica; Kaizen; Health Care Sector.

### Biography

Johan Rojas Rojas he is Doctoral student in Public Management and Business Administration at the Central American Institute of Public Administration (ICAP), master's in business administration and management, Mini-master's in business administration, Specialist in International Projects in Biomass, Electrician and first studies in Industrial Engineering. He is currently a Senior Quality Engineer with more than 14 years of experience in the medical device industry in Costa Rica and national and international speaker. Research Interests: Quality management, high education, validation

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## IMPROVEMENT OF THE GEAR CUTTING PROCESS BY THE POWER SKIVING METHOD BASED ON COMPLEX SYSTEMATIC SIMULATION

**Ihor Hrytsai**

*Lviv Polytechnic National University, Ukraine*

### Abstract

In recent years, the production of gears, which are an integral parts of modern machines, has been dominated by the use of the Power Skiving technology. The introduction of this highly productive and efficient process has been made possible by advances in tooling and coating, high-speed machines with increased rigidity, vibration resistance and perfect synchronisation of work movements. The significant advantages of Power Skiving over traditional gear cutting methods have led researchers to focus on ways to improve this process: optimal operation design, improvement of cutting tools and equipment. At the same time, due to the complexity of Power Skiving kinematics, its modelling is often based on simplified approaches that lead to incorrect solutions. We propose an original computer model that allows to cover all stages of the process according to the following scheme: 3D model of the layers to be cut  $\Rightarrow$  force loading  $\Rightarrow$  dynamic processes in the elastic system of the machine tool  $\Rightarrow$  tribological and thermal processes and phenomena accompanying cutting  $\Rightarrow$  temperature of the tool working surfaces  $\Rightarrow$  tool wear  $\Rightarrow$  machining accuracy. Based on this systematic and comprehensive approach and an in-depth study of the process, a number of recommendations have been developed to improve the technology, equipment and cutting tools. These recommendations include

changing the desine of tool teeth according to their kinematic angles and selecting the type of coating depending on the predominance of power or thermal load on the blades; optimising the feed, number of passes and depth of cut to minimise dynamic (shock) loads during the cut-in phase and ensure maximum productivity; selecting cutting condition to ensure the required machining quality. The practical application of the research results extends to gear manufacturing, machine tool design and cutting tools and will help improve the efficiency of manufacturers of gears and drives for modern machines.

### Biography

Ihor Y. Hrytsai was born in 1952 in Lviv, Ukraine. He received his M.Sc. in 1974, Ph.D. in 1983 and Dr.(Eng)Sc. in 2003, all in Mechanical Engineering. He has been an employee of the National University since 1990. During 2002-2019 he was the Head of the Department of Mechanical Engineering Technology. Currently he is Professor of Manufacturing Engineering at the Department of "Robotics and Integrated Mechanical Engineering Technologies" Institute of Mechanical Engineering and Transport Lviv Polytechnic National University, Ukraine. The scope of his scientific interests is gear manufacturing and systematic and complex study of numerous problems and phenomena accompanying gear forming and cutting processes. He is the author of 11 monographs and textbooks, 30 patents on inventions and more than 200 scientific papers, 12 of them in Scopus and Web of Science databases.



# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## DETERMINATION OF GROUNDWATER POTENTIAL ZONES ON THE EASTERN SLOPE OF MOUNT CAMEROON USING GEOSPATIAL TECHNIQUES AND SEISMOELECTRIC METHOD

