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# ICONAT 2023

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V. International Conference on Natural Science  
and Technologies  
Sunny Beach-Bulgaria  
1st-3th June 2023



**CONFERENCE BOOK**  
2023

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### HALL

<https://teams.microsoft.com/l/meetup->

[join/19%3ameeting\\_MTQ3OGU2MTAtOGExNC00ZGUzLWFIOWMtNmQ5M2Y2NTQ5NjZj%40thread.v2/0?context=%7b%22Tid%22%3a%22e24840f1-c171-4007-ae2d-ffc773f3119f%22%2c%22Oid%22%3a%2251bed7dc-4824-40c8-94e8-2672fe661cd7%22%7d](https://teams.microsoft.com/l/meetup-join/19%3ameeting_MTQ3OGU2MTAtOGExNC00ZGUzLWFIOWMtNmQ5M2Y2NTQ5NjZj%40thread.v2/0?context=%7b%22Tid%22%3a%22e24840f1-c171-4007-ae2d-ffc773f3119f%22%2c%22Oid%22%3a%2251bed7dc-4824-40c8-94e8-2672fe661cd7%22%7d)

Official Opening of the ICONAT-2023  
01 June 2023 Meeting Salon I–Royal Castle Hotel

ICONAT 2023 PROGRAMME

- 09.00 The Start of Registration Process
- 09.30 Official Opening of the ICONAT-2023  
Welcome by Conference
- Prof. Dr. Abidin Kılıç,  
Eskisehir Technical University, Türkiye  
Chairman of Organization Committee
- Prof. Dr. Omarov Murad,  
Vice-Rector, NURE, Ukraine
- Prof. Dr. Zafer Demir,  
Eskisehir Technical University, Türkiye  
Chairman of Organization Committee
- Invited Speaker  
Prof. Dr. Cengiz Türe
- Invited Speaker  
Prof. Dr. Cem Cevik
- Invited Speaker  
Prof. Dr. Igor Grebennik
- Invited Speaker  
Assoc. Prof. Yurii Romashov

12.00 **Lunch Break**

19.00 **Conference Dinner-Bulgarian Tradational Dinner**

**POSTER PRESENTATION SEASION: 01.06.2023 Thursday-15.00-17.00**

**01.06.2023 Thursday-14.00-15.00**

ORAL PRESENTATIONS		
Chairing Abidin Kılıç		
01	AA Christy <i>Norway</i>	Desiccant Properties of Natural Bio-polymers studied by NIR Spectroscopy
02	Okan Küllköylüoğlu, İsmail Ömer Yılmaz, Oğuz Mülayim, Süphan Karaytuğ, Serdar Sak, Serdar Sönmez <i>Türkiye</i>	Correlational Analyses Amid Water-Sediman Samples and Species From The Islands of Antarctica
03	Metin Özkurt <i>Türkiye</i>	Nilco Interaction May Play an Important Role in The Progression of Colorectal Cancer
04	Igor Nevliudov, Igor Badanyuk, Dmytro Nikitin <i>Ukraine</i>	Topological image processing for comprehensive defect and deviation analysis using adaptive binarisation

**01.06.2023 Thursday-15.15-16.15**

ORAL PRESENTATIONS		
Chairing Zafer Demir		
05	Oleksandr Miahkyi, Volodymyr Storozhenko, Roman Orel, Sergey Meshkov <i>Ukraine</i>	Reducing The Level Of Interference Considering The Morphological Characteristics of Objects in Thermal Nondestructive Testing
06	Oleksander Chubukin <i>Ukraine</i>	The Effect of Heat Treatment on The Structure of Niobium Oxide Films
07	Lili Arabuli, Ketevan Tavamaishvili, Tomas Macek, Petra Lovecka, Rudolf Jezek, Hristo Najdenski <i>Ukraine</i>	Synthesis, Characterization and Evaluation of Anti-Tuberculosis Potential of Novel Hybrid Compounds Based on Isoniazid and Pyrazinamide

**01.06.2023 Thursday-15.15-16.15**

ORAL PRESENTATIONS		
Chairing A.A. Christy		
08	Tuğçe Pekdoğan <i>Türkiye</i>	The Power of Green Walls: A Sustainable Design Solution
09	Igor Nevliudov, Vladyslav Yevsieiev, Svitlana Maksymova, Oleksandr Klymenko, Maksym Vzheshniewski <i>Ukraine</i>	Shuttle-Based Storage and Retrieval System 3d Model Improvement and Development
10	Igor Nevliudov, Serhii Novoselov, Oksana Sychova <i>Ukraine</i>	Control Automation of Assembly Operations Using A Computer Vision System in Intelligent Production
11	Onur Şahin <i>Türkiye</i>	Efficiency of Smart Transportation Systems in Detection of Structural Disorders in The <b>withdrawn</b> network

**01.06.2023 Thursday-16.30-17.30**

ORAL PRESENTATIONS		
	<b>Chairing Okan Külköylüoğlu</b>	
12	Emine Nur Ünveren Bilgiç, Nazire Burçin Hamutoğlu, Emre Çam <i>Türkiye</i>	Examination of The Relationship Between The Occupational Identity Perceptions of Primary School Mathematics Teacher Candidates and TPCK
13	Victoria Nevlyudova, Nikolay Starodubtsev <i>Ukraine</i>	Mathematical Modelling of The Informative Feature Choice for Lifecycle State Analysis of Radio-Electronic Means Processes
14	Igor NEVLIUDOV, Murad OMAROV, Yurii ROMASHOV <i>Ukraine</i>	Numerical Methods to Solve Optimal Control Problems for Technical Applications Under Novel Global Challenges
15	Yurdakul AYGÖRMEZ <i>Türkiye</i>	Effect of Magnesium Sulfate on Metal Zeolite Based Geopolymer Mortars Produced with <b>withdrawn</b> powder

**02.06.2023 Friday-9.30-10.30**

ORAL PRESENTATIONS		
	<b>Chairing Emre Aytuğ Özsoy</b>	
16	Hülya Kuru Mutlu, Mustafa Kulakci, Uğur Serincan <i>Türkiye</i>	High Selective Etching Gaas/Al <sub>0.3</sub> ga <sub>0.7</sub> as For Pn Junction Solar Cell Using Citric Acid Solution
17	Mehmet Fidan <i>Türkiye</i>	Two-Dimensional Data Generation Method From Multiple Time Series For 2d-Cnn-Based Rul Estimation Of Lithium-Ion Batteries
18	<i>Nihal Kuş</i> <i>Türkiye</i>	Analysis of C–H·O Interaction Between Anion and Cation of 1,3-Dimethylimidazolium Methylsulphate Using Natural Bond Orbital Method
19	Nazire Burçin Hamutoğlu, Emrah Bilgiç, Emine Nur Ünveren-Bilgiç <i>Türkiye</i>	An Evaluation on Inclusive Education During Distance Education Process: Classroom Teachers' Perceptions

**02.06.2023 Friday-10.45-11.45**

ORAL PRESENTATIONS		
	<b>Chairing Nihal Kuş</b>	
20	Aslı Kaya, Nazire Burçin Hamutoğlu, Emre Çam, Emine Nur Ünveren-Bilgiç <i>Türkiye</i>	The Importance of The Planning Cycle for An Effective Structuring of Online Teaching Processes
21	Turan Teymurbaylı, Utku Kaya <i>Türkiye</i>	Deep Learning Advancements in Railway Track Segmentation: Previous Studies and Improvements
22	Fehmi Aslan <i>Türkiye</i>	Investigation of The Efficiency Of DSSC For Saffron Extract
23	Sara Abdolmaleki, Samad Khaksar <i>Georgia</i>	Evaluation of The Central-Metal Effect on Anticancer Activity and Mechanism of Action of Isostructural Cu(II) and Ni(II) Complexes Containing Pyridine-2,6-Dicarboxylate.

**02.06.2023 Friday-14.00-15.00**

ORAL PRESENTATIONS		
Chairing Lili Arabuli		
24	Igor Nevlidov, Iryna Zharikova, Sergiy Novoselov, Dmytro Nikitin <i>Ukraine</i>	Simulation of Flexible Printed Structures Design for Mobile Robot Platform
25	Svitlana Maksymova, Viktoriia Nevliudova, Oleksandr Klymenko, Gennadii Makarenko <i>Ukraine</i>	Voice Control Using in Pharmaceutical Products Logistics Systems
26	Cihangir KALE, Hikmet ESEN <i>Türkiye</i>	Investigation of Hydrogen Production by Using Concentrated Photovoltaic/Thermal Hybrid Collector with Spectral Beam Splitting
27	Murad Omarov, Vusala Muradova <i>Ukraine</i>	Bayesian Regularization of Learning

**02.06.2023 Friday-15.15-16.15**

ORAL PRESENTATIONS		
Chairing Mehmat Fidan		
28	Sergii Makovetskyi, Kauk Viktor <i>Ukraine</i>	Research of The Stability of The Secure Radio-Frequency Communication in The Distributed Systems by Using Multy-Channel IOT LPWAN Technologies
29	L. Arabuli, I. A. Iashchishyn, N. V. Romanova, G. Musteikyte V. Smirnovas, H. Chaudhary, Ž. M. Svedruži' C, And L. A. Morozova-Roche <i>Ukraine</i>	Co-Aggregation Of S100a9 Protein With L- Dopa And Cyclen-Based Compounds – Effect On The Amyloid Fibril Self-Assembly
30	Peyman Salahshour, Samad Khaksar <i>Georgia</i>	3,5-Bis(trifluoromethyl) phenylammonium triflate: a new and green organocatalyst for the synthesis of indeno[1,2-b]pyridines
31	Olena Kovalenko, Olga Yunakova, Mykola Yunakov <i>Ukraine</i>	Peculiarities of Cs <sub>1-x</sub> Rb <sub>x</sub> Cu <sub>2</sub> Cl <sub>3</sub> Solid Solutions Absorption Spectra

**02.06.2023 Friday-16.30-17.30**

ORAL PRESENTATIONS		
Chairing N. Burçin Hamudoğlu		
32	Igor Nevlidov, Dmytro Nikitin, Igor Badanyuk, Roman Strelets, Yegor Korotun <i>Ukraine</i>	Factor Analysis of Photopolymer Resins for 3D Printing
33	Hatice Güney, Abidin Kılıç <i>Türkiye</i>	Examining The Symmetry Operations of The DNA Molecule with Clifford Algebra
34	Hatice Güney, Abidin Kılıç <i>Türkiye</i>	Investigation of Transformation Matrices of Symmetric Molecules with Clifford Algebra
35	Murad Omarov, Vladyslav Korobskyi, Viktoriia Nevliudova <i>Ukraine</i>	Ensuring the robot snake's movement on slippery surfaces
36	Emre Aytuğ ÖZSOY <i>Türkiye</i>	A Geotechnical Examination of Kahramanmaras (Turkey) Pazarcık & Ekinözü 6 February 2023 Earthquakes
37	Çetin Yavuz, Ali Tarokh, Aydın Dikici <i>Türkiye</i>	Numerical Analysis of A New Thermosiphon Heat Pipe

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39	Tarana Poladova <i>Azerbaijan</i>	Synthesis and Study of New Surface-Active Polymer Complex with Catanionic Salt
40	A.N. Mammadov, U.N. Sharifova, F.S. Ibrahimova, A.M. Qasimova, Mustafayeva A.N. <i>Azerbaijan</i>	Synthesis of Sodium Titanates Using Chitosan in The Environment
41	Ulkar Shiraliyeva, Elmira Huseynova, Aida Rzayeva, Zarifa Mammadova, Saida Nadjafova, Nurana Mardanova <i>Azerbaijan</i>	Study of Activity and Selectivity of Oxide Catalysts in Hydrocarbon Oxidation Reactions
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01

## DESICCANT PROPERTIES OF NATURAL BIO-POLYMERS STUDIED BY NIR SPECTROSCOPY

Christy A.A.

