Republic of Türkiye's 100th Anniversary. We are stronger together, our beloved Turkish Nation.

BOOK OF ABSTRACTS

6th Pak-Türk Conference on Emerging Technologies in the Field of Sciences and Engineering

PAKTÜRK 2023

May 4 – 6, 2023

Karabük University

Science Faculty, Physics Department

Karabük, Türkiye

PREFACE

The Pak-Türk conference series is a technical event which focuses on the advances in new technologies in engineering sciences, nuclear astrophysics, renewable energy resources, optical engineering, computer science and electrical engineering.

The purpose of this conference series is to provide a platform for researchers, academicians, and practitioners to make them familiar with recent advances in various fields of engineering and sciences. The organization committee accepts a wide range of papers to encourage young and experienced researchers to present their work and the possibility of initiating mutual collaboration with internationally renowned researchers and experts in the relevant industries. The conference format comprises of multiple sessions and the selected works in these sessions are based on substantial and novel research.

The series of events was initiated in 2018 by Ghulam Ishaq Khan Institute of Engineering Science and Technology (GIKI) which organized the "First International Pak-Türk Workshop on Emerging Technologies in the Field of Sciences and Engineering" held on 9th May of 2018 at Barber's Building in their campus.

Later events in the series are listed as:

- ✓ 2nd PAK-TÜRK International Conference (GIKI, Pakistan)
        (Face-To-Face) (March 11 – 13, 2019)
- ✓ 3rd PAK-TÜRK International Conference (GIKI, Pakistan)
        (Online Presentations – COVID restrictions) (June 9 – 10, 2020)
- ✓ 4th PAK-TÜRK International Conference (GIKI, Pakistan)
        (Online Presentations – COVID restrictions) (November 3 – 4, 2021)
- ✓ 5th PAK-TÜRK International Conference
    (University of Wah, Pakistan) (Online + Face-To-Face) (December 1 – 2, 2022)

We were wishing that **6th PAK-TÜRK** conference would be a face-to-face event in which we could enjoy international collaborations between our Pakistani and Turkish researchers in a direct and more accessible way. And for the first time, it would be organized in our home, Türkiye. However, on **February 6 - 2023**, Türkiye hit and affected by a massive earthquake.

As shattered by the devastating images of the quake and tried to manage the aftermath, it was now impossible to organize this event in a way that we can manage accommodations, travel problems, and other issues related to having some or all participants required to be in the same physical location. Therefore, we decided to conduct **6ᵗʰ** of the series as an online event starting on May 4, 2023, and ending on May 6, 2023. **Collected fees were directed to AFAD as an aid for the survivals of the earthquake.**

Hosted and organized by the Physics Department of University of Karabük, the conference was comprised of a series of online presentations contributed by researchers from different countries. **5** renowned researchers across Pakistan and Türkiye were invited to give talks on various subjects that can give directions to future scientific studies. **46** speakers from **8** different countries presented their works (**51** speeches in total). The countries represented by their respective fellow researchers were *Türkiye, Pakistan, Philippines, Ukraine, Libya, Morocco, Iraq, and Azerbaijan*. There were also participants from *Brazil, Portugal and France* who had a chance of watching and listening to presentations, asking some important questions on the possible future directions of presented works and igniting useful discussions. In total, the number of participants were **127** attending from across **11** different countries.

The event was conducted with the aim of honouring **100ᵗʰ anniversary of the foundation of the Turkish Republic**, and we believe, we achieved that. The topics of the meeting were more diverse compared to the previously held ones, but we managed to keep the integrity of the series intact. The quality of the works presented was evident. Respected researchers around the world appreciated our sincere efforts and praised useful discussions among peers that made the event even more delightful. Our hope is that this meeting made a positive impact on future collaborations among participants and guide our young Turkish researchers to the right path in their respective scientific studies.

Thanks to **Mustafa Kemal ATATÜRK** and his reforms, we achieved significant advances in science in the first century of our republic's history. We wish a brighter future for our beloved country and its young researchers.

Neclaçakmak

Prof. Dr. Necla ÇAKMAK
Chief of PAK-TÜRK 2023 Conference

ACKNOWLEDGEMENTS

First of all, we would like to thank all participants for their important contributions. Sounded and well-researched works presented in these meetings will encourage future participants to have even more quality in their respective works. The organizers of this conference make every effort to keep conference fees as low as possible to facilitate the attendance of young researchers. These efforts were relatively successful, and a lot of new young faces could be seen at the conference.

We also thank the chairs of each session, who successfully managed to let each presentation start and finish on time. Thanks to their patience and persistence in keeping track of time, we could have enough time for question-answer sessions that were really necessary to ignite useful discussions along the lines of relevant topics. They also helped young presenters when they needed some encouragement during their presentations, and they kindly handled some difficulties that are inherent in any online meeting.

The organizing committee also wishes to acknowledge the assistance and encouragement that we have received from our organizations, and the many other individuals, who helped prepare this event. In some stages of preparations, there were really only a handful of people who could sacrifice their time and they did it without asking for favours. We are also very grateful to the reviewers, whose very consistent reviewing of abstracts was of great help in improving the quality of many papers.

I am particularly thankful to the Jameel-Un NABI, a highly respected contributor and initiator of PAK-TÜRK conference series. As the current director of WAH University, his decision to have his university support many young students and academicians financially, just to be able to register and present their work at this conference, was an invaluable contribution to this event. He and his co-worker's presence greatly contributed to the friendly atmosphere we had here.

Finally, we would like to note that this year is the 100th anniversary of the foundation of the Turkish Republic. 100 years ago, Mustafa Kemal ATATÜRK and his fellow fighters fought for independence of this country with great resolve. Therefore, we like to see this event as a

commemoration of their efforts on saving our beloved nation and leading us to create a modern Turkish state. The following quotation united us in the past and will always guide us to the future:

"My moral heritage is science and reason. Anyone willing to appropriate my ideas for themselves after me will be my moral inheritors, provided they would approve the guidance of science and reason on this axis".

Mustafa Kemal ATATÜRK

Neclaçakmak

Prof. Dr. Necla ÇAKMAK

Chief of PAK-TÜRK 2023 Conference

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Savaş Ağduk (Physics Department)

Ulvi Kanbur (Physics Department)

Yasin Kanbur (Chemistry Department)

INVITED SPEAKERS

Ayben KARASU UYSAL

(KTO Karatay University, Department of Electrical & Electronic Engineering, Konya, Türkiye)

Recent Results from the ALICE Experiment

Fariha K. VARDAG

(Quaid-i-Azam University, Department of High Energy Physics & Cosmology, İslamabad, Pakistan)

Supergravity Hybrid Inflation and Gravitino Dark Matter

Jameel-Un NABI

(University of Wah, Vice Chancellor, Wah, Pakistan)

Investigations On Effects of Pairing Gaps on Charge-Changing Transitions

Serkan AKKOYUN

(Sivas Cumhuriyet University, Department of Physics, Sivas, Türkiye)

Artificial Intelligence Supported B(E2) Values Determination and An Online Calculation Tool

Zahid HALIM

(GIK Institute of Engineering Science and Technology, Department of Computer Sciences and Engineering, Khyber Pakhtunkhwa, Pakistan)

AI-Based Early Identification of an Accident and Profiling Utilizing Driver Dependent Vehicle Driving Features: A Scheme for Critical Infrastructure Protection

TOPICS

- ✓ Nuclear Astrophysics
- ✓ Internet of Things
- ✓ Computer Science
- ✓ Electrical Engineering
- ✓ Electronics
- ✓ Biotechnology
- ✓ Mechanical Engineering
- ✓ Statistics
- ✓ Microbiology
- ✓ Civil Engineering
- ✓ Chemistry & Chemical Engineering
- ✓ Material Science
- ✓ Manufacturing Engineering
- ✓ Data Science
- ✓ Mathematics
- ✓ Physical Sciences
- ✓ Welding Technologies
- ✓ Physical Geography
- ✓ Forest Industrial Engineering
- ✓ Energy Systems Engineering
- ✓ Management Sciences

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SCIENTIFIC PROGRAMME

May 4, 2023 Thursday

Morning Session 08.00 – 10.10   **Time Zone Istanbul (GMT+3)**
Chair: Necla Çakmak (Karabük Un., Karabük, Türkiye)

08.00 – 08.30   Opening Remarks

08.30 – 08.55   **Jameel-Un Nabi** (University of Wah, Wah Cantt, Pakistan)
Investigations on effects of pairing gaps on charge-changing transitions

08.55 – 09.10   **Tuncay Bayram** (Karadeniz Technical Un., Trabzon, Türkiye)
An Approach for Estimation of β-delayed Neutron Emission Probability

09.10 – 09.25   **Javeria Amin** (University of Wah, Wah Cantt, Pakistan)
Semantic Segmentation of Brain Tumor and Classification based on Quantum Neural Network

09.25 – 09.40   **Javid Shabbir** (University of Wah, Wah Cantt, Pakistan)
Estimation of Sensitive Proportion Based on Kuk's Randomized Response Model Using the Auxiliary
Data

09.40 – 09.55   **Abdullah Kepceoğlu** (Koç University, Istanbul, Türkiye)
The Role of Ion Properties in Reflection System Design for Time-of-Flight Mass Spectrometry: A
SIMION Simulation-Based Investigation

09.55 – 10.10   **Abdullah Kepceoğlu** (Koç University, Istanbul, Türkiye)
Electrospin biotin- and streptavidin-coated quartz crystal microbalance surfaces: characterization and
mass sensing performance using Open QCM

10.10 – 10.30   COFFEE BREAK

Morning Session 10.30 – 12.00   **Time Zone Istanbul (GMT+3)**
Chair: Nihal Büyükçizmeci (Selçuk Un., Konya, Türkiye)

10.30 – 10.45   **Aamra Urooj** (University of Wah, Wah Cantt, Pakistan)
Analysis of Analytical Approximate Solutions of Relaxation Oscillation Differential Equation of
Fractional Order