**Lionel Junior Ngome Njumbe**

*University of Buea, Cameroon and Alexander Drilling Company, Cameroon*

### Abstract

In complex hard rock terrain where the population suffers from water scarcity, the use of site-specific single-method surface geophysical surveys to prospect for groundwater is a common practice. However, this has not completely solved the problem of drilling dry wells. To combat this failure, geospatial data and the analytical hierarchy process (AHP) are being used as supporting techniques to increase the chance of success. This study had the aim of generating a groundwater potential zones (GWPZ) map of the complex strato-volcanic terrain of Buea by integrating geospatial techniques, AHP and the seismoelectric method. Five factors influencing groundwater recharge were used to define the groundwater potential zones. Via the AHP and weighted overlay methods, five classes of groundwater potential zones were delineated: very poor, poor, moderate, good and very good. More than half of the study area has good to very good groundwater potential. Lastly, the GWPZ model is validated with an iso-conductivity map from a seismoelectric survey and existing static water level data. The iso-conductivity map revealed four main conductivity zones that correlate positively with the GWPZ map. The northwestern part of the study area is characterized by moderate groundwater potential, poor formation conductivity and dry boreholes. There is an uneven distribution of groundwater and variable water table depth in the area. The results of this study are very encouraging, and the integrated approach used has proven to be efficient in determining groundwater potential zones in complex volcanic terrain.

### Biography

Lionel Njumbe is a PhD student in Applied Geology at the University of Buea, Cameroon. He is awaiting the defense of his PhD thesis. He obtained his master's degree in applied Geology at the University of Buea, Cameroon, in 2016. He works as the geologist and manager of Alexander Drilling Company Limbe and has more than 5 years of experience in groundwater exploration and exploitation. Dr. Njumbe has published 2 papers in reputed journals and has a manuscript presently under review. He has been using remote sensing and seismoelectric methods to explore for groundwater all over Cameroon. He builds ATS Geosuite cables used by some geophysicists in Cameroon to conduct seismoelectric surveys with the ATS GeoSuite App.

4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## RESTORATION OF THE MOORISH PAVILION AND ARCHITECTURAL COMPLEX OF MANGUINHOS, IN RIO DE JANEIRO, BRAZIL

**Benedito Tadeu de Oliveira**

*Oswaldo Cruz Foundation- Fiocruz, Brazil*

### Abstract

The article deals with interventions in the Moorish Pavilion or Moorish Castle in Manguinhos, in Rio de Janeiro, main monument of the architectural complex of the Oswaldo Cruz Foundation – Fiocruz, one of the most significant and symbolic architectural ensembles in Brazil. It is the headquarters Fiocruz, under the supervision of the Brazilian Ministry of Health, the most prominent institution of science and technology on health in Latin America. It was protected by the National Historic and Artistic Heritage Institute (IPHAN) in 1980. The construction of the complex started in 1904 and the construction of the Moorish Pavilion started in 1905. It was on the initiative of the renowned Brazilian scientist Oswaldo Cruz and was designed by the Portuguese architect Luiz Moraes Júnior. The Moorish Pavilion, adopted the eclectic language and received the most varied influences of monuments, styles and decor: Montsouris Observatory, English railway stations, Elizabethan architecture and Moorish architecture

An architectural reading of the Moorish Pavilion will be made, examining the architectural language adopted; the material and building systems used in its construction; its meaning for the city and the heritage designation process, the surrounding environment in various periods and the physical, functional and visual relationship with the city. Regarding the restoration works method, the following will be examined: causes of deterioration, diagnosis and state of conservation, interventions performed over the years, the project and methodology of the latest intervention. In the conclusion, the article will analyze the interventions undertaken in the light of the modern principles of cultural heritage preservation, the importance of the restoration works of the Moorish Pavilion Manguinhos and its use as a public cultural and scientific space for the city. The Manguinhos Architectural Complex, gathers historical, cultural and scientific values to apply as a candidate as UNESCO World Cultural Heritage.