Department of Science, Faculty of Engineering and Science, University of Agder, Norway

alfred.christy@uia.no

### ABSTRACT

Desiccants are substances used in the dehumidification process which is vital in order to avoid the degradation of materials. Silica gel is the most prominent type of desiccant used and today the world has developed an interest in bio-polymers due to certain demerits of silica. Hence this study was conducted to investigate the desiccant properties of the four commercial flours wheat, corn, potato and gram and to compare them with the common silica gel desiccant. The bio-polymers were dried under vacuum at 120 °C and were studied over time using Near-Infrared (NIR) spectroscopy for their –OH combination peak which appears at around 5200 cm<sup>-1</sup> and the derivative spectra were analyzed to recognize the specific –OH groups involved in hydrogen bonding process. Further, the gravimetric analysis was used to study the rate of adsorption and their long-term efficacies were detected using data loggers. The results clearly indicated that adsorption of water occurs at C1, C2+C3, C4 and C6-OH groups of the glucose units for wheat and corn flour while potato and gram flour showed only three peaks attributing to C1, C2+C3 and C6-OH. Further it was observed that C1 and C2+C3-OH groups have a similar and the highest rates. The rates of adsorption of all flours were greater than both analytical grade and commercial silica and corn flour was found to be an outstanding desiccant compared to conventional silica desiccant.

**Keywords:** Adsorption, bio-desiccant, Near-Infrared (NIR) spectroscopy, Gravimetric

02

## CORRELATIONAL ANALYSES AMID WATER-SEDIMAN SAMPLES AND SPECIES FROM THE ISLANDS OF ANTARCTICA

Okan KÜLKÖYLÜOĞLU<sup>1</sup>, İsmail Ömer YILMAZ<sup>2</sup>, Oğuz MÜLAYİM<sup>3</sup>, Süphan KARAYTUĞ<sup>4</sup>, Serdar SAK<sup>5</sup>,  
Serdar SÖNMEZ<sup>6</sup>

<sup>123</sup> Bolu Abant İzzet Baysal University, Middle East Technical University, Türkiye Petrolleri A.O., Adıyaman  
<sup>456</sup>MersinUniversity, BalıkesirUniversity, AdıyamanUniversity,

### ABSTRACT

Total of 32 water and sediman samples collected from four islands (Horseshoe, Nansen, Dismal, Livingstone) of Antarctica during the sixth Turkish Antarctica Expedition to Western Antarctica (TAE-6) were evaluated for providing ternary plot models among the variables. Although biodiversity (e.g., ostracods, copepods) of the sampling sites were low, unique species assemblages are valued with reporting a new ostracod species and two other reports of copepodid species. Models of ternary plots suggested that sampling sites divided in two groups based on anion and cation dominancy. First grup includes Na>Ca>K and Ca>Mg>K while the second group includes Cl>HCO<sub>3</sub>>SO<sub>4</sub>. Also, the same (Na>Ca>K) dominancy was found in sediman samples while correlation was positive amid some major anions of water and sedimant such as Na, Ca and K. However, there was no significant correlation between Ca and K values of water and sediman samples. According to the log Na and log K comparison, freshwater sampling sites are separated from the sites with highly saline sea water. Thus, correlation analyses and ternary plot models suggest that species reported from these sampling sites differ in their tolerance and optimum estimates. Further models are discussed for future possibilities.

**Keywords:** Antarctica islands, TAE-6, water and sediman chemistry, biodiversity, correlational analyses

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## NILCO INTERACTION MAY PLAY AN IMPORTANT ROLE IN THE PROGRESSION OF COLORECTAL CANCER

Mete ÖZKURT

Physiology Department, Mecidal Faculty, Eskisehir Osmangazi University, Eskisehir, Turkey

### ABSTRACT

**Aim:** NILCO is a novel mechanism that interacts with proinflammatory and proangiogenic signals, which are critical for cell proliferation and angiogenesis in cancer. We aimed to show the mechanisms of NILCO interaction in the colorectal cancer with a in-vitro study.

**Material and Methods:** We treated HT29 cells, a colorectal carcinoma cell line, with NOTCH1, Leptin and IL-1 siRNAs. Form the medium of the cells we made ELISA experiment for Leptin, IL-1 and VEGFA. We isolated mRNA and performed qRT-PCR for IL-1, NOTCH1, Leptin, VEGFA, MMP2, VEGFR2, Caspase9, E-Cad, IL-1R. We also isolated protein from the cells and performed western-blot analysis for IL-1, MMP2, NOTCH1, TIMP-1, VEGFA, VEGFR2 and OB-R .

**Results:** ELISA results showed no difference in all groups. Insignificant but folded increase was observed in IL-1,E-Cad and Leptin mRNA in all siRNA treated group. Leptin was significantly increased when Leptin siRNA was given. VEGFA, VEGFR2, IL-1R and MMP2 mRNAs were significantly increased when IL-1 siRNA was given. Caspase9 mRNA was significantly increased in both leptin and Il-1 siRNA treated groups. MMP2, VEGFA, OB-R proteins were higher while VEGFR were lower in IL-1 siRNA treated groups. NOTCH1 protein showed an increase in Leptin siRNA group.

**Conclusion:** Our results conclude that interaction of NILCO pathway but critically IL-1 may play an important role in the progression of colorectal cancer.

**Keywords:** NILCO, NOTCH1, Leptin, IL-1, Colorectal cancer, HT29

## TOPOLOGICAL IMAGE PROCESSING FOR COMPREHENSIVE DEFECT AND DEVIATION ANALYSIS USING ADAPTIVE BINARISATION

Igor Nevludov, Igor Badanyuk, Dmytro Nikitin

<sup>1</sup> Department of Computer-Integrated Technologies, Automation and Mechatronics;  
Kharkiv National University of Radio Electronics, Kharkiv, Ukraine

### ABSTRACT

PCB topology image processing is an important component of Industry 4.0, as images can be used for automated quality control and visual inspection of manufacturing processes related to PCB production. Image processing can be used to control the quality of printed circuit boards, for example, to detect defects that may be invisible to the human eye. The main objective of the study is to improve the method of adaptive binarization for images obtained by technical vision systems by developing an automatic algorithm for detecting the required value of the image binarization window. To achieve this goal, it was decided to develop an algorithm for automatically finding the size of the scanning area in adaptive binarization for processing technological images of the SOE topology.

**Keywords:** Process image processing, Adaptive binarization, Otsu method, GP topology, Finding "Block size".

## REDUCING THE LEVEL OF INTERFERENCE CONSIDERING THE MORPHOLOGICAL CHARACTERISTICS OF OBJECTS IN THERMAL NONDESTRUCTIVE TESTING

Oleksandr MIAHKYI, Volodymyr STOROZHENKO, Roman OREL, Sergey MESHKOV

Department of Physics, Kharkov National University of Radio Electronics, Kharkov, Ukraine

### ABSTRACT

The interferences characteristic of thermal non-destructive testing that reduces the reliability of the obtained results are described. A methodology for their reduction is proposed, consisting of two interdependent stages. The first stage consists in calculating and analysing the nature and level of the expected signal according to the developed thermophysical model against the background of the experimentally obtained level of interference. According to the results of the analysis of the calculations based on the thermophysical model for the selected samples, the most influential interference was the heterogeneity of the emissivity of the sample surface. The second stage of data processing is devoted to reducing this interference. The second stage consists of processing the thermograms of temperature fields and includes morphological analysis of the surface condition, filtering, and reduction of characteristic interference. It is divided into four practical procedures. Analysis of the visual image and obtaining a map of zones with the different emissivity of the sample surface, analysis of the thermogram with an assessment of the level of discreteness of the thermogram and the position of the reference points on the image, smoothing of the thermographic image and selection of zones with the different emissivity of the surface of the object under control on the thermogram, followed by noise filtering. Since the results of thermal control are strongly influenced by the shape of the object, the capabilities and effectiveness of the proposed methodology are illustrated on a cylindrical object (Figure).

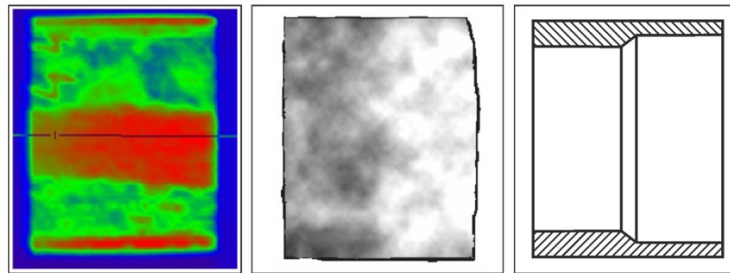


Figure - Thermogram of a sample fragment, its reconstructed temperature field and longitudinal section

The experiment confirmed the validity and correctness of the theoretical statements and allowed us to determine the internal structure of the object under study (different wall thicknesses) and reduce the level of structural interference by 3.6 °C. The research shows that the processing of experimental data, which was carried out taking into account the specifics of the thermal and structural characteristics of the objects under control, gives a significant positive result and is an important step towards automating thermal non-destructive testing procedures on the way to implementation in current production.

**Keywords:** thermal nondestructive testing, structural interference, thermophysical model, image processing, morphological analysis.

## THE EFFECT OF HEAT TREATMENT ON THE STRUCTURE OF NIOBIUM OXIDE FILMS

Oleksandr CHUBUKIN

Applied Physics, Faculty of Automatics and Computerized Technologies, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine

### ABSTRACT

Niobium oxide films are used as optical coatings, sensor materials and electrochromic films. They have a high refractive index in the visible range and a high dielectric constant. However, structural heterogeneities in their working layer can be a factor in reducing the reliability of products where these films are used. This is due to the fact that the integrated electrophysical parameters of devices are determined by locally changed properties of the working layer of this dielectric, which may differ from the properties of its main part. For example, a local increase in electrical conductivity in a dielectric layer entails heating of the defective area, which, in turn, increases the local conductivity of the dielectric and leads to its thermal breakdown. One of the methods for detecting defects in dielectric films is the method of electrography, which allows visualizing these defects. Electrography is used to study the structural inhomogeneities of solids that are decorated with specially selected physical process products, followed by visualization of the decorated areas using appropriate observation techniques. The aim of this work was to investigate phase formation in thin-film structures during annealing, in the course of which the dependence of the structure and composition of oxide films on the conditions of their heat treatment was investigated. This paper presents the methods and results of an electrographic study of the conductive properties of  $\text{Nb}_2\text{O}_5$  films of the Nb-Nb<sub>2</sub>O<sub>5</sub> system by analyzing the spatial distribution of inhomogeneities on samples annealed in different modes.

**Keywords:** Niobium oxide films, Heat treatment, Electrography, Spatial distribution of inhomogeneities

## SYNTHESIS, CHARACTERIZATION AND EVALUATION OF ANTI-TUBERCULOSIS POTENTIAL OF NOVEL HYBRID COMPOUNDS BASED ON ISONIAZID AND PYRAZINAMIDE

Lili Arabuli<sup>1\*</sup>, Ketevan Tavamaishvili<sup>2</sup>, Tomas Macek<sup>3</sup>, Petra Lovecka<sup>3</sup>, Rudolf Jezek<sup>3</sup>, Hristo Najdenski<sup>4</sup>

<sup>1\*</sup>University of Georgia, School of Science and Technology, Tbilisi, Georgia.