10.45 – 11.00   **Kashaf Tehreem** (University of Wah, Wah Cantt, Pakistan)
Techno-Economic Evaluation of Bio-Ethylene Production from Zea-Mays (Biorefinery as a sustainable
solution for the utilization of waste)

11.00 – 11.15   **Lina Majeed Hayder Al-Haideri** (Baghdad Un., Baghdad, Iraq)
Obtaining the adsorption surfaces of some radioactive materials by DFT calculations

11.15 – 11.30   **Attaullah Sial** (University of Wah, Wah Cantt, Pakistan)
Advance Exponential Expansion Method via Modified Kawahara Equation in Mathematical Physics

11.30 – 11.45   **Ayesha Bibi** (University of Wah, Wah Cantt, Pakistan)
Effective Energy Management System and Bill Calculation using PLC and SCADA

11.45 – 12.00   **Amna Ali A. Mohamed** (Tripoli Un., Tripoli, Libya)
A Hybrid machine learning techniques with Deep Neural Network Model for Colon Cancer Diagnosis

12.00 – 13.00   LUNCH BREAK

Afternoon Session 13.00 – 14.55   Time Zone Istanbul (GMT+3)
Chair: Savaş Ağduk (Karabük Un., Karabük, Türkiye)

13.00 – 13.25   Zahid Halim (GIKI, Khyber Pakhtunkhwa, Pakistan)
AI-Based Early Identification of an Accident and Profiling Utilizing Driver Dependent Vehicle Driving Features: A Scheme for Critical Infrastructure Protection

13.25 – 13.40   **Bushra Shakoor** (University of Wah, Wah Cantt, Pakistan)
Synthesis, Spectral Study and Comparative Pharmacological Assessment of Silver (I) Complexes Based on Electron Donor Ligands

13.40 – 13.55   **Fazeel Ahmad** (University of Wah, Wah Cantt, Pakistan)
Effect of optimized cycle of concentration on cooling tower for water conservation: A case study for cement plant (Pakistan)

13.55 – 14.10   **Seyran Ibrahimov** (Karabük University, Karabük, Türkiye)
On a Pillai-type Problem Associated with Lucas Numbers

14.10 – 14.25   **Ahmet Öztürk** (Karabük University, Karabük, Türkiye)
Modeling of Average Temperature Values in Türkiye for 2050 and 2096

14.25 – 14.40   **Ahmet Öztürk** (Karabük University, Karabük, Türkiye)
Assessment of Annual Average Drought Conditions in Türkiye Based on Surface Soil Moisture, Soil Moisture Anomaly, and Soil Moisture Profile Parameters

14.40 – 14.55   **Hakan Öcal** (Bartın University, Bartın, Türkiye)
Comparison of Baseline Unet and Depthwise Separable Unet models on Slices Left Atrium Segmentation from MRI

May 5, 2023 Friday

Morning Session 08.00 – 10.00   Time Zone Istanbul (GMT+3)
Chair: Necla Çakmak (Karabük Un., Karabük, Türkiye)

08.00 – 08.25   Serkan Akkoyun (Sivas Cumhuriyet University, Sivas, Türkiye)
Artificial Intelligence Supported B(E2) Values Determination and An Online Calculation Tool

08.25 – 08.40   **Huseyngulu Quliyev** (National Aviation Academy, Baku, Azerbaijan)
Investigation of the level structures of Giant and Pygmy dipole excitations

08.40 – 08.55   **Javad Rahebi** (Istanbul Topkapi Un., Istanbul, Türkiye)
A blockchain based to intrusion detection system in Software-defined networking

08.55 – 09.10   **Khalid Agayr** (Polytechnic University, Ben Guerir, Morocco)
Sulfuric Acid Recovery from Phosphate Waste Using Electro-Membrane Technology

09.10 – 09.25   **Bilal Karaduman** (Istanbul Ticaret Un., Istanbul, Türkiye)
Effect of Microcracks on Solar Module Efficiency

09.25 – 09.40   **Bilal Karaduman** (Istanbul Ticaret Un., Istanbul, Türkiye)
Prevention Methods of Microcracks on Solar Module

09.40 – 09.55   **Arzu Cevdetoğlu** (Mosi Textile R&D Center, Izmir, Türkiye)
A Review on Computer Aided Manufacturing Systems Used in the Apparel Industry

10.00 – 10.30   COFFEE BREAK

Morning Session 10.30 – 12.00   Time Zone Istanbul (GMT+3)
Chair: Khalid Hadi Mahdi Aal-Shabeeb (Karabük Un., Karabük, Türkiye)

10.30 – 10.55   **Ayben Karasu Uysal** (KTO Karatay University, Konya, Türkiye)
Recent Results from the ALICE Experiment

10.55 – 11.10   **Irum Jamil** (University of Wah, Wah Cantt, Pakistan)
A Facile Multicomponent Synthesis and antibacterial activity of Spiro Nitrogen Heterocycles

11.10 – 11.25   **Nihal Büyükçizmeci** (Selçuk Un., Konya, Türkiye)
Quality control of radiation dose estimation by using treatment plans on 3d phantom

11.25 – 11.40   **Madiha Rashid** (University of Wah, Wah Cantt, Pakistan)
Assessment of Prevalence of Hypertension-Related Heart Diseases Among Diabetic Patients

11.40 – 11.55   **Moin Khan** (University of Wah, Wah Cantt, Pakistan)
Numerical Modeling for Stresses Analysis in Single Lap Joints for Aerospace Applications

12.00 – 13.00   LUNCH BREAK

Afternoon Session 13.00 – 14.45   Time Zone Istanbul (GMT+3)
Chair: Necla Çakmak (Karabük Un., Karabük, Türkiye)

13.00 – 13.15   **Volodymyr V. Tkach** (Chernivtsi National Un., Chernivtsi, Ukraine)
The theoretical description for sucralose and perillartine CoO(OH)-assisted electrochemical determination in beverages

13.15 – 13.30 **Volodymyr V. Tkach** (Chernivtsi National Un., Chernivtsi, Ukraine)
The mathematical modeling for galvanostatic heavy metal removal from wastewater by a green conducting polymer, based on three poisonous mushrooms

13.30 – 13.45 **Masoud Giyathaddin Obaid** (Karabük Un., Karabük, Türkiye)
Impact of Aluminum Addition on The Melting Point and Wettability of The Sn-2Ag-0.5Cu-1In Solder Alloy System

13.45 – 14.00 **Serkan Oguz** (Karabük Un., Karabük, Türkiye)
Effect of Melting Temperature on Wettability of (96.5-x)Sn-2Ag-0.5Cu-1Bi-xAl Solder Alloy Systems

14.00 – 14.15 **Zeenat Haq** (University of Wah, Wah Cantt, Pakistan)
Physicochemical properties of Anthozoan Fluorescent proteins: an in-silico analysis for biotechnology applications

14.15 – 14.30 **Yavuz Ekincioğlu** (Bayburt University, Bayburt, Türkiye)
Structural and Electronic Characterization of m-Fluoroaniline and m-Iodineaniline: A Density Functional Theory study

14.30 – 14.45 **M. Waqas Mustafa** (University of Wah, Wah Cantt, Pakistan)
Comparative Structural and Thermal Analysis of Aluminum Alloys Piston using FEA

May 6, 2023 Saturday

Morning Session 09.00 – 10.30 **Time Zone Istanbul (GMT+3)**
Chair: Necla Çakmak (Karabük Un., Karabük, Türkiye)

09.00 – 09.25 Fariha K. Vardag (Quaid-i-Azam University, Islamabad, Pakistan)
Supergravity hybrid inflation and gravitino dark matter

09.25 – 09.40 **Sajjad Saeed Ali Ali** (Selçuk Un., Konya, Türkiye)
Use of Alkylbromide-derived Calix[4]arene segments in Inhibition of Hemoglobin Pseudo-Peroxidase Activity in Patients with Thalassemia

09.40 – 09.55 **Ramadan Ahmed Ali Agoub** (Tripoli Un., Tripoli, Libya)
Optimum Modeling In Terms Of Energy Efficiency In Pv/T Solar Systems By Using New Advanced Jellyfish Algorithm

09.55 – 10.10 **Yusof-den Jamasali** (Mindanao State Un., Marawi City, Philippines)
Simulation of air pollutant dispersion around Afşin Elbistan – A Thermal Power Plant, Türkiye using Gaussian Plume Model in Freemat

10.10 – 10.15 **Yusof-den Jamasali** (Mindanao State Un., Marawi City, Philippines)
Radiological Assessment of Seyitömer Thermal Power Plant in Kütahya, Türkiye using RESRAD-ONSITE Code 7.2

10.15 – 10.30   **Samet Nohutçu** (Karabük Un., Karabük, Türkiye)
Improving The Mechanical Properties of Force TIG Welded Ti6Al4V Titanium Alloy by Post Weld Heat Treatment

10.30 – 11.00   COFFEE BREAK

Morning Session 11.00 – 12.00   Time Zone Istanbul (GMT+3)
Chair: Hüseyin Yıldırım (Karabük Un., Karabük, Türkiye)

11.00 – 11.15   **Jalaleddin Mohamed** (Karabük Un., Karabük, Türkiye)
An Approach to Alzheimer Disease Classification Based on The Artificial Neural Network

11.15 -11.30   **Hifza Azam** (University of Wah, Wah Cantt, Pakistan)
Design and development of voice and gesture controlled smart wheelchair for specially abled persons using dc motors

11.30 – 11.45   **Anes Hayder** (Karadeniz Technical Un., Trabzon, Türkiye)
The Collimator Optimization for ^{133}Xe and ^{201}Tl Isotopes on the Simulation SPECT Imaging Model

11.45 – 12.00   **Şevki Şentürk** (Karadeniz Technical Un., Trabzon, Türkiye)
Investigation of production cross-sections of ^{73}Se radioisotope via proton indicated reaction channels

12.00 – 13.00   LUNCH BREAK

Afternoon Session 13.00 – 14.00   Time Zone Istanbul (GMT+3)
Chair: Ahmet Mustafa Erer (Karabük Un., Karabük, Türkiye)