### Biography

Benedito Tadeu de Oliveira he is studied Architecture at the University of Brasilia, UnB - 1980. His undergraduate thesis received UIA prizes in Warsaw, Poland and at the XIV Congress of the International Union of Architects, the Union of Egyptian Engineers and the Union of Architects of the former Union of Soviet Socialist Republics (USSR) in 1981. Completed his doctorate degree in Restoration of Monuments at the University of Rome, La Sapienza in 1985, where he defended the thesis in Men Hospital of St. John Lateran. In 1987 he joined the Fiocruz, Rio de Janeiro, RJ, where coordinated the restoration of the historic architectural complex of Manguinhos receiving prizes and honorable mentions in 1991/92/93/94/96; participated in the creation of Fiocruz Life Museum (awarded the prize “Best Works with Year Steel” ABCEM, 1999). He was director of the National Historic and Artistic Heritage Institute - IPHAN in Ouro Preto (2002-2009) and is a member of the Icomos.

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## EXPERIMENTAL RESEARCH OF THE DESORPTION PROCESS WITH THE CO<sub>2</sub>/ACETONE MIXTURE IN A PLATE HEAT EXCHANGER FOR COMPRESSION/RESORPTION HEAT PUMPS

**Paúl Sebastián Dávila Aldás**

*International University of Ecuador, Ecuador*

### Abstract

The present research presents the results of the experimental study of the process of desorption of the CO<sub>2</sub>/acetone mixture in a heat exchanger of plates for compression/resorption heat pumps. The research has been conducted with a bibliographic review of the energy demand at the industrial level to identify temperature ranges in which compression/resorption heat pump technology can be implemented. The operating conditions have been analysed to conduct the experimental study of the desorption process of the CO<sub>2</sub>/acetone mixture in a plate heat exchanger formed by 4 plates/3 channels. An experimental equipment has been designed and built to characterize the desorption process of the CO<sub>2</sub>/acetone mixture in the plate heat exchanger. Results have been obtained for the heat transfer coefficient of the solution, average steam flow, heat flow and desorption mass flow in the central channel of the plate heat exchanger. Finally, an empirical correlation is proposed to extend the results of the heat transfer coefficient of the CO<sub>2</sub>/acetone solution in applications outside the experimentally determined range. In this way, the results shows that the most influential variables are the test pressure and heating water temperature at the inlet of the desorber, where, with a concentration of C<sub>o2</sub> (X<sub>co2</sub>) between 22 and 25%, the heat transfer coefficients obtained have an order of 0.50 kW×m<sup>-2</sup>K<sup>-1</sup>.

### Biography

Paúl Dávila received his PhD in the Faculty of Chemical Engineering in the research line of Fluid and Energy Thermodynamics from Rovira I Virgili University in the city of Tarragona, Catalunha-Spain. He has worked as a researcher and professor at universities in Ecuador and Spain, in addition to having worked in important organizations and institutes related to the efficient use of energy. She has made important publications in high impact journals worldwide and is working on research projects related to mechanical design, materials, use and utilization of energy with renewable sources. He currently serves as director and professor of Industrial Engineering at the International University of Ecuador, UIDE.



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4<sup>th</sup> International Conference on

# Applied Science and Engineering

June 27-28, 2024 | Hotel Mercure Wien Westbahnhof, Vienna, Austria

## USING 3D PRINTING TECHNOLOGY TO MANUFACTURE MICRONEEDLE PATCHES FOR VETERINARY MEDICINE

**Justyna Kornicka**

*Wrocław University of Science and Technology, Poland*

### Abstract

Recent advancements in 3D printing technology have revolutionized various industries, including healthcare. One promising application of this technology is the manufacturing of microneedle patches, which offer a minimally invasive and efficient delivery method for therapeutics.

Microneedle patches have garnered significant attention due to their ability to deliver medications, vaccines and other bioactive agents through the skin's outermost layer, bypassing the need for traditional injections. In veterinary medicine, where precise dosing and ease of administration are paramount, microneedle patches present a promising alternative to conventional methods. The versatility of 3D printing enables the customization of microneedle patches to suit the unique anatomical characteristics of different animal species. By leveraging computer-aided design (CAD) software, microneedle arrays can be design with precise dimensions and geometries, ensuring optimal drug delivery and patient comfort.