<sup>2</sup>Georgian-American University, Medical school, Tbilisi, Georgia

<sup>3</sup>University of Chemistry and Technology, Department of Biochemistry and Microbiology, Prague, Czech Republic

<sup>4</sup>The Stephan Angeloff Institute of Microbiology, Bulgarian Academy of Sciences, Bulgaria

### ABSTRACT

Tuberculosis remains one of the most dangerous infectious diseases and causes over 1 670 000 deaths annually all over the world. To treat tuberculosis, there are traditionally old drugs but several new medications like bedaquiline, delamanide, pretomanide and rifapentine were proposed which are under phase 3 clinical trials. The main problem in Tub therapy, drug-resistant and multidrug-resistant tuberculosis is considered. Therefore, the main goal in therapy and drug discovery is to shorten duration of treatment, reduce side effects of drugs and develop/discover new effective drugs, showing less side effects. Herein, we present preparation, structural characterization (<sup>1</sup>H, <sup>13</sup>C NMR, FT-IR, UV-vis, determination of melting points) of new hybrid compounds (Fig. 1.) consisting in the molecule isoniazid, pyrazinamide, L-Dopa, 1,4,7,10-tetraazacyclododecane and small peptide fragments, as well as evaluation their anti-mycobacterial properties/activities on the strains of *M. tuberculosis* H37 (ATSS 25177 and ATSS 19274). In addition, ADME software was used for prediction of drug-likeness properties and their deviations from optimal drug-likeness rules. Among 10 novel synthesized compounds, some of them showed promising anti-tubercular activities and based on preliminary results, further structural modification and detailed anti-Tub bacterial investigation will be planned.

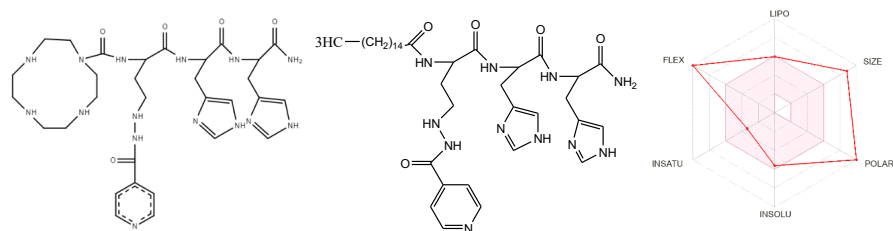


Fig. 1. Structures of synthesized hybrid compounds based isoniazid and pyrazinamide and ADME diagramme

**Keywords:** Tuberculosis, drug-likeness, isoniazid, pyrazinamide, L-dopa, cyclen, biological activity

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## THE POWER OF GREEN WALLS: A SUSTAINABLE DESIGN SOLUTION

Tugce PEKDOGAN<sup>1,\*</sup>

<sup>1</sup> Department of Architecture, Faculty of Architecture and Design, Adana Alparslan Turkes Science and Technology University, Adana, Turkey

### ABSTRACT

In recent years, the climate change crisis has driven architects and urban planners towards sustainable building designs that can reduce energy demand, minimize environmental impact, and mitigate the urban heat island effect. Adding green roofs and living walls to buildings is part of an urban design approach that aims to address the existing challenges of built environments. Green roofs can cover impermeable roof areas in urban areas, thus providing numerous environmental, economic, and social benefits. Additionally, living walls located inside and outside buildings have the potential to improve air quality, reduce pollution levels, lower indoor and outdoor temperatures, decrease energy consumption, provide sound insulation, promote biodiversity, and enhance human physical and psychological health. As such, it is crucial to examine and evaluate the impact of living walls on indoor air quality, thermal performance, noise reduction, and social and visual aspects with their environmental, social, and economic dimensions in mind. In this paper, the concept of green walls is explored, including its advantages and disadvantages and its applicability.

**Keywords:** Green walls, sustainable design, environmental impact.

## SHUTTLE-BASED STORAGE AND RETRIEVAL SYSTEM 3D MODEL IMPROVEMENT AND DEVELOPMENT

Igor Nevliudov<sup>1</sup>, Vladyslav Yevsieiev<sup>1</sup>, Svitlana Maksymova<sup>1</sup>, Oleksandr Klymenko<sup>2</sup>, Maksym Vzhesniewski<sup>2</sup>

<sup>1</sup> Department of Computer-Integrated Technologies, Automation and Mechatronics;  
Kharkiv National University of Radio Electronics, Kharkiv, Ukraine  
<sup>2</sup>«Kapelou» LLC, Kyiv, Ukraine

### ABSTRACT

The development of new design solutions for Radioshuttle will increase the storage density of heterogeneous goods, increase the efficiency and productivity of warehouse logistics, reduce the cost of renting warehouse space and reduce the negative impact on the environment, which makes this development extremely relevant and necessary in modern logistics.

Authors proposed to improve the designs of the Radioshuttle, through the use of the Mecanum Wheel. To test this, the authors designed a 3D model of a Radioshuttle with a Mecanum Wheel using Autodesk Fusion 360 while maintaining overall dimensions and a 3D model of rack structures.

**Keywords:** Shattle, Storage, Retrieval System, Warehouse Management System, Warehouse 4.0.

## CONTROL AUTOMATION OF ASSEMBLY OPERATIONS USING A COMPUTER VISION SYSTEM IN INTELLIGENT PRODUCTION

Igor NEVLIUDOV<sup>1</sup>, Serhii NOVOSELOV<sup>1</sup>, Oksana SYCHOVA<sup>1</sup>

<sup>1</sup>Department of Computer-Integrated Technologies, Automation and Mechatronics, Faculty of Automatics and Computerized Technologies, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine

### ABSTRACT

The using principles control means of assembly operations in production are described. An methods analysis for assessing the accuracy of component installation during assembly work was carried out. The scheme of the automated system operation for controlling the execution of assembly operations has been developed. The mathematical model synthesis of the proposed automated system was performed. The experimental research result is described.

**Keywords:** Computer vision, assembly operations, Industry 4.0, Emgu CV.

## AKILLI ULAŞIM SİSTEMLERİNİN ULAŞIM AĞINDAKİ YAPISAL BOZULMALARIN TESPİTİNDEKİ ETKİNLİĞİ

Onur ŞAHİN<sup>1</sup>

<sup>1</sup> İnşaat Mühendisliği Bölümü, İnşaat Fakültesi, Ulaştırma Ana Bilim Dalı, Yıldız Teknik Üniversitesi, İstanbul, Türkiye

### ABSTRACT

Ulaşım sistemleri bir ülkenin gelişmişlik düzeyiyle paralel ölçüde gelişen hizmet sistemleridir. Aktif, sürdürülebilir ve tıkanmalara anlık müdahale imkânı tanıyan teknoloji odaklı sistemler ise akıllı ulaşım sistemleri olarak nitelendirilmektedir. Bu bağlamda ulaşım ağının sürekli olarak gözlemlenmesi ve karşılaşılan engellerin tespiti, ulaşım ağında teknolojinin yoğun bir biçimde kullanılması, hem uygulanabilirlik hem de zaman kazandırması açısından büyük önem taşımaktadır. Özellikle yoğun yağış alan ve zemin dolguları yeterli düzeyde bulunmayan ulaşım altyapıları sebebiyle heyelanlar meydana gelmekte ve bu büyük toprak kütlelerinin hareketleri sonucu aktif kullanılan bazı ulaşım sistemleri bozulmaktadır. Güzergâhı kullanan araç sayısına bağlı olarak bu tıkanıklığın maddi manevi sonuçları çok büyük boyutlara ulaşabilmektedir. Dolayısıyla bu tip bir durum meydana geldiğinde süratle tespiti ve müdahale ekibinin yönlendirilmesi oluşacak birçok kaybın önüne geçilmesine olanak sağlayacaktır. Akıllı ulaşım sistemleri olarak adlandırılan ve aktif olarak takip edilebilir ve anlık uyarı bildirim merkezi sayesinde çok hızlı ve etkin bir biçimde hasar alan bölgenin tespit edilmesini sağlayan sistemlerin heyelan riski bulunan bölgeleri uygulanması gereklilikten öte bir zorunluluk haline gelmiştir. Ekonomik açıdan akıllı ulaşım sistemlerinin kent ulaşım politikalarına uyarlanması ek bir yük getirirse de uzun vadede sağladığı fayda ve önüne geçebileceği kayıplar düşünüldüğünde maliyetini karşılama ve pozitif bir etki bırakması öngörülmektedir. Bu çalışmada, akıllı ulaşım sistemlerinin hangi bölgelere nasıl uygulanabileceği ve etkinliği incelenecek ve sağlanan faydaların tespiti yapılacaktır.



## EXAMINATION OF THE RELATIONSHIP BETWEEN THE OCCUPATIONAL IDENTITY PERCEPTIONS OF PRIMARY SCHOOL MATHEMATICS TEACHER CANDIDATES AND TPCK

Emine Nur ÜNVEREN BİLGİÇ<sup>1,\*</sup>, Nazire Burçin HAMUTOĞLU<sup>2</sup>, Emre ÇAM<sup>3</sup>

<sup>1</sup> Education Faculty, Mathematics and Science Education department, Düzce University, Düzce, Turkey

<sup>2</sup> The Centre for Teaching and Learning Excellence, Eskişehir Technical University, Eskişehir, Turkey

<sup>3</sup> Niksar Niksar Vocational School, Tokat Gaziosmanpaşa University, Tokat, Turkey

### ABSTRACT

It is important for the element of quality in education to define the factors that form or change the perceptions of teachers who are new to the profession and who gain experience over time, the reasons why teachers choose the profession or which conditions are effective over time, the way teachers perceive themselves in the region where they live or in the society in general or how the society perceives teachers, the change in the perception of the teacher after the interaction of the teacher with other teachers, students and administrators of the school. Another important context for quality in educational processes is Pedagogical Content Knowledge defined by Schulman (1987). Today, with the inclusion of the technology component in teacher knowledge, it is a very important topic to examine teacher knowledge, which was redefined as Technological Pedagogical Content Knowledge by Mishra and Koehler (2016), in this context (Vijayan & Joshith, 2018). The aim of this study is to examine the relationship between pre-service elementary mathematics teachers' perceptions of professional identity and Technological Pedagogical Content Knowledge. From this point of view, the research will be carried out in a relational survey design with a quantitative paradigm. "Teachers' Perception of Professional Identity Scale" developed by Yıldız and Çetin (2020) and "Technological Pedagogical Content Knowledge Scale (TPACK-Math)" developed by Önal (2016) will be used for the participants who will be provided from all grade levels with maximum diversity sampling.

**Keywords:** Professional Identity, TPCK, Mathematics Education

## MATHEMATICAL MODELLING OF THE INFORMATIVE FEATURE CHOICE FOR LIFECYCLE STATE ANALYSIS OF RADIO-ELECTRONIC MEANS PROCESSES

VICTORIA NEVLYUDOVA, NIKOLAY STARODUBTSEV

Department of Computer Integrated Technologies, Automation and Mechatronics, Faculty of Automation and Computerized Technologies, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine

### ABSTRACT

The solution of problems of mathematical modeling of efficiency functions of radio electronic means life cycle processes (REM LC) and selection of informative attributes for REM LC monitoring, by classification of REM states and life cycle processes in attribute space, each of which has a certain significance, that allowed to find a complex criterion and to formalize selection procedures, is given. The cases of insufficient amount of a priori data for correct classification are considered; heuristic methods of selection according to criteria of basic prototypes and information priorities are proposed.