13.00 – 13.15   **Najm Abdullah Saleh Saleh** (Karabük Un., Karabük, Türkiye)
U1F Transition Properties for K-44 Isotope by pn-QRPA

13.15 – 13.30   **Mehmet Dağ** (Karabük Un., Karabük, Türkiye)
Gamow-Teller Transition Properties for Tc-100 Isotope by Pyatov Method

13.30 – 13.45   **Khalid H. Mahdi Aal-Shabeeb** (Karabük Un., Karabük, Türkiye)
Comparing the concentration of radon in the old and new residential houses in Karabük city/Türkiye using the passive method

14.00 – 14.30 Closing Remarks

ABSTRACTS

Analysis of Analytical Approximate Solutions of Relaxation Oscillation Differential Equation of Fractional Order

Aamra Urooj[1*], Muhammad Yaqub Khan[2] and Qazi Mehmood Ul Hassan [3]

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Abstract

Fractional calculus has gained a considerable amount of interest and attraction by authors and researchers in field of physics and engineering as it is useful in fabricating various physical phenomenon of massive significance. Relaxation oscillation is one of the most fundamentals and notice worthy phenomenon in physics and engineering that can be dealt mathematically by a differential equation of fractional order. Generating solution and explicating the results of associated FDE is crucial. This article unfolds the mathematical approach to this physical phenomenon and figure out the different analytical techniques for finding its solution. Adomian Decomposition Method and Homotopy Analysis Method are implemented, and the solution is compared with the exact one. Moreover, the results are plotted by utilizing maple software to perceive the performance of the solutions developed by the aforementioned techniques. The plots are helpful in investigating the effectiveness and reliability of methods.

Keywords — *Relaxation Oscillation, Fractional Differential Equation, Homotopy Analysis Method, Adomian Decomposition Method.*

The Role of Ion Properties in Reflectron System Design for Time-of-Flight Mass Spectrometry: A SIMION Simulation-Based Investigation

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Abstract

This study aimed to investigate the impact of multiple ions and reflectron parameters on the mass resolution of a reflectron time-of-flight mass spectrometry (ReTOF-MS) system. The charged particle optics simulation software, SIMION, was utilized to simulate ion behavior within the reflectron and electro-optics sections of the system, while optimizing the system design by altering the geometrical parameters of the electrodes and reflectron. Specifically, the effect of ion parameters, such as ion energy (IE), birth position (BP), statistical distribution (SD), and mass (m), on the mass resolution (R) of the system was evaluated. In addition, the influence of various reflectron parameters, including reflectron geometry, electrode position and shape, and applied voltages, was investigated. The simulations encompassed a broad range of ion and reflectron parameters, offering insights into the effects of these parameters on the system's mass resolution. The findings emphasize the necessity of optimizing the reflectron and electro-optics design of a time-of-flight mass spectrometry system.

Keywords — *Mass Spectrometry, Reflectron, Charged Particle Optics, Simulation, Ion Properties, Resolution, Ion Trajectories.*

Electrospin Biotin- and Streptavidin-Coated Quartz Crystal Microbalance Surfaces: Characterization and Mass Sensing Performance Using OpenQCM

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Abstract

In this study, a quartz crystal microbalance (QCM) sensor surface was coated with biotin and/or streptavidin using the electrospinning method. The coated surfaces were analyzed using Raman spectroscopy method. QCM measurements were carried out using the OpenQCM platform. The results indicate that the electrospinning method can be used to coat QCM surfaces with biotin and/or streptavidin, and that the coated surfaces exhibit distinct morphological and spectroscopic properties. The QCM measurements showed that the coated surfaces are highly sensitive to changes in mass, indicating their potential for use in biosensing applications. Overall, this study provides new insights into the use of QCM sensors coated with biotin and/or streptavidin for biological sensing and detection applications.

Keywords — *Quartz Crystal Microbalance (QCM), Biotin, Streptavidin, Electrospinning, Surface Coating, Raman Spectroscopy, Biosensing.*

Supergravity Hybrid Inflation and Gravitino Dark Matter

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Abstract

The inflationary paradigm provides an elegant explanation of all the cosmological problems faced by the standard model of cosmology–the hot big bang or the standard big bang. It avoids the monopole overproduction problem which usually occurs in the grand unified theories (GUTs). To realize inflation within supersymmetric GUTs we consider supersymmetric (SUSY) hybrid models of inflation; an extension of hybrid inflation which incorporates constrained minimal supersymmetric model or minimal supergravity model, where supersymmetry is broken in the hidden sector, and the inflation is associated with the spontaneous breaking of a gauge symmetry. The inflation is driven by radiative, soft supersymmetry, and supergravity corrections, which are results of supersymmetry breaking in the very early universe. The SUSY GUTs are natural extensions of the standard model and provide the lightest SUSY particle as a natural dark matter candidate, which in the context of supergravity is the gravitino.

Advance Exponential Expansion Method via Modified Kawahara Equation in Mathematical Physics

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Abstract

In this study, the primary purpose of this research is to analyze the voyaging wave engagements soliton dynamics of the nonlinear modified Kawahara equation in the absence of self-phase modulation using the advanced exp $\left(-\Omega(\eta)\right)$-expansion method. Our method is an improved version of the generalized $\exp\left(-\Omega(\eta)\right)$-expansion method. We examine the families of solitary wave solutions. The advanced exp $\left(-\Omega(\eta)\right)$-expansion method is used to generate optical soliton, solitary optical soliton, dark optical soliton, and combination optical soliton solutions to our aforesaid nonlinear modified Kawahara equation are developed, as well as trigonometric, hyperbolic, and rational function solutions are also acquired. Maple18 examines and demonstrates the dynamics nonlinear wave solution in 3D, 2D, and contour plots with precise values of the complicated parameters depicted. The advanced exp $\left(-\Omega(\eta)\right)$-expansion method is a consistent way for obtaining key nonlinear waves that improve a wide range of dynamic models encountered in engineering fields. The computational software Mathematica 10 was used to graphical representation of the obtained solutions.

Recent Results from the ALICE Experiment

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Abstract

ALICE (A Large Hadron Collider Experiment) at the CERN Large Hadron Collider (LHC) aims to study the hot and dense QCD matter formed in high-energy heavy-ion collisions. ALICE is the only dedicated heavy-ion experiment at the LHC and has an extensive set of sub-detectors which can probe a broad set of observables from heavy-ion and elementary collisions. Highlights of recent results from the ALICE collaboration will be presented. The collision systems investigated are Pb–Pb, p–Pb, and pp, and results from the QGP's thermodynamic, global, hydrodynamic, and transport properties will be shown, and how QGP affects the formation of hadrons will be discussed. A brief description of the ALICE upgrade program will also be given.

Effect of Optimized Cycle of Concentration On Cooling Tower For Water Conservation: A Case Study For Cement Plant (Pakistan)

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Abstract

Thermal power plants specifically in the cement industry are one of the most water consuming industries. Due to scarcity of water resources its optimized utilization is necessary for the sustainability of environment. Majority of power plants in the Pakistan are put into shutdown condition owing to very less sources of water. In the current study, effect of increase in cycle of concentration (COC) on water conservation has been discussed. Various strategies have been discussed to increase the increase of cycle of concentration. With increase in the cycle of concentration, water evaporation losses are reduced. The sole objective of this research is to assess the effect of optimized COC (4.6) on make-up water, bleed rate, hardness, total dissolved solids, chlorides, chemical dosage, pH, sulphates etc. The effect of increasing COC was also studied for the chemical treatment cost. With the increase of COC from 1 to 4.6, Bleed rate would reduce from 24.7 to 14.3 tons per day, make-up water decreases from 75400 m^3/ h to 63200 m^3/ h with increasing cycle of concentration from 1 to 4.6 the chemical treatment cost (acid and scale inhibitor) would decrease from Rs. 290305 to 173634 for the period of one month. In the same way, acid (H_2SO_4 or $NaOH$) dosage being used for chemical treatment and scale inhibitor will decrease from 146.2kg /day to 140.4kg/day. By increasing the COC, the concentration of total dissolve solids and their hardness increases time to time for 12 hours shift during sampling due to zero blow down during the acidic treatment. and similar effect will be observed for higher COC. With increase COC from 1 to 5, would save almost $1x10^4$ m^3 of water per year.

Keywords — *Thermal Power Plants, Cycle of Concentration, Cooling Tower, Water Conservation, Cement Industry.*

A Review on Computer Aided Manufacturing Systems Used in the Apparel Industry

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Abstract

The labor-intensive apparel production is one of the most important sectors in Türkiye. With developing technology, apparel structure has changed from the custom fitting and assembly of individual hand-sewn garments to the mechanized and mass production and distribution of ready-to-wear products in the world market. One of the most important factors enabling this change is the Computer Aided Manufacturing (CAM) systems used in the apparel industry. CAM means the use of computer software to control machine in the manufacturing process and it is considered as a numerical control programming tool. In this study, it is aimed to give detailed information's about the fully automatic spreading machines used in the fabric spreading process and the fully automatic cutting machines used in the fabric cutting. The benefits, advantages, general working principles and productivity-enhancing solutions of these systems are discussed in detail.