Moreover, 3D printing allows for rapid prototyping and iteration, accelerating the development process of microneedle patches for veterinary applications. This technology offers flexibility in material selection, enabling the use of biocompatible polymers and even incorporating active pharmaceutical ingredients directly into the patches.

The adoption of 3D printing for microneedle patch manufacturing in veterinary medicine holds promise for enhancing treatment efficacy, reducing stress associated with traditional administration methods, and improving overall animal welfare.

In this article we present use of 3D printing with common resins used for microfluidics devices, for preparation of microneedle mold with comparison of different geometries. We are introducing among others, microfabrication characterization of biodegradable polyvinylpyrrolidone/ polyvinyl alcohol PVP/PVA microneedles (Scanning Electron Microscopy , SEM), biocompatibility assessment (cell viability assays, histological analysis) insertion performance and mechanical testing.

### Biography

Justyna Kornicka is a Molecular Biotechnology and Biocatalysis graduate from Wrocław University of Technology. She synthesized bacterial serine protease inhibitors during engineering studies and explored cannabinoids from Cannabis sativa L. in type 2 diabetes prevention during master's. She is certified in R&D projects, with expertise in business negotiations and EU fund acquisition. Collaborated with biotech, high-tech and IT sectors to secure EU funds. Currently researching cannabis-derived compounds' therapeutic potential on Adipose-derived Stem Cells at the International Institute of Translational Medicine while driving innovation and facilitating partnerships. She is also PhD. Student at Wrocław University of Science and Technology at the Microsystems Department, where she is working on creating novel method for transdermal drug delivery (microneedle patch) with elements of diagnostics for veterinary medicine. This industrial doctorate is conducted with cooperation with Hippovet+ company. She is the co-author of three scientific publications.

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## INDEX

Abhishek Gaikwad	79
Akuba Bezeba Yalley	36
Albandari Fahad Abdulrahman Alsumayt	48
Ana Isabel Palmero Marrero	47
Anabela Simoes	43
Andreea Mihaila	42
Arturs Medvids	80
Avilasha BG	77
Bahar Feizollahbeigi	52
Benedito Tadeu de Oliveira	83
Bogumiła Winid	30
Boo Yong Lee	57
Branka Hadžić	66
Cerasela-Ionela Cleminte	60
Elena-Anca Paraschiv	31
Emerson Alves da Silva	56
Gayane Amatuni	49
Georges BREMOND	38
Guilherme Vilas Boas Ferreira da Silva	25
Hrayr Darbinyan	33
Hülya Coskun	50
Igor E. Uflyand	59
Ihor Hrytsai	82
Issam Khaloufi	73
Jesus Moises Martinez Buendia	46
Johan Rojas Rojas	81
Jörg M. Hoffmann	21
Jörg-Martin Hohberg	27
Justyna Kornicka	86
Karol Kyzioł	15

Kasim Karam Abdalla	34
Khalid Abdullatif Alsnaie	62
Lionel Junior Ngome Njumbe	51
Lusine Harutyunyan	58
Maximilian Schmitz	18
Md. Hashibul Islam	75
Michaela Kröppl	70
Mohamed Abdelsabour Fahmy	72
Mohamed Ge. Zayda	63
Mohammed Awad Alharbi	64
Naoya Nishimura	61
Noor Ahmed	35
Nouhaila ELKOUFI	74
Paúl Sebastián Dávila Aldás	53
Rahmira Rufus	26
Rana Ali Bakoban	28
Rand Raheem	24
Robert Guidoin	67
Rodolfo Toledo	29
Roy Chaoming Hsu	23
Rubén Rodríguez Elizalde	71
Shahid Ali Khan	54
Shi-Jinn Horng	20
Verena Kantere	39
Verónica Janeth Martínez-Hernández	19
Viorel PAUNOIU	14
Vladimir Kitanovski	45
Xiaohong Han	22
Zartasha Mustansar	78

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