**Keywords:** informative features, identification of REM states, life cycle monitoring.

## NUMERICAL METHODS TO SOLVE OPTIMAL CONTROL PROBLEMS FOR TECHNICAL APPLICATIONS UNDER NOVEL GLOBAL CHALLENGES

Igor NEVLIUDOV<sup>1</sup>, Murad OMAROV<sup>1</sup>, Yurii ROMASHOV<sup>1,2,\*</sup>

<sup>1</sup> Computer Integrated Technologies, Automation and Mechatronics, Faculty of Automatics and Computerized Technologies, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine

<sup>2</sup> Applied mathematics, School of Mathematics and Computer Sciences, V.N. Karazin Kharkiv National University, Kharkiv, Ukraine

### ABSTRACT

The optimal control problem formulation and the most fundamental results are associated with L. Pontryagin. Such problems are researched last decades, but we have only a lot of analytic-numerical methods suitable for particular classes of the tasks. We have no of all-conventional pure numerical methods to solve optimal control problems directly without additional dimensions restrictions and linearity requirements. The interests to improved optimal controls is the aftermaths also of decisions striving to resolve of different novel global challenges. Well-known European plans of introducing a Carbon Border Tax is the example of it, because in this reality the optimal controls providing the minimal carbon leakages will be the principal for modern automation. Engineering implementations of optimal controls with different optimality criteria requires considering of corresponded complicated optimal control problems without dimensions restrictions and linearity requirements, and only the numerical methods can do it. To use the numerical methos to solve the optimal control problem, it is proposed to reduce it to minimizing of some many variable objective function. The principal difficulty of this approach in optimal control considering will be the necessity of solving the nonlinear system of ordinary differential equations to compute the value of the objective function for its given arguments. Due to this, the significant amounts of computing will be required, and it is required the correspondent computers and programming languages providing the maximum fast executing code.

**Keywords:** Optimal control, numerical methods, objective function, minimization

## KAOLİN KİLİ TOZU İLE ÜRETİLEN METAZEOLİT TABANLI GEOPOLİMER HARÇLARDA MAGNEZYUM SÜLFAT ETKİSİ

Yurdakul AYGÖRMEZ<sup>1,\*</sup>

<sup>1</sup> İnşaat Mühendisliği Bölümü, Davutpaşa Kampüsü, Yıldız Teknik Üniversitesi, İstanbul, Türkiye

### ÖZET

Çimento esaslı malzeme dünyanın her ülkesinde yaygın olarak kullanılan bir yapı malzemesidir ve zaman geçtikçe şehirlerin daha da büyümesi ile bu ihtiyacın artması beklenmektedir. 2050 yılında beton ihtiyacının 1990 yılına göre yaklaşık dört kat daha fazla olacağı tahmin edilmektedir. Ayrıca Portland Çimentosu kullanımı ile sera gazı emisyonu önemli ölçüde artmaktadır. Bu şekilde oluşan emisyonların önümüzdeki yıllarda artacağı bir gerçektir. Küresel ısınma endeksi de bu durumdan etkilenmektedir. Bu durumda inşaat alanında betonun yoğun olarak kullanılması, gelecekte sürdürülebilirlik ile ilgili adımların atılmasını gerekli kılmaktadır. Farklı alternatif üretimler kullanılması önemli bir avantaj sağlar ve sürdürülebilirlik kavramını sağlamak için çevresel olumsuz etkileri azaltmaktadır. Geopolimer üretimi bu bakımdan büyük önem taşımaktadır.

Sülfat saldırısı, tüm dünyada beton ve harç yapılarının dayanımını ve zarar görmesine neden olduğu kabul edilen sebeplerden biridir. Bu nedenle, sülfat saldırı direnci, inşaatta kullanılan malzemeler için önemli bir dayanıklılık ve hizmet verebilirlik sorunudur. Magnezyum sülfat direncini değerlendirmek için metazeolit tabanlı geopolimer harç numuneler üretilmiştir. Bu çalışmada kaolin kili tozu üç farklı oranda (%5, %15 ve %25) metazeolit tabanlı geopolimer harç numunelere agrega olarak katılmıştır. Numuneler 24 aya kadar %5 magnezyum sülfat çözeltisine daldırılmıştır. Bu çalışmada değerlendirilen özellikler, görsel inceleme, numunelerin ağırlık değişimi, basınç dayanımı, eğilme dayanımıdır. Sonuçlar, kaolin kili tozunun %5 oranında katılmasının basınç dayanımı sonuçlarını artırdığını gösterirken %15 oranında kullanımın kabul edilebilir seviyelerde dayanım sonuçları oluşturduğunu göstermiştir. %25 oranında kaolin kullanılması durumunda ise önemli dayanım azalması görülmüştür. Genel olarak, geopolimer harçlar magnezyum sülfat çözeltisine karşı önemli dirençler göstermiştir.

**Anahtar Kelimeler:** Geopolimer, Metazeolit, Kaolin, Magnezyum sülfat etkisi

## HIGH SELECTIVE ETCHING GAAS/AL<sub>0.3</sub>GA<sub>0.7</sub>AS FOR PN JUNCTION SOLAR CELL USING CITRIC ACID SOLUTION

Hülya KURU MUTLU<sup>1,2,\*</sup>, Mustafa KULAKCI<sup>2,3</sup>, Uğur SERINCAN<sup>2</sup>

<sup>1</sup>Opticianry Program, University of Eskişehir Osmangazi, Eskişehir, Türkiye

<sup>2</sup>Nanoboyut Research Laboratory, Department of Physics, Eskişehir Technical University, Eskişehir, Türkiye

<sup>3</sup>Institute of Earth and Space Sciences, Eskişehir Technical University, Eskişehir 26470, Türkiye

<sup>4</sup>Advanced Technologies Application and Research Center, Eskişehir Technical University, Eskişehir, Türkiye

### ABSTRACT

In this study, effects of selective citric acid solution on the surface properties of p-n junction solar cells were investigated and analyzed. Solar cell structures were grown by molecular beam epitaxy (MBE) system and cut into small pieces with a size of  $0.5 \times 0.5 \text{ cm}^2$  for a detailed etch study. First of all, the samples were cleaned sequentially in acetone, isopropanol (at 80°C), and distilled water for a duration of 5 minutes and then dried with N<sub>2</sub> flow. Following the cleaning procedure, the native oxide on the samples was removed in HCl acid solution at a ratio of (H<sub>2</sub>O) 5:1 (HCl) in 20-25 seconds. After oxide removal, samples surfaces were coated with a photoresist (AZ 5214E) using a spin coating system at 3000 rpm for 40 seconds and then pre-cured at 110°C on a hot plate. Mesa patterns were transferred onto the samples using a photo-lithography system. After UV exposure, mesa patterns appeared in the developer solution (AZ400K: H<sub>2</sub>O; 1:4) and the samples were cured again at 120 °C for 5 minutes on a hot plate. The photoresist thickness of each sample was measured using a profilometer. Afterward, a mixture of citric acid and water was prepared at a ratio of 1:1, and a solution of citric acid was prepared by mixing the prepared mixture with H<sub>2</sub>O<sub>2</sub> at a ratio of 1:5. The samples were kept in this prepared citric acid solution for 30, 60, 90 or 120 seconds. Etch depths were measured using a profilometer and an etching graph was formed. Surface photographs were taken before and after citric acid treatment and the effects of etching on the surface were examined.

**Keywords:** Citric acid, Etching, pn junction, solar cell

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## TWO-DIMENSIONAL DATA GENERATION METHOD FROM MULTIPLE TIME SERIES FOR 2D-CNN-BASED RUL ESTIMATION OF LITHIUM-ION BATTERIES

Mehmet FIDAN<sup>1</sup>

<sup>1</sup> Rail Systems Electrics and Electronics Program, Vocational School of Transportation, Eskişehir Technical University, Eskişehir, Turkey

### ABSTRACT

As the use of electric vehicles increases in our age, the reliability of Lithium-Ion batteries increases their importance. One way to increase the reliability of Lithium-Ion batteries is to strongly estimate the Remaining Useful Life of these batteries. A robust RuL estimation contains important information for the control of these batteries. In this study, a new two-dimensional data generation method is proposed from multiple time series formed from the past current and voltage values measured from the terminals and chargers of Lithium-Ion batteries, as well as the simultaneously measured battery temperature data. The two-dimensional data generated by the proposed method are used in RuL estimation with pretrained 2d-CNN networks and detailed estimation performances are presented.

**Keywords:** Lithium-Ion batteries, 2d-CNN, Multiple time series, RuL estimation

**ANALYSIS of C–H···O INTERACTION BETWEEN ANION and CATION  
of 1,3-DIMETHYLIMIDAZOLIUM METHYLSULPHATE USING  
NATURAL BOND ORBITAL METHOD**

**Nihal KUŞ**

Department of Physics, Science Faculty, Eskisehir Technical University, 26470, Eskisehir, Turkey

**ABSTRACT**

It is clear that more studies should be done on ionic liquids, as the usage areas and importance of ionic liquids have increased considerably. In this study, geometry optimizations, charge density and natural bond orbital (NBO) analysis of 1,3-dimethylimidazolium and methylsulphate (DIMIM-MS) ionic liquid in cation and anion form were carried out at the Becke, 3-parameter, Lee, Yang-Parr (B3LYP) version with 6-311++G(2d,2p) basis set. Stabilization energies due to the C–H···O weak hydrogen bonds orbital interactions are calculated from the second-order perturbation approach using Fock matrix equation. Donor-acceptor interactions and hybridization for the C–H···O interaction between anion and cation orbital interactions of DIMIM-MS were analyzed and orbital electron density schemes were plotted. HOMO-LUMO, Mulliken charges and NBO charges were calculated and interpreted using DFT-B3LYP/6-311++G(2d,2p) method.

**Keywords:** Ionic liquid, orbital interaction, stabilization energy, 1,3-dimethylimidazolium methylsulphate, NBO.

**ACKNOWLEDGMENT**

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**AN EVALUATION on INCLUSIVE EDUCATION DURING DISTANCE EDUCATION PROCESS:  
CLASSROOM TEACHERS' PERCEPTIONS**

**Emrah BİLGİÇ<sup>1\*</sup>, Emine Nur ÜNVEREN-BİLGİÇ<sup>2</sup>, Nazire Burçin HAMUTOĞLU<sup>3</sup>**

<sup>1</sup> Department of Basic Education, Faculty of Education, Sakarya University, Sakarya, Turkey

<sup>2</sup> Education Faculty, Mathematics and Science Education department, Düzce University, Düzce, Turkey

<sup>3</sup> The Centre for Teaching and Learning Excellence, Eskisehir Technical University, Eskisehir, Turkey

**ABSTRACT**

The covid-19 pandemic, which has caused changes in many fields globally, and the natural disaster in our country on February 6, 2023, centered in Kahramanmaraş, have shown that various changes are necessary in the field of education. This change has manifested itself in the form of closing schools in the field of education and switching from face-to-face education to distance education. This distance education process led to many new experiences by conducting synchronous and asynchronous distance education with children with normal development as well as inclusion of student with special education needs (SEN) who need various support in face-to-face education. In this study, it is aimed to determine the perceptions of primary school teachers toward SEN at the primary school level in the distance education process. In this direction, the process that classroom teachers experiences with the inclusion of SEN in distance education (advantages and disadvantages of the process, difficulties experienced in the process, examination of the process in terms of academic disciplines, family support, etc.) are going to be revealed. The research is going to be conducted according to the qualitative method and is going to be designed with phenomenology study. The study group of the research is going to consist of 10 primary school teachers teaching in the 1st, 2nd, 3rd, and 4th grades who are going to be determined according to the convenience sampling method. The research data is going to be obtained through individual interviews with the participant teachers. In the process of collecting the data, an interview form with semi-structured interview questions prepared by the researchers and reorganized by taking expert opinion is going to be used. The data is going to be subjected to content analysis. In this process, codes, categories, and themes is going to be created. It is thought that the results to be obtained from the study is going to shed light on the inclusive education of SEN and teachers who are going to be responsible for the inclusive education of SEN.