Keywords — *Apparel, Computer Aided Manufacturing, Fabric Spreading, Fabric Cutting, Spreader, Cutter.*

Assessment of Prevalence of Hypertension-Related Heart Diseases Among Diabetic Patients

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Abstract

Background: Globally, hypertension is regarded as a silent killer and a source of public health concerns. It is a frequent condition, especially in people with diabetes. Both hypertension and diabetes are global issues with rising prevalence, although they are rarely discussed in many developing nations**. Objective:** The current study aimed to estimate the incidence of the prevalence of common heart diseases, Hypertension (HTN), and ischemic heart disease (IHD) and both hypertensions along with ischemic heart disease (HTN+IHD) in a local diabetic population of Wah Cantt, Pakistan. **Methods:** A study was conducted in POF's Hospital, Wah Cantt, to assess the prevalence of common heart diseases, hypertension, and ischemic heart disease (HTN+IHD) in local diabetic patients, to analyze the lipid profile and possible risk factors associated with heart diseases. The structured questionnaire data was obtained. The study included 305 patients, 155 known diabetes, and 150 control participants aged 40 to 60. **Results:** Among 305 individuals, 155 (50.81%) were diabetic. The prevalence of diabetes was higher in female subjects (61.29%) than in male subjects (38.70%). The mean age of female subjects was 54.85±8.78 years, and of male subjects was 54.98±9.06 years. The prevalence of HTN subjects was 70 (45.156%), IHD was 50(32.25%), and HTN+IHD was 35(22.58%). It was observed that diabetic female subjects were more prone to all three heart diseases; HTN, IHD, and HTN+IHD 57.14%, 70%, and 57.14%, respectively (56.38±8.82, 51.63±8.74, 58.21±7.66) while diabetic male subjects were lower in HTN, IHD, and HTN+IHD 42.85%, 30% and 42.85% respectively (57±8.93, 50.07±9.85, 53.94±7.88) factually there was no critical connection among gender and heart disease (p-value= 0.10). Public awareness may help the local administration manage the healthcare load in the face of limited resources.

Keywords — *Diabetes, Hypertension, Ischemic Heart Disease, Gender, Lipid Profile.*

A Hybrid Machine Learning Techniques with Deep Neural Network Model for Colon Cancer Diagnosis

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Abstract

Deep learning is one of the specialized forms of machine learning. In machine learning, the workflow process begins with its own characteristic, namely the extraction of images manually. These features are then used to create a model that can classify objects and objects in images. Colon cancer detection is of great significance task in medical diagnosis. the detection of colorectal cancer in early stage can significantly facilitate clinicians' decision-making and reduce mortality. The accurate detection results help to explore symptomatic treatment promptly; this can be achieved by using automatic systems with histopathological images. Recently, Convolutional Neural Networks (CNN's) have become state-of-the-art for many computer vision tasks. In this study, we are using of CNN's for the automated classification of colon histopathological images and the combination of convolutional neural networks and Supervised machine learning methods are used to achieve better classification results than using individual pre trained deep networks. Therefore, this study is aimed to get a high performance and accuracy of CNN combined them with supervised machine learning methods. Support Vector Machine (SVM), decision tree and k-nearest neighbour as the classification of colon cancer to get the best accuracy.

Keywords – Colon Disease Diagnose, CNN, Machine Learning, SVM, Decision Tree, K-Nearest Neighbour.

Optimizing Photovoltaic Model Parameters with an Improved Artificial Jellyfish Search Algorithm

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Abstract

Photovoltaic (PV) systems are used to convert solar energy into electrical energy. The optimization of photovoltaic (PV) systems relies on the development of an accurate model of the parameter values for the solar/PV generating units. This work proposes a modified artificial jellyfish search optimizer (MJSO) with a novel premature convergence strategy (PCS) to effectively define the unknown parameters of PV systems. The PCS works on preserving the diversity among the members of the population while accelerating the convergence toward the best solution based on two motions: (i) moving the current solution between two particles selected randomly from the population, and (ii) searching for better solutions between the best-so-far one and a random one from the population. To confirm its efficacy, the proposed method is validated on three different PV technologies and is being compared with some of the latest competitive computational frameworks. İn this study, develops a novel metaheuristic algorithm that is inspired by the behavior of jellyfish in the ocean and is called artificial Jellyfish Search (JS) optimizer. Applying new optimization methods such as the mermaid algorithm to increase the efficiency of photovoltaic (PV) systems.

***Keywords** – Optimizer, PV systems, Machine Learning, Artificial Jellyfish Algorithm, Solar Energy.*

Semantic Segmentation of Brain Tumor and Classification based on Quantum Neural Network

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Abstract

Brain tumor is an aggressive disease its abnormal cells grow rapidly and destroy the normal/healthy cells. Computerized methods play a vital role in the speedy and accurate detection of diseases that provide a second opinion for radiologists. In this article, a method is proposed for the segmentation and classification of brain tumors. The semantic segmentation method is developed in which features are extracted from the pre-trained Xception model and fed as input to the deeplabv3 model. This model is trained on the selected learning parameters such as 16 batch-size, 100 epochs, and Adam optimizer. The proposed segmentation model is trained and tested on the publically available datasets as well as real patients' images to authenticate the method's performance. After segmentation, classification is performed using the proposed quantum neural network based on 2 qubits. This model is trained on the 16 batch-size, Adam optimizer, and 100 training epochs. The proposed classification model provides 98.4% accuracy to classify the tumor/non-tumor slices. The experimental results demonstrate that the proposed method performed better compared to the existing state-of-the-art methods published in this domain.
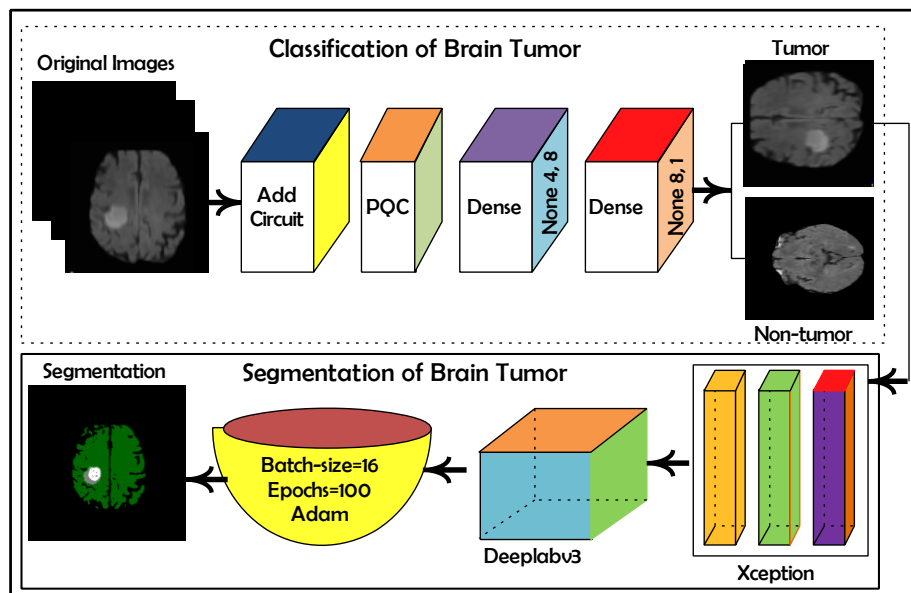
Keywords — Neural Network, Tumor, MRI, Segmentation, Quantum.

Techno-Economic Evaluation of Bio-Ethylene Production from Zea-Mays (Biorefinery as A Sustainable Solution For The Utilization of Waste)

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Abstract

The nonrenewable nature of fossil fuels and their connection to the buildup of greenhouse gases in the atmosphere have been recognized for a long time. As a result, renewable methods have been developed that utilize both non-biomass sources like wind, solar, geothermal, and hydroelectric power, and biomass sources that can be directly combusted or converted into value-added products using various thermochemical processes or using microorganisms. This combination of microorganisms and biomass has paved the way for the creation of a bioeconomy, enabling the commercial production of biofuels, biochemicals, and other miscellaneous materials. This study focuses on the production of bio-ethylene from Zea Mays (a waste biomass of corn). Ethylene is a key feedstock for various downstream chemical products like PET, ethylene oxide etc. It is responsible for the production of about half of all plastics produced globally (a fast-growing industry all over the world). Annually, over 140 million tons of ethylene are produced, and demand for it is expected to rise, particularly in developing economies. With its resemblance to ethylene in terms of chemical makeup, bio-ethylene can also be used to make plastics and other downstream products with the current machinery and production capacity. This study provides techno-economic analysis to produce bio-ethylene from Zea Mays (corn stover). The production of bio-ethylene from biomass-based pathways involves two primary steps: fermentation to produce bioethanol from biomass, followed by the catalytic dehydration of bioethanol to bio-ethylene. This research work discusses all the technical aspects with the economic evaluation of the production process. All indicators of economic analysis (Net Present Worth, IRR etc.) show the Bio-Ethylene from Zea Mays is economically viable (with 27.8% rate of return) to produce value added product (bio-ethylene) with least environmental implications.

Keywords — *Biorefinery, Zea Mays, Greenhouse Gases (GHG), Bio-Ethylene, Fermentation, Economic Evaluation, Profitability Analysis, Discounted Cash Flow, Net Present Worth Rate of Return, Depreciation.*

Modeling of Average Temperature Values in Türkiye for 2050 and 2096

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Abstract

The climate system resulting from the mutual interaction of natural environments exhibits variations due to natural events, such as changes in orbit and axial inclination, precession movement, and major volcanic eruptions. The increasing industrial activities and population size over the last century have given rise to the notion that human factors also influence these changes, leading to a growing body of research in this area. The Rio Conference, Kyoto Protocol, and Paris Agreement represent significant international efforts in the fight against climate change. Unfortunately, reports indicate that the Mediterranean basin, including Türkiye, is expected to experience serious impacts from climate change. This research aims to reveal the possible changes in average temperatures in Türkiye. in the coming years due to climate change. The analyses were carried out using the Google Earth Engine operating system based on the socio-economic (stage 1) greenhouse gas emission scenario of the Coupled Model Intercomparison Project 6 (CMIP6), derived from the General Circulation Model (GCM). The "NASA Earth Exchange Global Daily Downscaled Climate Projections" forms the data source of the research. As a result of the analyses, it is predicted that the average temperature of 13.1°C measured for the Turkish territory in 2022 will be 15°C in 2050 and 17.7°C in 2096. The increase in the amount of temperature will be 1.9°C during the period 2022-2050 and 2.7°C during the period 2050-2096. This indicates that the trend of increasing average temperatures will continue to strengthen. When it is considered that the lowest average temperatures during the 2022-2096 period will rise from approximately 2°C to 6°C and the highest average temperatures will rise from 21°C to 26°C, the model results predict a strong warming trend that spreads over large areas in Türkiye. When the model outputs are examined regionally, the Southeastern Anatolia Region, the Mediterranean coasts, and the southwestern Aegean are the areas where the temperature increase will be experienced the most. The areas where low temperatures are observed in the Eastern Anatolia Region will rapidly decrease until 2096. The average temperatures seen on the southern coasts today will likely occur on the Aegean coast in 2050 and even on the Black Sea coast in 2096. The North Anatolian Mountain Range, the Taurus Mountains, and the rugged terrains in the Eastern Anatolia Region are also among the areas that will be heavily affected by the warming trend. In the Central Anatolia Region, it is estimated that the annual average temperatures, which are approximately 11.5-13.5°C in 2022, will rise to the range of 14-16°C in 2050 and 16.5-18.5°C in 2096. Changes in climate parameters are notable because of both natural and anthropogenic influences. Prolonged heat waves and increases in tropical days are indicative of rising temperature averages. Depending on the drought conditions, agricultural production, drinking water quantity, and human health are likely to be negatively affected by this increasing trend. In addition, forests will become more susceptible to both natural and anthropogenic fires. Considering all these outcomes,

combating and adapting to global climate change should be carefully carried out, and investments in measures should be made in areas that are expected to be more affected by drought, particularly.