**Keywords:** Distance education, inclusive education, students with special educational needs, teachers' perceptions.

## THE IMPORTANCE OF THE PLANNING CYCLE FOR AN EFFECTIVE STRUCTURING OF ONLINE TEACHING PROCESSES

Ash KAYA<sup>1</sup>, Nazire Burçin HAMUTOĞLU<sup>2</sup>, Emre ÇAM<sup>3</sup>, Emine Nur ÜNVEREN-BİLGİÇ<sup>4</sup>

<sup>1</sup>Department of Statistics, Faculty of Science, Anadolu University, 26470, Eskisehir, Turkey

<sup>2</sup> The Centre for Teaching and Learning Excellence, Eskisehir Technical University, Eskisehir, Turkey

<sup>3</sup>Niksar Niksar Vocational School, Tokat Gaziosmanpaşa University, Tokat, Turkey

<sup>4</sup>Education Faculty, Mathematics and Science Education department, Düzce University, Düzce, Turkey

### ABSTRACT

The need for effective structuring of learning and teaching processes in the changing world makes itself felt more and more every day. As a matter of fact, as seen in the past Covid 19 pandemic and the Kahramanmaraş-Pazarcık-centered earthquake(s) on February 6, 2023; rapid decision-making policies regarding the transition process to online learning environments also form the basis of the need for an effective structuring of online learning environments. The ability of educational institutions to show quick reflexes to emerging problems and to provide adaptation processes; possible on the basis of effective planning carried out in advance. In all these processes, it has been seen that the primary measure taken against the emerging problems is the transition to the distance education method. However, the interruption of educational activities in institutions where there is no effective planning cycle; creates a handicap in terms of gaining learning outcomes that cannot be compromised. In this study, the importance of the planning cycle in the effective structuring of teaching processes is mentioned. The importance of the planning cycle is emphasized in the study and its reflections will be examined in terms of creating the input of the web-based system that is under development.

**Keywords:** Online learning, quality, planning cycle, effective structuring, teaching and learning.

## DEEP LEARNING ADVANCEMENTS IN RAILWAY TRACK SEGMENTATION: PREVIOUS STUDIES AND IMPROVEMENTS

Turan TEYMURBAYLI<sup>1</sup>, Utku KAYA<sup>2</sup>

<sup>1</sup> "Railway Systems Engineering Department, Eskişehir Technical University Eskişehir, Turkey

<sup>2</sup> Vocational School of Transportation, Eskişehir Technical University Eskişehir, Turkey

### ABSTRACT

This article focuses on investigating the utilization of deep convolutional neural networks for segmenting railway tracks. Deep learning, which aims to simplify data processing by emulating human intelligence on computers, plays a significant role in this regard. Railway tracks are widely recognized for their importance in railway transportation. Consequently, ensuring track integrity requires thorough surface scanning. However, considering the extensive expanse of railway tracks, manual scanning proves to be a challenging and time-consuming task. Railway track segmentation serves as a fundamental step in identifying track defects, enabling easier detection by extracting tracks from surrounding images. This article discusses various studies conducted in this field and provides insights into the advantages offered by each approach.

**Keywords:** Deep learning, Railway track segmentation, Convolutional neural networks

## INVESTIGATION OF THE EFFICIENCY OF DSSC FOR SAFFRON EXTRACT

Fehmi ASLAN<sup>1</sup>

<sup>1</sup>Rail Systems Machinery Technology, Yeşilyurt Vocational School, Turgut Özal University, Malatya, Turkey

### ABSTRACT

This study used the soxhlet method to extract the saffron dye. TiO<sub>2</sub> nanoparticles were produced by hydrothermal method. The XRD peaks of the synthesized particles confirmed the mineralogical structure. Surface photographs of TiO<sub>2</sub> were examined with SEM images. These images showed microsphere structures in close contact with each other. When the UV analyses of the saffron dye were examined, remarkable absorption behaviors were detected in the visible region. When the photovoltaic parameters of the produced dye-sensitized solar cell were examined, the photoelectric conversion efficiency ( $\eta$ ), open circuit voltage ( $V_{oc}$ ), short circuit current ( $J_{sc}$ ) and filling factor (FF) were found to be 0.007, 0.2 V, 0.081 mA/cm<sup>2</sup> and 0.46, respectively.

**Keywords:** Solar cell, organic dye, photovoltaic.

## EVALUATION OF THE CENTRAL-METAL EFFECT ON ANTICANCER ACTIVITY AND MECHANISM OF ACTION OF ISOSTRUCTURAL Cu(II) AND Ni(II) COMPLEXES CONTAINING PYRIDINE-2,6-DICARBOXYLATE

Sara Abdolmaleki, Samad Khaksar \*\*

School of Science and Technology, The University of Georgia, Tbilisi, Georgia

### ABSTRACT

Metal ions have a significant role in the biological processes of the body as the vital activities of the cell and enzymes are organized by their inherently existent metals. Therefore, through many decades, metal-based compounds have been evaluated for the treatment of various diseases. Two Cu(II) (C1) and Ni(II) (C2) complexes were designed through the one-pot reaction of pyridine-2,6-dicarboxylic acid and 2-amino benzimidazole respectively with copper(II) nitrate hexahydrate and nickel(II) nitrate hexahydrate. Both complexes were characterized by single-crystal X-ray diffraction and the distorted octahedral geometry was recognized for them. The anticancer evaluations showed that these compounds have a different inhibition effect on the tested cell lines and it was concluded that the type of central metal could affect the inhibitory effect and action mechanism of the compounds as an anticancer drug.

The assay of apoptosis- and autophagy-related proteins indicated that bimodal death can be suggested through mitochondria-mediated apoptosis and autophagy pathways in BEL-7404 cells treated with the complexes, although each of these processes may be more prominent depending on the type of central metal in the complexes.

**Keywords:** Cu(II) and Ni(II) complexes, Anticancer effect, Production of ROS, Apoptosis, Autophagy

## SIMULATION OF FLEXIBLE PRINTED STRUCTURES DESIGN FOR MOBILE ROBOT PLATFORM

Igor Nevliudov<sup>1</sup>, Iryna Zharikova<sup>1</sup>, Sergiy Novoselov<sup>1</sup>, Dmytro Nikitin<sup>1</sup>

<sup>1</sup> Department of Computer-Integrated Technologies, Automation and Mechatronics, Faculty of Automatics and Computerized Technologies, Kharkiv National University of Radioelectronics, Kharkiv, Ukraine

### ABSTRACT

The mobile robot platform was designed for remote performing of special tasks for various fields. For example, these tasks can be the next: reconnaissance and surveillance, research of dangerous objects in the military sphere; surveillance, dangerous objects search and identification in the field of public safety; victims search and assistance during emergencies liquidation; and also tasks for fields of health care and agriculture.

The control system of proposed mobile platform consists of sensors, actuators and auxiliary modules such as navigation subsystem, power management subsystem and others. The conducted research made it possible to determine that the main nodes of the robot are the movement control node, the manipulator control node, the main control node, as well as navigation, sensor, technical vision, power control and communication nodes.

One of the important advantages of proposed robot platform design is replacement of rigid hardware components with flexible ones. This decision can reduce their weight and size, improve quality, functionality, reliability etc. Such structures ensure the connections stability between the platform modules, even if it is affected by destabilizing external factors, for example, vibrations and shocks during its movement.

Based on the results of stress-strain state studies for flexible boards and loops flexible-rigid the interconnections system based on copper-foiled polyimide was designed for the developed robotic platform.

Thus, the subject of research is the commutative system of a mobile robotics platform based on flexible polyimide structures.

**Keywords:** flexible printed structures, mobile robot platform, 3D model, polyimide.

## VOICE CONTROL USING IN PHARMACEUTICAL PRODUCTS LOGISTICS SYSTEMS

Svitlana Maksymova<sup>1</sup>, Viktoriia Nevliudova<sup>1</sup>, Oleksandr Klymenko<sup>2</sup>, Gennadii Makarenko<sup>1</sup>

<sup>1</sup> Department of Computer-Integrated Technologies, Automation and Mechatronics;  
Kharkiv National University of Radio Electronics, Kharkiv, Ukraine

<sup>2</sup> «Kapelou» LLC, Kyiv, Ukraine

### ABSTRACT

Existing technologies development, as well as the creation of new ones, lead to the emergence of new trends in various areas of automation. Thus, in the pharmaceutical industry, logistics systems are widely used for the selection of products in automated warehouses, which significantly increase the speed and accuracy of processing requests, which leads to an increase in the efficiency of production as a whole. One of the extremely relevant directions in the development of production control, as well as individual operations, is the use of voice control at various stages of production processes. The authors suggest introducing voice control for critical operations execution on an automated logistics line. The study conducted by the authors showed that in some cases it may be appropriate. Thanks to the use of at least elements of such control, production efficiency can be increased, including by reducing the cost of logistics systems.

**Keywords:** Storage, Voice Control, Pharmaceutical Production, Warehouse Management System, Warehouse 4.0.



## INVESTIGATION OF HYDROGEN PRODUCTION BY USING CONCENTRATED PHOTOVOLTAIC/THERMAL HYBRID COLLECTOR WITH SPECTRAL BEAM SPLITTING

Cihangir Kale

Hikmet Esen

<sup>1,2</sup> Department of Energy Systems Engineering, Faculty of Technology, University of Firat, Elazığ, Turkey

### ABSTRACT

Hydrogen (H<sub>2</sub>) is an element with high heating value. In addition, it is energy efficient and does not harm the environment as it only releases water and a small amount of NO<sub>x</sub> when burned with air. However, although hydrogen is an abundant element on earth, hydrogen is not found in nature alone as a gas. H<sub>2</sub> can be obtained by using primary energy sources and renewable energy sources. Using renewable energy sources to produce hydrogen is of great importance for a faster transition to a sustainable-clean environment. Solar energy is the richest renewable energy source in the world. Hydrogen can be produced with different technologies from solar energy. The most practical and widely used method among these technologies is the electrolysis of water. However, the efficiency in conventional Photovoltaic (PV)-electrolysis systems is quite low.

In this study, hydrogen production potential was investigated with a concentrated photovoltaic/thermal (SBS-CPV/T) hybrid collector with spectral beam splitters are also used instead of conventional PV-electrolysis. As a result of the study, the optical efficiency of the SBS-CPV/T collector was found to be 83.6%. While the average temperature of the multi-junction solar cell was found to be 79.7°C under 765X condensation, it was concluded that it provided 38.8% electrical efficiency at this temperature. Based on these findings, it has been seen that high temperature hydrogen production with SBS-CPV/T collector is a promising solution.

**Keywords:** Concentrated photovoltaics, multi-junction solar cell, spectral beam splitting, hydrogen.

## BAYESIAN REGULARIZATION OF LEARNING

Murad Omarov<sup>1</sup>, Vusala Muradova<sup>2</sup>

<sup>1</sup> Department of Computer-integrated technologies, automation and mechatronics, Kharkov National University of Radio Electronics, Kharkov, Ukraine

<sup>2</sup> Department of Natural Sciences, Kharkov National University of Radio Electronics, Kharkov, Ukraine  
Email of corresponding author: viusalia.muradova@nure.ua

### ABSTRACT

**The subject of research** in the article is the Bayesian approach based on the first principles of the probability theory is the most consistent paradigm of statistical learning. From practical perspective Bayesian learning offers intrinsic regularization procedure providing a viable alternative to traditional cross-validation technique. **Objective:** Machine learning aims to identify patterns in empirical data. In contrast to mathematical modeling, which studies the consequences of known laws, machine learning seeks to recreate the causes by observing the consequences generated by them are empirical data training, so thus, it belongs to the class of inverse problems and, in the general case, is a poorly defined or ill-posed problem. These tasks are different special sensitivity of some solutions to data and finding stable solutions implies a regularization procedure, which is a restriction of the class of feasible solutions. **The following tasks are solved in the article:** Bayesian regularization, the subject of this review, is an alternative technique for optimizing model complexity. It is not based on an estimate of the expected error, but on the choice of the most plausible model supported by the available data. This approach has a number of advantages. First, it proceeds from the first principles of probability theory and statistical learning theory, which guarantee a reduction in generalization error. Secondly, it implies an assessment of variations in the model parameters and, accordingly, an assessment of the accuracy of one's predictions. Thirdly, the problem posed in this way can in some cases of practical importance be solved with a minimum number of additional simplifying assumptions. And finally, as a consequence, last but not least: Bayesian regularization can be built directly into learning algorithms. Moreover, such regularized algorithms no longer imply a validation stage, uniformly using all available data both to select the optimal complexity of the model and to configure its parameters.

**Keywords:** Bayesian regularization, Bayesian learning, machine learning, mathematical modeling.

## RESEARCH OF THE STABILITY OF THE SECURE RADIO-FREQUENCY COMMUNICATION IN THE DISTRIBUTED SYSTEMS BY USING MULTY-CHANNEL IOT LPWAN TECHNOLOGIES

Makovetskyi Sergii<sup>1</sup>, Kauk Viktor<sup>2</sup>

<sup>1</sup> PhD student, Faculty of Computer Science, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine

<sup>2</sup> Assistant professor of the Department of Software Engineering, Scientific supervisor of CTDL, Member of EMC, Candidate of Technical Sciences, Assistant professor, Faculty of Computer Science, Kharkiv National University of Radio Electronics, Ukraine

### ABSTRACT

Nowadays, the distributed systems for processing and transmitting information are of considerable interest among the scientists. The existing methods of the information processing and transmission are not entirely efficient and in some specific cases do not work at all in the distributed systems. The distribution systems don't have a central computing module, so the usual methods of the information processing do not work in this case.

The data processing in the distributed systems is in high demand in the systems that support people's life both in critical infrastructure facilities and in military systems.

The information transfer methods occupy a special place in modern distributed systems. In some cases, people's lives and health depend on the effectiveness of the chosen methods.

This article will present the results of the practical research on the stability of radio frequency communication in distributed systems using the example of a distributed system based on LoRa technology.

The work shows the main advantages of broadband LoRa technology and the practical results of using Mesh modules.

**Keywords:** Cybersecurity, LPWAN, LoRaWAN, distributed systems

## CO-AGGREGATION OF S100A9 PROTEIN WITH L- DOPA AND CYCLEN-BASED COMPOUNDS – EFFECT ON THE AMYLOID FIBRIL SELF-ASSEMBLY

L. Arabuli<sup>1,2</sup>, I. A. Iashchishyn<sup>1</sup>, N. V. Romanova<sup>1</sup>, G. Musteikyte<sup>3</sup>, V. Smirnovas<sup>3</sup>, H. Chaudhary<sup>1</sup>, Ž. M. Svedruži'c<sup>4</sup>, and L. A. Morozova-Roche<sup>1</sup>

<sup>1</sup>Department of Medical Biochemistry and Biophysics, Umeå University, SE-90781 Umeå, Sweden

<sup>2</sup>Department of Natural Sciences, School of Science and Technology, University of Georgia, 0171 Tbilisi, Georgia

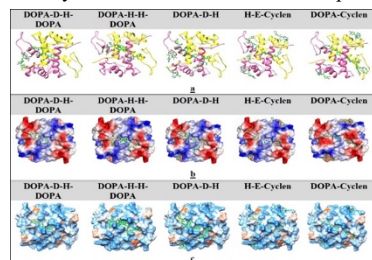
<sup>3</sup>Institute of Biotechnology, Life Sciences Center, Vilnius University, LT-10257 Vilnius, Lithuania

<sup>4</sup>Department of Biotechnology, University of Rijeka, HR-51000 Rijeka, Croatia

E-mail: l.arabuli@ug.edu.ge

We studied the effect of cyclic compounds and their conjugates on the amyloid formation of pro-inflammatory S100A9 protein, which was found to be a common denominator in Alzheimer's and Parkinson's disease as well as in traumatic brain injury, which is considered as a pre-cursor state for neurodegenerative ailments [1,2]. Indeed, amyloid formation is commonly associated with neuroinflammation, and pro-inflammatory S100A9 protein acts both as an alarmin, inducing the production of pro-inflammatory cytokines, and as a highly amyloidogenic protein, which self-assembles into amyloids under physiological conditions.

The amyloid cascade is central for the neurodegeneration disease pathology, including Alzheimer's and Parkinson's, and remains the focus of much current research. S100A9 protein drives the amyloid-neuroinflammatory cascade in these diseases. DOPA and cyclen-based compounds were used as amyloid modifiers and inhibitors previously, and DOPA is also used as a precursor of dopamine in Parkinson's treatment. Here, by using



fluorescence titration experiments we showed that five selected ligands: DOPA-D-H-DOPA, DOPA-H-H-DOPA, DOPA-D-H, DOPA-cyclen, and H-E-cyclen, bind to S100A9 with apparent K<sub>d</sub> in the sub-micromolar range. Ligand docking and molecular dynamic simulation showed (Fig.1) that all compounds bind to S100A9 in more than one binding site and with different ligand mobility and H-bonds involved in each site, which all together is consistent with the apparent binding determined in fluorescence experiments. By using amyloid kinetic analysis, monitored by thioflavin-T fluorescence, and AFM imaging, we found that S100A9 co-aggregation with these compounds does not hinder amyloid formation but leads to morphological changes in the amyloid fibrils, manifested in fibril thickening. Thicker fibrils were not observed upon fibrillation of S100A9 alone and may influence the amyloid tissue propagation and modulate S100A9 amyloid assembly as part of the amyloid-neuroinflammatory cascade in neurodegenerative diseases.

Figure 1. Binding sites on S100A9 homo-dimer for different DOPA and Cyclen-based compounds.

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## 3,5-BIS(TRIFLUOROMETHYL) PHENYLAMMONIUM TRIFLATE: A NEW AND GREEN ORGANOCATALYST FOR THE SYNTHESIS OF INDENO[1,2-B]PYRIDINES

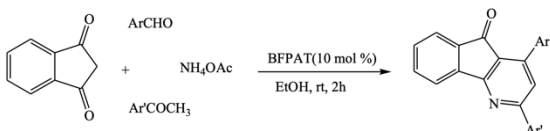
Peyman Salahshour, Samad Khaksar \*

School of Science and Technology, The University of Georgia, Tbilisi, Georgia

### ABSTRACT

In the past 20 years, organocatalysis has emerged as an important area of research. Organocatalysts are easy and inexpensive to assemble, generate no waste, have simple purification, and have aspects of the high atomic economy thus encompassing the principles of green chemistry. Recently, aryl ammonium triflate has gotten impressive consideration for numerous organic reactions, giving the corresponding products in high yields with great selectivity.

In this study, we have demonstrated an efficient and practical process for the synthesis of indeno[1,2-b]pyridine compound derivatives



by four-component condensation of aldehyde, aromatic ketones, 1,3-indanedione, and ammonium acetate using BFPAT as a green, inexpensive, and powerful organocatalyst in ethanol.

The advantages offered by this method are simple reaction conditions, operational simplicity, a green and cost-effective catalyst, easy purification, and excellent yields.

**Keywords:** Organocatalyst, Green, Pyridine, Reusable, Heterocycle

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## PECULIARITIES OF Cs<sub>1-x</sub>Rb<sub>x</sub>Cu<sub>2</sub>Cl<sub>3</sub> SOLID SOLUTIONS ABSORPTION SPECTRA

Olena KOVALENKO<sup>1</sup>, Olga YUNAKOVA<sup>2</sup>, Mykola YUNAKOV<sup>3</sup>

<sup>1</sup>Department of Physics, Faculty ACT, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine

<sup>2</sup>Physical optics Department, Faculty of Physics, V. N. Karazin Kharkiv National University, Kharkiv, Ukraine

<sup>3</sup>Department of Materials for Reactor Constructing and Physical Technologies, Education and Research Institute "School of Physics and Technology", V. N. Karazin Kharkiv National University, Kharkiv, Ukraine

### ABSTRACT

Peculiarities and characteristics of absorption spectra Cs<sub>1-x</sub>Rb<sub>x</sub>Cu<sub>2</sub>Cl<sub>3</sub> solid solutions have been studied in this work. Many complex compounds related to this system have high ionic conductivity and are classified as solid electrolytes [1,2], some of them can be decent luminophores [3] and can be used in light-emitting devices. The absorption spectra of thin films of CsCu<sub>2</sub>Cl<sub>3</sub> and RbCu<sub>2</sub>Cl<sub>3</sub> are isostructural and are close by spectral position of the bands [1]. The exciton spectrum of both compounds is interpreted on the basis of transitions in the Cu<sup>+</sup> ion.

Thin films for investigation were prepared by vacuum evaporation of a melt mixture of pure CuCl, CsCl and RbCl. Then the films were annealed for an hour at 100°C.

In the concentration range 0 ≤ x ≤ 0.6, the absorption spectra of Cs<sub>1-x</sub>Rb<sub>x</sub>Cu<sub>2</sub>Cl<sub>3</sub> thin films are similar in the structure of the spectrum and close in the spectral position of the absorption bands (Fig. 1a). As x increases, the A and B exciton bands slightly linearly shift to the short-wavelength region of the spectrum with dE<sub>m</sub>/dx = 0.03 eV and 0.045 eV, respectively. In the range 0.6 < x ≤ 1, on the contrary, a noticeable linear long-wavelength shift of the A and B exciton bands is observed with increasing x with dE<sub>m</sub>/dx = -0.43 eV and -0.59 eV. The half-width Γ(x) of the exciton bands A and B (Fig. 1b) slightly linearly increases in the range 0 ≤ x ≤ 0.6 with dΓ<sub>A</sub>/dx = 0.05 eV and dΓ<sub>B</sub>/dx = 0.049 eV. In the interval 0.6 < x ≤ 1, the half-width Γ(x) increases with dΓ<sub>A</sub>/dx = 0.19 eV and dΓ<sub>B</sub>/dx = 0.185 eV.

We assume that the presence of two concentration intervals with different concentration behavior of E<sub>m</sub>(x) and Γ(x) of the exciton A and B bands is due to the different crystal structure of the Cs<sub>1-x</sub>Rb<sub>x</sub>Cu<sub>2</sub>Cl<sub>3</sub> compounds in the intervals 0 ≤ x ≤ 0.6 and 0.6 < x ≤ 1. In the first concentration range, apparently, the Cs<sub>1-x</sub>Rb<sub>x</sub>Cu<sub>2</sub>Cl<sub>3</sub> solid solutions are isostructural with CsCu<sub>2</sub>Cl<sub>3</sub>, since their exciton spectra are similar by structure and close in the spectral position of the bands. A slight short-wavelength shift of the A and B bands in the

range  $0 \leq x \leq 0.6$  indicates a slight increase in the ionicity of the compounds and the bandgap width  $E_g$ . In this concentration range  $E_g(x)$  grows linearly (Fig. 1c) according to equation  $E_g(x) = E_g(0) + ax$ , where  $E_g(0) = 4.605 \pm 0.001$  eV,  $a = dE_g/dx = 0.03 \pm 0.003$  eV.