Keywords — *Global Climate Change, Temperature Increase, CMIP6, Google Earth Engine, Türkiye.*

Assessment of Annual Average Drought Conditions in Türkiye Based on Surface Soil Moisture, Soil Moisture Anomaly, and Soil Moisture Profile Parameters

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Abstract

The term "soil moisture" refers to the water held in the soil by the molecular attraction force. The water accumulated in the soil through the effects of adhesion and cohesion is lost through evaporation, transpiration, and percolation. Changes in soil moisture are crucial for plant growth and agricultural production. Monitoring soil moisture is essential in detecting drought conditions, along with other important parameters such as plant health. The purpose of this study is to evaluate the regional parameters of surface soil moisture, soil moisture anomaly, and soil moisture profile in the Turkish terrain between 2015 and 2023 and to reveal trends under drought conditions. The analyses were conducted using the Google Earth Engine cloud computing platform and mapped using ArcMap 10.4. The data source for the study was the "NASA-USDA Enhanced SMAP Global Soil Moisture Data" catalog available in the Google Earth Engine data library. Regional mean values were determined for all three parameters (surface soil moisture, soil moisture anomaly, and soil moisture profile), and the resulting maps were overlaid to identify the riskiest areas. Furthermore, trends in drought conditions have been identified by comparing surface soil moisture and soil moisture anomaly analyses from the first and last years in the data source, which have data integrity, namely the years 2016-2021. As a result of the research, it was observed that surface soil moisture had the lowest values, especially in the Central Anatolia and Southeastern Anatolia regions, based on the eight-year average values. The eastern part of the Küre Mountains in the Black Sea Region, the Iğdır region in Eastern Anatolia, the Ergene and Southern Marmara Regions in the Marmara Region, the Western Taurus and Hatay regions in the Mediterranean Region, and the southeastern region of the Aegean region are areas where the values are lowest. The eight-year average anomaly values for soil moisture are strongly negative in Southeast and Eastern Anatolia regions, indicating maximum drought conditions. Other areas where negative anomalies are common include the Western Black Sea Region, Western Taurus, Çukurova, and the Hatay region. The coastal Aegean region, the Sakarya region, the west of the Ergene Plain, and the north and south of the Central Black Sea region have positive anomaly values. According to the soil moisture profile data expressed as a percentage, the driest regions in Türkiye are the Central Anatolia Region, the southern part of Southeast Anatolia, the Western Taurus, Southeastern Aegean, Malatya, Elazığ, Hatay, and the Iğdır region. The highest soil moisture profile values are observed on the Black Sea coast, especially in the Eastern Black Sea. The risk analysis, which was created by combining the results of all three parameters, reveals that the entire Southeast Anatolia Region, the lower parts of the Central Anatolia Region, the Western Taurus, Çukurova, and Hatay in the Mediterranean

Region, the southeastern region of the Aegean Region, the eastern part of the Western Black Sea Region, the south of the Central Black Sea Region, the eastern and southern parts of Van Lake in Eastern Anatolia Region, and the Malatya-Elazığ-Iğdır region are the areas that experience the most severe drought in Türkiye. When the surface soil moisture and soil moisture anomaly values of 2016 and 2021 are compared, it is noteworthy that there is a transition towards drier conditions throughout the country. Surface soil moisture values are decreasing throughout Türkiye, especially in the Southeast and Eastern Anatolia regions. The Eastern Anatolia Region, which had the highest positive anomaly values (moist) in 2016, along with the high-altitude regions of the Eastern Black Sea and the Western Black Sea, now exhibit the highest negative (extremely dry) anomaly values in 2021. These areas have rapidly become drier over time. Considering that drought is a slowly developing and highly impactful natural disaster that is difficult to recover from, it needs to be continuously monitored. Soil moisture properties are the most accurate data sources that reflect drought. According to the analyses based on the eight-year average values, the severity of drought is increasing and persisting in Turkish lands. The regions with the driest climates in Türkiye are the Central and Southeast Anatolian regions, the Western Taurus Mountains, the eastern part of the Western Black Sea, the Southeast Aegean, and the areas around Hatay-Iğdır-Malatya and Elazığ. Planning agricultural policies according to the changing conditions and effective management of water resources are among the measures that need to be taken now to mitigate the effects of the increasingly inevitable dry periods in the coming years.

Keywords —*Soil Moisture, Soil Moisture Anomaly, Soil Moisture Profile, Drought Conditions, Google Earth Engine, Türkiye.*

Design and Development of Voice and Gesture Controlled Smart Wheelchair for Specially Able Persons Using Dc Motors

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Abstract

Physically challenged persons those who are suffering from different physical disabilities face many challenging problems in their day-to-day life for commutating from one place to another and even sometimes they need other person to change their place. There are 144 million disable people who use a wheelchair in 32 developed countries, accounting for 1.82 percent of the global population. A sector of physically challenged people finds it very difficult to use traditional wheelchairs. There have been many significant efforts over the past few years to develop smart wheelchair platforms that could enable the person for its ease of operation without any difficulty. Researchers have been working on computer-controlled chairs which utilize sensors and quick control algorithms to minimize the level of human intervention. This project is based on a design that aids the voice activation system for physically disabled people by incorporating manual operation. Arduino microcontroller and voice recognition have been used to support the movement of the wheelchair. The wheelchair does not respond to an incorrect speech command. Depending on the direction given through voice and gesture wheelchair will be able to move in four different directions *i.e.* forward, backward, left, right. The Arduino controls the wheelchair directions The prototype is designed in such a way that it can be used independently and efficiently with less effort. It saves time, reduces cost and energy of the users.

Keywords — Specially Able, Smart, Wheelchair, Voice Control, Gesture Control.

On a Pillai-type Problem Associated with Lucas Numbers

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Abstract

Let $(L_k)_{k \geq 1}$ be the Lucas sequence defined by the recurrence relation $L_1 = 1, L_2 = 3$ and $L_k = L_{k-1} + L_{k-2}$ for all $k \geq 3$. In this paper, we find all positive integer solutions to the Pillai-type equation $3^x - L_n 2^y = 1$ using the properties of Lucas numbers.

Obtaining The Adsorption Surfaces of Some Radioactive Materials by DFT Calculations

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Abstract

In this work, a surface was prepared for the adsorption of some radioactive materials, such as uranium, plutonium, and lead, using the theoretical density function, and theoretical calculations were made to calculate the HOMO and LUMO energy for the purpose of obtaining miniature energy structures and molecular and atomic features, also DOS diagrams as a result of the adsorption of uranium, plutonium, and lead, where the necessary improvements were successfully made in order to obtain a better Electronic modeling, which has been evaluated, may contribute to other advanced applications of these models. Graphene was used in three sizes around the central uranium molecule to obtain three layers of UG1, UG2, and UG3, they were examined to obtain the most stable composition of the electronic structure. As for plutonium, models of carbon nanoparticles with different angles 120, 180, 240 were used for the adsorption of the plutonium atom and it was PuNC120 is the best among them. For the adsorption of lead (Pb), three models were used, for the adsorption of one (mono) or two (Dual) atoms and on one side Cis or on two sides Trans of the Coronene molecule.

Keywords – *Graphene; Coronene; Lead; Doped; Density Functional Theory.*

Effective Energy Management System And Bill Calculation using PLC and SCADA

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Abstract

Electrical systems are a wonderful achievement by Engineers of the 20th Century. Our civilization today could never exist without these systems. Generation, transmission, and distribution overall systems are main gears of electrical system. In manual control of industries, a technical operator is required who operates the machine manually. In case, unskilled person will handle the high-tech machine, there is a high chance that machine or system will malfunction. Also, Non-protected power systems are the main cause of failure in electrical system and its subsequent equipment. These failures must be diminished to an acceptable level through an efficient process to prevent failures in electrical systems. The Design and implementation of prototype for monitoring and controlling of industry using PLC and HMI. It is an intelligent system which aims to manage all the electrical systems using automation technology. All devices are controlled, protected, and monitored by automated system that collects information from the control equipment and performs actions depending upon its needs. This project explains controlling of different loads through PLC and generate bill automatically also monitoring all load parameters through SCADA.

Keywords — *PLC, SCADA, HMI, Automation, Monitoring, Controlling.*

Effect of Microcracks on Solar Module Efficiency

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Abstract

The popularity of solar energy has increased recently due to its clean and renewable nature and increasing energy demand. The solar module, which converts solar energy into electricity, is one of the main elements of the solar energy system. Micro cracking, one of the problems of solar modules regardless of cutting technologies, is a phenomenon that develops on the surface of solar modules when the solar module is exposed to mechanical stress or temperature fluctuations. Micro cracks can have a major negative impact on the conversion efficiency, power efficiency and lifetime of solar modules. In this study, the effects of micro cracks on solar module efficiency are described.