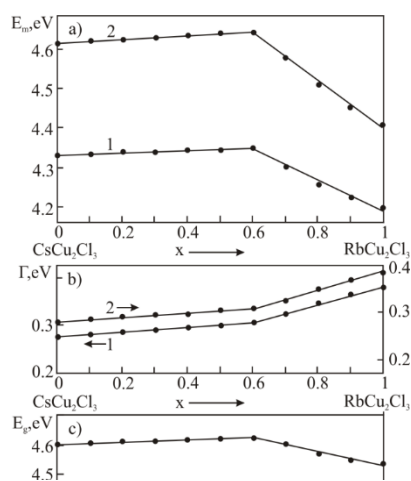


Fig. 1. The concentration dependences of the spectral position  $E_m(x)$  (a), half-width  $\Gamma(x)$  (b) of the long-wavelength exciton bands A(1) and B(2) and the bandgap width  $E_g(x)$  (c).

In the range  $0.6 < x \leq 1$  solid solutions  $Cs_{1-x}Rb_xCu_2Cl_3$  are isostructural with  $RbCu_2Cl_3$ . A significant long-wavelength shift of the spectral position  $E_m(x)$  of the A and B exciton bands in this concentration range indicates a decrease in the ionicity of the  $Cs_{1-x}Rb_xCu_2Cl_3$  solid solutions. In this concentration range, the bandgap width  $E_g(x)$  decreases linearly (Fig. 1c) from  $dE_g/dx = -0.23$  eV. The linear concentration dependences of the bandgap width  $E_g(x)$ , spectral position  $E_m(x)$  and half-width  $\Gamma(x)$  of exciton bands in  $Cs_{1-x}Rb_xCu_2Cl_3$  solid solutions confirm the localization of excitons in the sublattice of compounds that contains  $Cu^+$  ions.

**Keywords:** solid solutions, thin films, absorption spectra, excitons

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## FACTOR ANALYSIS OF PHOTOPOLYMER RESINS FOR 3D PRINTING

Igor Nevludov, Dmytro Nikitin, Roman Strelets, Yegor Korotun

Department of Computer-Integrated Technologies, Automation and Mechatronics;  
Kharkiv National University of Radio Electronics, Kharkiv, Ukraine

#### ABSTRACT

3D printing is one of the key elements of Industry 4.0, which is the fourth industrial revolution. This technology allows you to create objects with three-dimensional shapes from various materials, including metals, plastics, ceramics and others. It is used in many industries, including medicine, aviation, automotive and engineering. The main advantage of 3D printing is the ability to create objects without a large amount of production and tooling costs. Instead, 3D printing allows you to create objects directly from digital models, which reduces production time and costs. In Industry 4.0, 3D printing is used to create customised products, reduce prototype development and production time, and produce parts for complex systems and machines where precision and quality are essential. Applications of 3D printing in Industry 4.0 can include processes such as prototyping, manufacturing, repair and maintenance of equipment, as well as the setup and optimisation of production processes. One of the most important advantages of 3D printing is the ability to reduce the time required to develop and manufacture new products. The technology also helps to reduce production costs and increase productivity by optimising production processes and reducing prototype development time. The development of additive manufacturing technologies is becoming increasingly common in industry and everyday life. 3D printing is one of the most versatile and affordable means of producing three-dimensional parts of complex shapes. Currently, 3D printers can produce parts made of plastic (FDM printing), metal (SLS/SLM printing) and photopolymer (SLA, DLP and LCD printing). Photopolymer 3D printing has a number of advantages, such as affordability, high precision of manufacturing parts, simplicity of technology and a large number of free software. Due to these advantages and features of the technology, this manufacturing method can be used in many areas, such as jewellery production (creation of master models for casting), dentists (creation of dentures), creation of decorative models for interior design.

**Keywords:** additive technologies, photopolymer 3D printing, resins, factor analysis, production, technical quality control.

### EXAMINING THE SYMMETRY OPERATIONS OF THE DNA MOLECULE WITH CLIFFORD ALGEBRA

Hatice Güney<sup>1</sup> Abidin KILIÇ<sup>1</sup>  
<sup>1</sup>Eskişehir Technical University

#### ABSTRACT

The DNA Molecule has a structure similar to the Platonic Solids Dodecahedron in terms of its properties. The physical properties of this molecule can be studied with Clifford Algebra. The Clifford Algebra was used to establish a general and practical method for obtaining operators of the kinetic energy of molecular vibrational-rotation of polyatomic molecules and symmetric molecules. Whereas, the vibration and rotation measurement vectors appearing in the metric tensor for any geometrically defined coordinate of the shape and frame of the molecules were easily determined using geometric algebra. The present method (Clifford algebra) generates molecular vibrational-rotational kinetic energy operators that are in excellent agreement with previous work. In this study, the symmetry operations of the DNA molecule were investigated by Clifford Algebra.

**Keywords:** Clifford Algebra, Symmetric Molecules, Symmetry Operations

*This study was supported by the Eskişehir Technical University Commission of Research Project under grant no: 23ADP043.*

### INVESTIGATION OF TRANSFORMATION MATRICES OF SYMMETRIC MOLECULES WITH CLIFFORD ALGEBRA

Hatice Güney<sup>1</sup> Abidin KILIÇ<sup>1</sup>  
<sup>1</sup>Eskişehir Technical University

#### ABSTRACT

Clifford Algebra was used to create a general and practical method for obtaining the operators of the kinetic energy of the molecular vibration-rotation of polyatomic molecules and symmetric molecules. On the other hand, these polyatomic molecules' precise intrinsic kinetic energy operators include a metric tensor. The elements of this metric tensor were expressed as the mass-weighted sum of measuring vector inner product vectors compatible with the molecule's nucleus. Whereas, the vibrational and rotational measuring vectors that appear in the metric tensor for any geometrically defined coordinates of the shape and frames of the body were easily determined using geometric algebra. The current method (Clifford algebra) generates molecular vibration- rotation kinetic energy operators that are in perfect agreement with earlier studies. In this study The symmetric molecule's symmetry operations was investigated by Clifford Algebra.

**Keywords:** Clifford Algebra, Symmetric Molecules, Transformation Matrices

*This study was supported by the Eskişehir Technical University Commission of Research Project under grant no: 23ADP043.*

### ENSURING THE ROBOT SNAKE'S MOVEMENT ON SLIPPERY SURFACES

Murad Omarov, Vladyslav Korobskyi, Viktoriia Nevliudova

Department of Computer-Integrated Technologies, Automation and Mechatronics, Faculty of Automation and Computerized Technologies, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine

#### ABSTRACT

A relevant issue today is the ability of a robot snake to move on different surfaces due to friction forces. In nature, when a robot snake moves over loose sands, its movement differs from that of a snake moving over a rough surface. A living snake crawls not forward, but sideways ("laterally"), pulling the back of its body forward, it flips it over without touching the surface forward, and then, leaning on the entire side of the body, pulls the front part up. The support with this type of movement is more stable to fix the snake's position. This type of movement is asymmetrical, so the load on the muscles is uneven; to equalize it, the snake has to periodically change the "working side" of its body - crawl forward with its left or right side.

The problem with modern snake robots is that if the surface of movement is slippery or loose, such as smooth glass, or smooth ice, or loose dust, then the movement of the snake robot is almost impossible. Since the snake-like movement uses a support - the surface of movement, the efficiency of movement depends on the roughness of the support.

**Keywords:** Snake robot, lateral movement, support, slippery surface.

## A GEOTECHNICAL EXAMINATION OF KAHRAMANMARAS (TURKEY) PAZARCIK & EKINOZU 6 FEBRUARY 2023 EARTHQUAKES

Emre Aytuğ ÖZSOY<sup>1,\*</sup>

<sup>1</sup> Building Inspection Program, Porsuk Vocational School, Eskisehir Technical University, Eskisehir, TURKEY

As it is known, Turkey is located on the geologically active fault zones. On 6 February 2023, 2 major destructive earthquakes occurred within the borders of Kahramanmaraş province on some fault segments forming the East Anatolian Fault (EAF) Zone, one of the most important active faults of our country. The first of these earthquakes, which occurred at 04:17, is 7.7 (Mw) according to Boğaziçi Kandilli Observatory and 7.8 (Mw) (later corrected as 7.7) according to AFAD, and the focal depth of this earthquake, which is called Pazarcık Earthquake, is still in focus. 10 km and 8.6 km respectively according to the same organizations. (KOERI, 2023; AFAD, 2023). The epicenter of the second earthquake, which occurred at 13:24 on the same day, was near the Ekinözü district in the south of Elbistan district, its magnitude was Mw7.6 according to KOERI and AFAD, and its focal depth was 10 km and 7 km, respectively, according to these two institutions. It was named Ekinözü after the earthquake.

In the earthquakes total of 11 provinces, including Hatay, Kahramanmaraş, Adiyaman, Malatya, Gaziantep, Osmaniye, Adana, Şanlıurfa, Kilis and Diyarbakır were affected to varying degrees. According to official records; The number of our citizens who lost their lives has exceeded 50,000 and 107,204 citizens have been injured, and according to official statements, 304.000 buildings have completely collapsed and severely damaged.

In addition to the destruction and damage in the buildings, transportation structures (highway, railway, bridge), industrial facilities, power lines, infrastructure elements etc. in these earthquakes. is also damaged. In addition, mass movements such as landslides, rockfalls, soil liquefaction and lateral spreading, which adversely affect the surface structures and buried structures, were observed. In this study, the field studies, reports and all published studies after the 6 February 2023 Kahramanmaras earthquakes were examined, how much of the local soil properties and geoscience data were used correctly at the right time.

**Keywords:** Earthquake, Kahramanmaras, Geotechnics, Soil Properties.

## NUMERICAL ANALYSIS OF A NEW THERMOSYPHON HEAT PIPE

Çetin YAVUZ 1 , Ali TAROKH 2 , Aydın DİKİCİ 3

1 Department of Electrical and Energy, Tatvan Vocational School, Bitlis Eren University, Bitlis, Turkey

2 Department of Mechanical Engineering, Lakehead University, Thunder Bay, Canada

3 Department of Energy System Engineering, Fırat University, Elazığ, Turkey

### ABSTRACT

In this study, an experimental and 3-dimensional numerical analysis of a thermosiphon heat pipe (THP) using two-phase fluid cycling was performed to model the heat transfer process by evaporation and condensation. R404A refrigerant was chosen as the working fluid for the THP and 50% of the evaporator section was filled with the working fluid. Numerical analysis was performed using ANSYS FLUENT program and VOF method. In the meantime, in order to model the evaporation and condensation process successfully, a UDF code written in C was used and introduced to the fluent program. As a result of the study, it was seen that the temperature values obtained from the experimental and numerical analysis for the evaporator and condenser parts of the THP were in good agreement. As a result of the numerical analyzes carried out in 3D, the contours of the evaporation and condensation process and the heat transfer process are presented visually. The analysis took a total of 200 seconds.

**Keywords:** Thermosiphon heat pipe, Evaporation and condensation, ANSYS, VOF



## THE STIMULATING EFFECT OF THE *CUPRESSUS SEMPERVIRENS* MAJOR ALLERGEN (CUP S1) ON BRONCHIAL EPITHELIAL CELLS (BEAS -2B)

Imane BOUGUENOUN<sup>1,\*</sup>, Widad BOUGUENOUN<sup>2</sup>, Dalila BENDJEDDOU<sup>3</sup>, Marie-Claire DE PAUW-GILLET<sup>4</sup>, Edwin DE PAUW<sup>5</sup>

- 1 Department of Biology, Faculty of Biologic Sciences and Agronomic Sciences, University of Mouloud Mammeri, Algeria.  
 2 Department of Nature and Life Sciences, Faculty of Exact Nature and Life Sciences, University of Mohamed Khider, Algeria.  
 3 Department of Biology, Faculty of Nature and Life Sciences, Earth and Universe Sciences, University of 8 May 1945, Algeria.  
 4 Laboratory of mammals cells culture, Institute of chemistry, University of Liège, Belgium  
 5 University of Liège, Faculty of Sciences, Belgium.

### ABSTRACT

Allergic diseases have a central place in chronic pathologies. For over 20 years, their frequency has been increasing. Allergies to pollen, at present, are a major public health problem because of pollen diversity. However, all the pollens are not allergenic, their nature and quantity vary significantly depending on the region and climatic conditions. *Cupressus sempervirens* is one of the most widespread species in Algeria with very high allergenic capacity. The aim of this work is to evaluate the stimulatory effect of the major allergen of this species

The present study was carried out on human bronchial epithelial cells (BEAS-2B) transformed by an adenovirus 12 SV40 hybrid. In this context we are interested in the stimulation, in vitro, of those cells by different doses of the major allergen Cup s1 to test the viability and the release of IL-8 and IL-6. After a series of culture, the cells were exposed for 24 hours at a concentration of 0.02µg/µl, 0.06µg/µl, 0.1 µg/µl, 0.3 µg/µl and 0.9µg/µl of allergen Cup s1. The viability was assessed by the MTS assay and the assay of cytokine was carried out in the supernatant using the technology Luminex100. The MTS test showed that cells exposed to different doses were all viable. The release of IL-8 by the cells exposed to different concentrations of Cup s1 showed a highly significant increase with cells exposed to 0.1 µg/µl, 0.3µg/µl and 0.9µg/µl of the major allergen. However, cell culture with 0.1 µg/µl, 0.3 µg/µl and 0.9µg/µl stimulated significant release of IL-6. Our experiments showed that the allergen Cup s1 represents no risk vitality of the cells and had the potential to stimulate the release of IL-8 and IL-6 in a dose-dependent manner.

**Keywords:** Allergy, Pollen, *Cupressus sempervirens*, BEAS-2B, IL-8, IL-6.

## SYNTHESIS AND STUDY OF NEW SURFACE-ACTIVE POLYMER COMPLEX WITH CATIONIC SALT

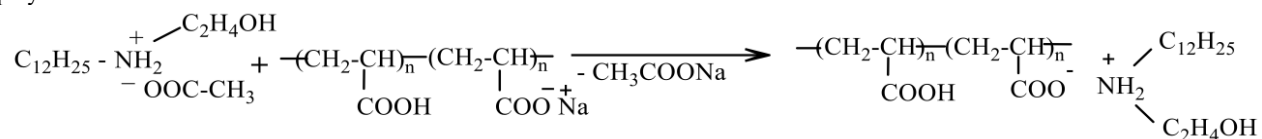
Poladova Tarana Ali

Y. H. Mamedaliyev's Institute of Petrochemical Processes  
of the Ministry of Science and Education

### ABSTRACT

The extensive carrying of crude oil and its products across the oceans has increased concerns about the effects of accidental spillage of petroleum hydrocarbons in the marine environment. Major marine oil spills highlight the need for cost-effective and environmentally responsible ways for their liquidation. Similar oil spill incidents worldwide indicate that the 'first-minute response' principle plays a key role as an environmentally safe and cost-effective response to marine oil spills. Polymer surfactants find applications in different operations of petroleum production. They are essentially used to improve the total recovery of petroleum as well as in environment protection.

The main aim of the presented work was to produce a new, ecologically safe and efficient oil slick-collecting agent based on a new polymer-complex surfactant. It was synthesized by interaction of dodecylmonoethylolammonium ethanoate with neutralized polyacrylic acid:



It is a yellow wax, well-soluble in water accompanied with intensive foam formation. Composition and structure of this reagent have been identified by IR- spectroscopy. Surface tension at the water-air interface in the presence of the synthesized surfactants was



determined by a Du Nouy ring tensiometer. A high surface activity of aqueous solutions of the synthesized product was revealed (at 0.2% -50.8 mN/m; 0.5%-46.8 mN/m; 0.7%-40.9 mN/m; without surfactant 72.0 mN/m).

The specific electroconductivity of the surfactant solutions was measured using a conductometer. By the electroconductometric method it was found that the specific electrical conductivity ( $\kappa$ , in  $\mu\text{S}/\text{cm}$ ) of aqueous solutions of this surfactant increases as the concentration (% by weight) of the solution increases (19°C): 0.025% 139.4; 0.075% 369.1; 0.1% 524.2; 0.5% 2516.4; 0.7% 4060.4.

The petrocollecting effectiveness of the surfactant was studied using an unthinned reagent and its 5 wt.% aqueous solution (or dispersion). The tests were carried out in three types of water having various degrees of mineralization (fresh, Caspian sea and distilled waters) using thin (thickness: 0.17 mm) layers of Pirallahy petroleum (from the oil field near Baku, Azerbaijan). This surfactant has a high petrocollecting capacity. When it is applied in unthinned form and used as a 5% aqueous dispersion, this polymer complex demonstrates high values of petrocollecting coefficient (K) which characterizes a ratio of surface areas of initial petroleum slick and petroleum spot formed by a surfactant action. Maximum value of K equals 80.2, the time of the reagent action exceeding 192 hours.

**Keywords:** petroleum production, surfactant , electroconductivity, petrocollecting

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## SYNTHESIS OF SODIUM TITANATES USING CHITOSAN IN THE ENVIRONMENT

A.N. Mammadov, U.N. Sharifova, F.S. Ibrahimova, A.M. Qasimova , Mustafayeva A.N.

Nagiyev Institute of Catalysis and Inorganic Chemistry ANAS, H.Javid Avn.,113, AZ 1134, Baku

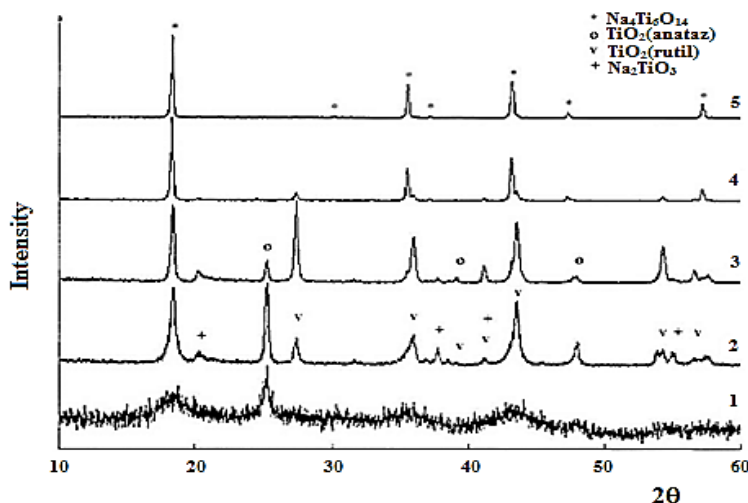
### ABSTRACT

The method of hydrothermal synthesis was used to obtain titanates with the general formula  $\text{Na}_2\text{Ti}_n\text{O}_{2n+1}$  in the environment. Polytitanates  $\text{TiO}_2 \cdot n\text{H}_2\text{O}$  obtained from titanium concentrate were treated with concentrated aqueous NaOH solution.

From Fig.1 It follows that the production of single-phase  $\text{Na}_4\text{Ti}_6\text{O}_{14}$  from  $\text{Na}_2\text{TiO}_3$ , anatase and rutile modifications of  $\text{TiO}_2$  is possible at temperatures above 950K. In the dissertation work, titanates  $\text{Na}_4\text{Ti}_6\text{O}_{14}$ ,  $\text{Na}_2\text{Ti}_3\text{O}_7$  and  $\text{Na}_2\text{Ti}_6\text{O}_{13}$  were also obtained by hydrothermal method, the compositions of which are in accordance with the phase diagram of the  $\text{Na}_2\text{O} - \text{TiO}_2$  system.

To desilicate titanium dioxide, the mixture was treated with a weak solution of sodium hydroxide at the boiling point of the solution. Polytitanic acid powder  $x\text{TiO}_2 \cdot y\text{H}_2\text{O}$  was mixed with pure chitosan powder in a mass ratio of 20:1 and calcined in a temperature range of 850-900°C to obtain technical titanium dioxide in the form of a mixture of 94.5% anatase and 4.5% rutile. When calcining polytitanic acid powders  $x\text{TiO}_2 \cdot y\text{H}_2\text{O}$  in the absence of chitosan, technical titanium dioxide mainly consisted of rutile.

The use of chitosan as a modifier is not accidental. We have revealed the influence of a bioactive natural polymer – chitosan as an organic reagent on the formation of the texture morphology and phase composition of products during hydrothermal treatment of  $\text{TiO}_2$  powders.



**Figure 1.** Fragments of anatase, rutile,  $\text{Na}_2\text{TiO}_3$  and  $\text{Na}_4\text{Ti}_6\text{O}_{14}$  diffractograms annealed for 6 hours at 650 (1). 750 (2). 850 (3). 950 (4). 1050K (5).

**Keywords:** chitosan, sodium titanates, polytitanates  $\text{TiO}_2 \cdot n\text{H}_2\text{O}$

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## STUDY OF ACTIVITY AND SELECTIVITY OF OXIDE CATALYSTS IN HYDROCARBON OXIDATION REACTIONS

Ulkar Shrahyeva, Elmira Huseynova, Aida Rzayeva, Zarifa Mammadova, Saida Nadjafova, Nurana Mardanova

Scientific Research Institute "Geotechnological Problems of Oil, Gas and Chemistry", ASOIU, 20, Baku, Azerbaijan

### ABSTRACT

The selectivity of complex reactions is one of the main problems of heterogeneous catalysis. Thus, it is known that the oxidation of hydrocarbons can proceed with the formation of soft and deep oxidation products. Finding the factors that determine one or the other direction of the reaction means obtaining a method for controlling the selectivity of the process. For a few catalytic oxidation reactions, there is reliable information about their mechanism.

**Keywords:** deep oxidation; C<sub>3</sub>-C<sub>4</sub>-olefins; the selectivity; catalytic reactions; re-oxidation.

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## THE IMPORTANCE OF EARTHQUAKE EDUCATION IN SCIENCE CENTER

Nur ULUHAN<sup>1</sup>, Abidin KILIÇ<sup>1</sup>

<sup>1</sup>Eskisehir Technical University, Faculty of Science, Physics Department

### ABSTRACT

Turkey is an earthquake country on fault lines region from its east to west boundaries. Therefore, earthquake awareness training is important in our country. As AFAD, The Ministry of Education, AKUT, non-governmental organizations organize educations about earthquakes. This article describes both earthquake and earthquake education importance. It is mentioned that science centers' importance, earthquake education in the world and in science centers. Furthermore, the earthquake education in Eskisehir Science Center is mentioned in the article too. The search about the effects of earthquake education is mentioned in the results and conclusion.

**Keywords:** Earthquake Education, Science Center, Non-Formal Education

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## AN APPROACH TO THE REPRESENTATION OF PLATONIC SOLIDS WITH GEOMETRIC ALGEBRA

Almila Selcen Uray<sup>1</sup>

Abidin KILIÇ<sup>1</sup>

<sup>1</sup>Eskisehir Technical University, Faculty of Science, Physics Department

Geometric algebras known as a generalization of Grassmann algebras complex numbers and quaternions are presented by Clifford and this algebra describing the geometric symmetries of both physical space and spacetime is a strong language for physics. Groups generated from 'Clifford numbers' is firstly defined by Lipschitz (1886). They are used for defining rotations in a Euclidean space. In this work, Clifford algebra are identified. Energy of classic particles with Clifford algebra are defined. This calculations are applied to some Archimedean solids. Also, the vertices of Archimedean solids presented in the Cartesian coordinates are calculated. Platonic Solids can also be represented by Geometric Algebra, which provides advantages mathematically and physically. These advantages have been demonstrated in many studies. But maybe as a new perspective, can a platonic solid's volume decrease or increase in 3-dimensional space be defined directionally by Geometric Algebra? This recommendation is discussed in this study.