Keywords — *Micro Crack, Solar Module, Effect of Micro Crack, Type of Micro Crack.*

Prevention Methods of Microcracks on Solar Module

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Abstract

The popularity of solar energy has increased recently since it is clean and renewable feature and due to the increasing demand for energy. The solar module, which transforms the sun's energy into electricity, is one of the primary elements of a solar energy system. Microcracking, which is one of the problems with solar modules regardless of cutting process technologies, is a phenomenon that develops on the surface of solar modules when the solar module is subjected to mechanical stress or temperature fluctuations. Microcracks can have a major negative impact on the solar module's conversion efficiency, power efficiency and lifespan. In this work, effects of microcracks on solar module efficiency is described and some methods are proposed to lessen microcracks consequences.

Keywords — *Microcrack, Solar Module, Prevention Methods.*

Comparison of Baseline Unet and Depthwise Separable Unet Models on Slices Left Atrium Segmentation from MRI

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Abstract

Accurate and precise segmentation of the left atrial node is crucial in early diagnosing and treating atrial fibrillation. Segmentation of 3D images obtained by Magnetic Resonance Imaging with the naked eye is time-consuming and challenging. Therefore, the use of deep learning-based segmentation methods, which are popular today, comes to the fore. Many deep-learning models have been proposed in the literature for the segmentation of medical images. Baseline Unet and Depthwise Separable Unet models, among the best segmentation architectures presented in this study, were analyzed comparatively. The architectures were trained and tested with the same parameters in the Left Atrium Segmentation Challenge 2013 (LASC'13) Magnetic Resonance Imaging (MRI) dataset. As a result of the analysis, Depth-wise, Separable Unet obtained a Dice score of 92.5, while the Baseline Unet architecture obtained a Dice score of 95.5. The obtained scores show that when a trade-off is made, Depthwise, Separable Unet can achieve good results with three times fewer parameters than Basic Unet.

Keywords — *Baseline Unet, Depthwise Separable Unet, Left Atrium Segmentation.*

Investigation of The Level Structures of Giant and Pygmy Dipole Excitations

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Abstract

In this study, both Pygmy Dipole Resonance (PDR) and Giant Dipole Resonance (GDR) excitations for the even-even ^{166}Er isotope were investigated within the framework of translation and Galilean invariant (TGI-) Quasiparticle random phase approach (QRPA) method. More specifically, the level structures of GDR and PDR excitations were examined and the level densities of these two modes were compared. In this context, the nucleon density, energy density and nuclear level densities of the excitation were investigated.

***Keywords — *** *PDR, GDR, Level Density, QRPA, Nucleon Structure, Er-166*

A Facile Multicomponent Synthesis and Antibacterial Activity Of Spiro Nitrogen Heterocycles

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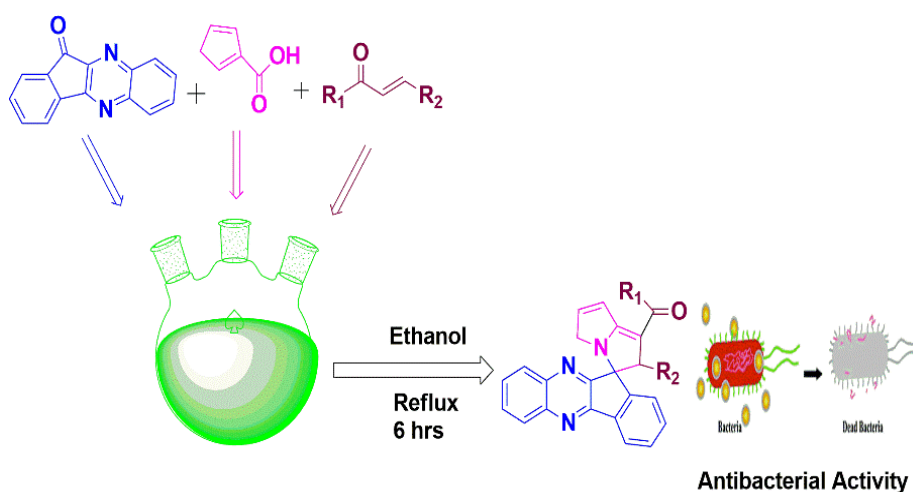*Department of Chemistry, University of Wah, Wah Cantt, 47040, Pakistan*

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Abstract

Over the last few years, multicomponent reactions (MCRs) have gained great interest and were used to synthesize complex molecules and are highly functionalized in a single synthetic operation. MCRs are considered an inventive strategy in organic chemistry. Therefore, multicomponent reactions are part of sustainable chemistry and constitute a novel way of ideal organic synthesis. Complex structures are rapidly obtained from very simple substrates involving simple synthetic operations and safe processes in the environment. Many heterocyclic compounds are distinguished as active products pharmaceutically and are gaining consistent attention in the development of new active multifunctional drugs derivatives. Heterocyclic molecules have various clinical applications and play an active role as antitumor, antibacterial, anti-inflammatory, antiviral, and antifungal agents. Current study deals with the synthesis of Spiro Nitrogen Heterocycles using ninhydrin, o-phenylenediamine, L-proline and alpha-beta unsaturated derivatives in the presence of ethanol as solvent under reflux for 6 hours to afford the corresponding spiro indenoquinoxaline derivatives characterized through spectral analysis. High yields, simple procedure, easy workup, short reaction times are the advantages of this green methodology. The synthesized compounds were evaluated for biological activity and were found to have very good anti-bacterial activity.

Keywords – Heterocyclic Compounds, Multicomponent Reaction, Antibacterial.

Estimation of Sensitive Proportion Based on Kuk's Randomized Response Model Using the Auxiliary Data

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Abstract

Collecting sensitive type data through survey sampling using the randomized response technique (RRT) is a major issue. In this set up, we propose an improved general class of estimators in estimation the proportion of sensitive people when population mean of the non-sensitive auxiliary variable is known. We generated eight new estimators from a generalized class of estimators for further enhancement which are more efficient than Kuk (1990) estimator and difference estimator. A small-scale survey was conducted in the department of Statistics, University of Wah, Pakistan on RRT to observe the performances of models.

Keywords — *Randomized Response, Kuk's Model, Auxiliary Variable.*

Sulfuric Acid Recovery from Phosphate Waste Using Electro-Membrane Technology

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Abstract

Phosphoric acid production industries such as the leader OCP Group use the wet process, which leads to enormous amounts of phosphogypsum (PG) as a byproduct (100-250 Mt/year worldwide) [1]. On the other hand, Morocco does not have a natural deposit of sulfur to meet its needs for this element, which is the basic element in the production of sulfuric acid, and so it imports a considerable amount each year. In 2021, Morocco consumed 6.87 MT [2]. PG contains high levels of sulfate which can be a source of environmental pollution if not properly managed. The storage or discharge of PG into the oceans is currently considered to be a serious and global issue, not only environmentally, but also economically. Therefore, the aim of this work is to recover sulfates from phosphogypsum by converting it into a sulfate-rich solution that will be treated and then transformed into sulfuric acid. Electrodialysis with bipolar membrane (EDBM) has emerged as a promising technology for the recovery of sulfates from phosphogypsum, as it allows for the selective separation of sulfate ions from other ions in the solution. In this study, a PG conversion process was investigated, the process starts with the conversion of the gypsum matrix ($CaSO_4.2H_2O$) in aqueous medium to highly soluble sulfate salts (Na_2SO4, $(NH_4)2SO_4$) [3]. The results reveal that the conversion rate of PG into Na_2SO_4, $(NH_4)2SO_4$ was reached an optimum of 96-98%. Then The EDBM was used to regenerates the sulfuric acid from these salts, a production of sulfuric acid and NaOH with a concentration of 1M and 1.5M respectively was achieved. This technology has been shown to be effective in laboratory and pilot-scale experiments and has the potential to be scaled up for industrial applications. The value of this process is important since H_2SO_4 can be reused in industrial phosphoric acid production or to leach precious metals from phosphogypsum. Also, the NaOH produced can be sold or used in fertilizer production steps. To assess the feasibility, we used a laboratory scale bipolar membrane electrodialysis system to study the trade-off between achieving high feedstock concentration and high specific energy consumption.

Keywords — *Electromembrane Technologies, Waste Management, Phosphate Industrie.*

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Impact of Aluminum Addition on The Melting Point and Wettability of the Sn-2Ag-0.5Cu-1In Solder Alloy System

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Abstract

This study explored at how adding aluminum affected the melting point and wettability of $(96.5\text{-}x)$Sn-2Ag-0.5Cu-1In-(x)AL quinary lead-free solder alloys with ($x = 0.3, 0.5, 0.7, 0.8, 0.9$ in wt%). Sessile drop technique was used to determine the contact angles of solder alloys on Cu substrate at specific temperatures (275^0C, 300^0C, 325^0C). By using a differential scanning calorimeter (DSC), it was revealed that SAC205-1In-0.3Al Pb-free solder alloy exhibits lower melting temperatures than SAC205-1In-0.5Al, SAC205-1In-0.7Al, SAC205-1In-0.8Al, and SAC205-1In-0.9Al alloys. The wettability of SAC205-1In-0.3Al was found to be the best. At 325°C on a Cu substrate, the SAC205-1In-0.3Al contact angle was lowest at 37.61°. The production cost of $(96.5\text{-}x)$Sn-2Ag-0.5Cu-1In-(x)Al produced solder alloys will be reduced by Sn-Al optimization ($x=0.3\%, 0.5\%, 0.7\%, 0.8\%$, and 0.9 wt. %). The results of wetting tests show that the addition of 0.3, 0.5, 0.7, 0.8, and 0.9 in Wt.% Al improves the wetting properties of the Sn-2Ag-0.5Cu-1In. The lowest wetting angle ($^0\theta$) was obtained as 34,66° for Sn-2Ag-0.5Cu-1In-0.8 Al alloy at a temperature of 325 °C.

Keywords — *Contact Angle, Wettability, Melting Temperature, Sessile Drop Technique.*

Numerical Modeling for Stresses Analysis in Single Lap Joints for Aerospace Applications

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Abstract

Over the last few decades industry was shifting towards composite material applications in aerospace industry. Lightweight materials were preferred as of good strength to weight ratio thereby enhancing system efficiency. This study presents a numerical modelling procedure and stress analysis of single lap joint between metal (AA 6061-T6) and composite (carbon/epoxy laminate) whereas stainless steel 304 was used as a rivet material. Joint was modelled with three different joining techniques namely: adhesive, hybrid, and riveted joining. ABAQUS/StandardTM cohesive zone model (CZM) tool was used for simulating adhesive and hybrid joints while simple finite element analysis (FEA) tool was used for simulating riveted joint under tensile loading. Fracture toughness (GIIC) was determined using analytical expression, with the help of tensile load. The results were evaluated in terms of Von Mises stress, shear stress, and normal stress in X, Y & Z directions. It was observed that adhesive joint shows much lower stresses as compared to hybrid and riveted joint because of equal distribution of the load along the whole surface.

Keywords — *Lap Joint, Composite, FEA, ABAQUS.*

Physicochemical Properties of Anthozoan Fluorescent Proteins: An *In Silico* Analysis For Biotechnology Applications

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Abstract

Bioinformatics tools are helful in categorizing and identifying key proteins easier and more organized, saving time and money on lab assessments and errors. Comparative sequencing helps to determine protein structure and function. NCBI, MEGA5, ProtParam, PeptideCutter, ProtScale, TMHMM, Phyre2, Batch CD-Search and ScanProsite were used for sequence retrieval, multiple sequence alignment and phylogenetic analysis, physiochemical properties, identification of potential cleavage sites, transmembrane structures, motifs, domains, and super families of 33 Anthozoan fluorescent proteins. MEGA5 matched sequences. MEGA5, ClustalW, and MUSCLE provided algorithms. Some essential residue sequences of proteins were identical, whereas others had deviations. MEGA5 phylogenetic analysis found that hriCFP and hriGFP are unusual among Anthozoan fluorescent proteins due to their small size (134 amino acids) and are not descendants of the same common ancestor as 31 other proteins. The calculates of physiochemical parameters showed that only hriCFP and hriGFP differed significantly among 31 anthozoan fluorescent proteins. hriCFP and hriGFP have 134 amino acids, while other 31 proteins have 220-234 amino acids. Molecular weight ranged from 15617.3 to 15718.4Da for hriGFP and hriCFP. pI values found 17 acidic and 16 basic proteins. 27 proteins were stable, while 6 were unstable (II > 40). All 33 anthozoan fluorescent proteins range from 52.38 to 80.04. Hydrophilic proteins have negative GRAVY values. Calculates extinction co-efficient, half-life, amino acid, and atomic composition. All cleavage sites of proteins were examined using PeptideCutter. 33 anthozoan fluorescent proteins lacked transmembrane domains. TMHMM detected no membrane proteins. Phyre2 predicted structural similarities among 31 Green fluorescent protein, while the other 2 (hriCFP and hriGFP) did not belong to this family and had a different structure. Most 3D Ligand site architectures were similar. All Anthozoan fluorescent proteins, save hriCFP and hriGFP, contain a similar domain. hriCFP and hriGFP have a same profile domain (GIY YIG). Anthozoan fluorescent proteins were most predicted. This will improve protein analysis. Proteins can be identified by their physicochemical properties and helpful in biotechnology applications.

Keywords *— Anthozoan Fluorescent Proteins, Phyre2, Clustalw, Algorithms, Phylogenetic Analysis.*

Comparative Structural and Thermal Analysis of Aluminium Alloys Piston using FEA

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Abstract

Piston is an integral part of the engine as it receives, and transfer power produced from combustion. Stresses produced in piston when subjected to pressure and temperature may lead to permanent deformation of piston. Therefore, lightweight, and restraining stress Aluminum Alloys were preferred for piston. In this study the comparative analysis of 3x materials namely: Aluminum Alloy 4032, GHY-1250 and A390-T5 were carried out using Finite Element Analysis (FEA) technique. Static structural and steady-state thermal analysis were carried out to analyze stress distribution, total deformation, total heat flux and temperature distribution in different sections of the piston owing to pressure and thermal fluctuations. Aluminum Alloy GHY-1250 was superior in terms of stress distribution and total deformation with 6.57% and 1.58% respectively while it succeeds A390-T5 in terms of total heat flux with 0.008%.

Keywords — *Engine-Piston, Aluminum Alloys, FEA, ANSYS.*

Investigations on Effects of Pairing Gaps on Charge-Changing Transitions

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Abstract

We re-examine the effects of pairing gaps on computed charge-changing transitions and the associated β-decay half-lives. Calculations are performed using the proton-neutron quasiparticle random phase approximation (pn-QRPA) model for 250 nuclei of astrophysical significance. One of the key model parameters in the pn-QRPA approach is the pairing gap between the nucleons. Three different values of empirically computed pairing gaps (TF, 3TF and 5TF) were used as input parameters in our nuclear model. Changing the pairing gap values significantly altered the Gamow-Teller (GT) distributions including the total strength and centroid values. The β-decay half-lives also changed substantially. The half-lives computed *via* the three-term pairing formula, based on separation energies of nucleons, were in best agreement with the measured data.

Keywords — Pairing Gaps, Charge-Changing Transitions, Three-Term Pairing Formula, pn-QRPA Model.

Synthesis, Spectral Study and Comparative Pharmacological Assessment of Silver (I) Complexes Based on Electron Donor Ligands

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Abstract

An important reagent in the synthesis of numerous heterocyclic compounds is thiourea, an O and S-containing compound that is employed as a source of sulphides. The presence of O and S donor atoms opens a wide range of bonding options, enabling them to function as versatile ligands, and makes it possible for them to form stable complexes. To synthesize effective antibacterial and antifungal compounds, this research sought to synthesize transition metal complexes of acyl derivatives with oxygen and sulphur donor atoms. The interaction between isothiocyanate and substituted amine produced an O, S donor ligand. These bidentate ligands' metal complexes were synthesized through a reaction between the metal salt and the ligands. Silver based thioureas such as: 1-(3,4-dichlorobenzoyl)-3-(4-nitrophenyl) and 1-(4-bromobenzoyl)-3-(4-nitrophenyl) thioureas display a broad spectrum of biological applications. Acyl derivatives and its complexes were structurally analysed by Fourier transform infrared spectroscopy and elemental analysis. Biological activities were checked by preparing different culture media.

Keywords — *Acyl Derivative, FTIR, Elemental Analysis, Antibacterial Activity, Antifungal Activity.*

The Collimator Optimization for ^{133}Xe and ^{201}Tl Isotopes on the Simulation SPECT Imaging Model

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Abstract

Since the performance of the gamma camera is significantly influenced by the geometrical design of collimators, geometrical collimator optimization is crucial for creating high-quality images. In this study, optimizations for the parallel hole collimator have been considered by regarding Low Energy General Purpose (LEGP) collimator for the ^{133}Xe isotope and the Medium Energy General Purpose (MEGP) collimator for the ^{201}TI isotope. The Monte Carlo simulation platform (GATE) was used for researching the effect of hole lengths for the two types of hexagonal parallel hole collimators (LEGP and MEGP) on the spatial resolution and the sensitivity of the Single-Photon Emission Computed Tomography (SPECT). The optimal hole lengths for the considered collimators were predicted by the trade-off between the spatial resolution and the sensitivity. The results of this work are found to be consistent with previous studies' results.

Keywords –*SPECT, Collimator, Monte Carlo Simulation, GATE.*

Comparing the Concentration of Radon in The Old and New Residential Houses in Karabük City/Türkiye Using The Passive Method

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Abstract

This study is an update of the little information about Radon concentration available for the Karabük region, especially the old residential houses, 10 old residential houses and 15 modern houses were selected in summer and 10 old and the same new houses in winter. 180 CR-T9 track detectors, four detectors for each house, were suspended in the living and sleeping rooms for a period of one month. The detectors were then collected and chemically etched. The results indicated that the radon concentrations in the old houses (with a range of 82.884 to 113.083 Bq/m^3) were higher than in the modern ones (with a range of 55.884 to 77.581 Bq/m^3) by 31% in winter, and 11% in summer (with a range of 34.845 to 60.487 Bq/m^3) and (with a range of 32.215 to 51.282 Bq/m^3) respectively. This is due to the nature of the building materials used and the style of construction (where we find glass facades that occupy larger areas in modern houses). The radioactive indices of radon gas were also calculated, so they were higher in the old houses than in the modern houses, but we find both are less than the values recommended by scientific institutions [UNSCEAR & ICRP].

Keywords — *CR-39 Detector, Radon, Old Residential Houses.*

Artificial Intelligence Supported B(E2) Values Determination and An Online Calculation Tool

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Abstract

The reduced electric quadrupole transition probability includes nuclear information about energy of low-lying levels of nuclei. The spin of the first excited states of the even-even nuclei is 2. Therefore, the transition from this state to the ground state is important. It is highly related to nuclear quadrupole deformation parameter, mean lifetime, and electric quadrupole moment. The reduced electric quadrupole transition probability is experimentally determined by inelastic electron scattering, muonic x-ray measurement, Mössbauer spectroscopy, Coulomb excitation, lifetime measurement or resonance fluorescence [1]. Additionally, there are several theoretical models based on single-shell asymptotic Nilsson model [2], finite-range droplet model [3], Woods-Saxon model [4], relativistic mean-field model [5], extended Thomas-Fermi Strutinsky-Integral method [6], Hartree-Fock+BCS method [7] and dynamical microscopic model [8]. In this study, we used artificial intelligence methods as an alternative approach to determine the reduced electric quadrupole probability. We published the results obtained in the calculations we performed with different machine learning approaches, as a calculation module on an open access website. Thus, in cases where experimental data is not available, the results of different machine learning approaches are calculated online by entering the proton, neutron, and mass numbers of the atomic nuclei whose reduced electric quadrupole value is desired. The results are provided to users along with statistical error indicators.

Keywords — *B(E2), Nuclear Structure, Artificial Intelligence.*

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Use of Alkylbromide-derived Calix[4]arene segments in Inhibition of Hemoglobin Pseudo-Peroxidase Activity in Patients with Thalassemia

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Abstract

Calixarenes, one of the third-generation molecules of supramolecular chemistry, come to the forefront in terms of synthesis and modification compared to cyclodextrin and crown ethers. Although calixarene molecules have many uses, they have been widely used in the field of nanotechnology and nanofiber in recent years. In this study, the inhibitory effect on hemoglobin pseudoperoxidase activity was studied in thalassemia patients compared to healthy individuals, after synthesis and characterization of Alkylbromide-derived calix[4]arene derivatives were performed with ^{1}H NMR. Synthesized calixarene Alkylbromide-derived calix[4]arene; Blood samples were taken from ß-thalassemia major patients aged between 10-50 years, and it was found to have a 43% inhibition. when used in plasma Estimated groups of some biochemical parameters including "hemoglobin pseudoperoxidase activity, Serum Vitamin D level, Iron Studies Tests and / thyiol gorup" studies.
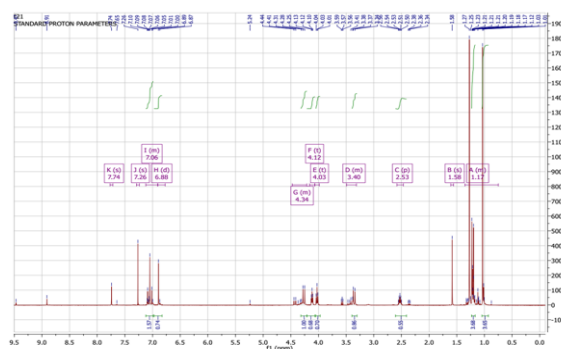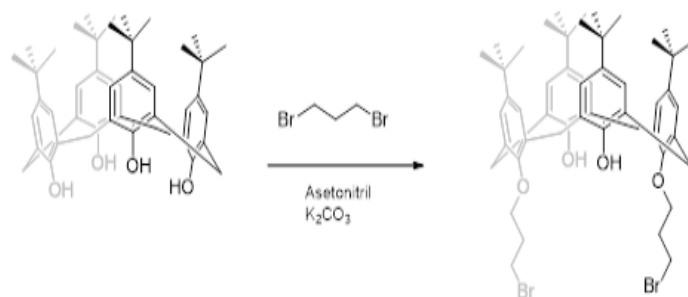
Keywords — Calixarene, Pseudoperoxidase, ß-thalassemia.

Improving The Mechanical Properties of Force TIG Welded Ti6Al4V Titanium Alloy by Post Weld Heat Treatment

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Abstract

Titanium alloys are used in submarines, marine platforms, aero engine equipment, biomedical implants, and dentistry. More than 50% of all alloys used today are Ti6Al4V alloys. Tungsten Inert Gas (TIG) welding is among the usage methods used in joining Ti6Al4V alloys. However, it is known that the properties of Ti6Al4V bonding deteriorate due to residual stresses in the melting zone and heat-affected zone (HAZ) after welding. Post-weld heat treatment (PWHT) is often used to prevent residual stresses and to improve their mechanical properties. In this study, the effects of post-welding heat treatment on the properties of Ti6Al4V alloy, which is autogenously joined by Force TIG welding, were investigated. Microstructures of welded samples were investigated. As a result of the tensile test, yield, and tensile strength as well as elongation values were determined. In addition, the hardness distributions of the joint were determined. Findings were compared for welded samples before and after post weld heat treatment. As a result, it was determined that the formability of the joint was significantly improved with the application of post-weld heat treatment.

Keywords — *Ti6Al4V, Welding, Tig Welding, Post Weld Heat Treatment, Mechanical Properties.*

Effect of Melting Temperature on Wettability of (96.5-x)Sn-2Ag-0.5Cu-1Bi-xAl Solder Alloy Systems

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Abstract

In this article, SACBi-xAl new quinary lead-free solder alloy was produced by adding Al at certain ratios (x=0.05, 0.1, 0.3, 0.5, and 0.6% wt.) to the previously produced SAC-1Bi quaternary lead-free solder alloy. The spreading properties and melting temperatures of SACBi-xAl solder alloy on Cu substrate in Ar gas atmosphere at 275, 300, and 325°C temperatures were investigated. It has been reported that the lowest melting temperature (212.5°C) and spreading angle (38.44°) belong to SACBi-0.1Al solder alloy. It has been reported that adding Al in microalloying improves the spreading by up to 0.1% and reduces the melting temperature. 0.1% wt. It has been observed that adding larger amounts of Al deteriorates the spreading properties and increases the melting temperatures.

Keywords — *Al-Added Lead-Free Solder Alloy, Wetting Angle, SACBi-Al, Sessile Drop.*

The Theoretical Description For Sucralose and Perillartine Coo(OH)-Assisted Electrochemical Determination In Beverages

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Abstract

Perillartine (Fig.1) (perillaldehyde *anti*-aldoxime) is a natural sugar substitute, extracted from Japanese perilla (shiso) leaves. It is considered twice as sweet as sucralose, four times as sweet as saccharine and 2000 times as sweet as sucrose. Besides of the proper perillartine, its ether derivative is also used, despite of being much less sweet than the proper perillartine (possessing the sweetness, nearly equal to that of aspartame).
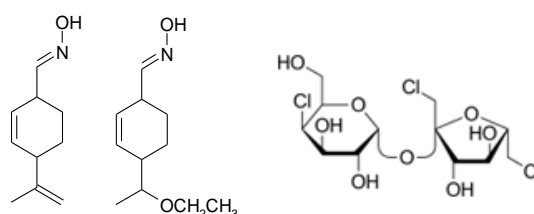
Figure 1. Perillartine, its ether derivative and sucralose.

This oxime is bioavailable and biodegradable, contrarily to the synthetic sweeteners like aspartame, saccharine, and sucralose. Moreover, it isn´t considered toxic or dangerous for the environment. Nevertheless, it may be allergic for people allergic to shiso herb. Also, some toxic nitrogen derivatives like hydroxylamine may form during its metabolism in some people. It is important to mention that perillaldehyde aldoxyme and its derivatives are rarely used as sweeteners outside Japan, so this statement may be used in investigation of falsification of allegedly Japanese product claimed to contain the peryllartine. Thus, the development of an efficient, exact, and rapid method for perillartine determination is actual task, and the electroanalytical methods would give it a good service. Sucralose (Fig. 1 to the right) is an extremely stable artificial sweetener up to 1000 times as sweet as common sugar. Its effects on human and animal organisms hasn´t been completely studied yet. Moreover, being hardly metabolized, it is accumulated in the environment. Also, the organisms capable to metabolize it transform

the sucralose transform it into toxic chloroorganic derivatives like dioxines and tetrachlorodibenzofurans. Moreover, sucralose may be added in the double dose to mimic perillartine presence in the products, pretending to be Japanese. For this reason, the sucralose and perilartine determination is also actual. In this work, the electrochemical determination of sucralose and perilartine in beverages on CoO(OH)-modified electrode has been theoretically described. Schematically, the electroanalytical process may be described as on the Fig. 2:
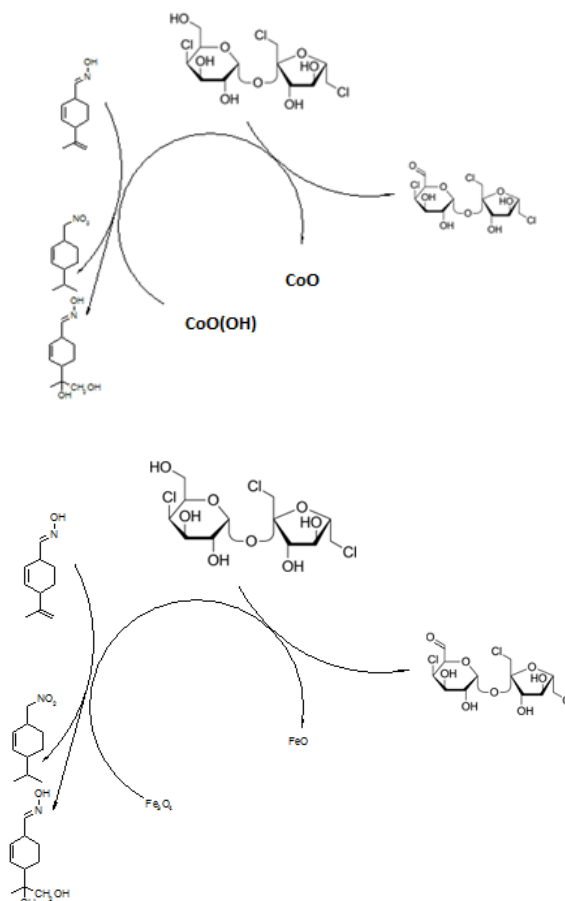

Figure 2. The scheme of the electroanalytical process.

Taking certain assumptions, we describe the system´s behavior by the equation-set of three variables:

$$\begin{cases} \frac{ds}{dt} = \frac{2}{\delta}\left(\frac{\Delta}{\delta}(s_0 - s) - r_{11} - r_{12}\right) \\ \frac{dp}{dt} = \frac{2}{\delta}\left(\frac{D}{\delta}(p_0 - p) - r_{21}\right) \\ \frac{dc}{dt} = \frac{1}{c}(r_{11} + r_{12} + r_{21} - r_3) \end{cases} \qquad (1)$$

Analysis of the model confirms that the neutral media (pH=7) is the most suitable for sucralose and perillartine electrochemical determination on magnetite nanoparticles. In the basic media, the linear range of the dependence between the current and the concentration is narrower, being even narrower in the acidic media. In both the probability of the oscillatory behavior in current enhances. Nonetheless, cobalt (III) oxyhydroxide is an efficient electrode modifier for sucralose and perillartine determination in beverages.

Keywords — *Food Safety, Environment Safety, Sucralose, Perillartine, Electrochemical Sensor.*

The Mathematical Modeling for Galvanostatic Heavy Metal Removal from Wastewater by A Green Conducting Polymer, Based on Three Poisonous Mushrooms

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Abstract

The term "heavy metals" has been interoduced by german chemist Leopold Gmelin in 1817. This term became so popular that has given its name to the musical style, known as "heavy metal rock". As for now, more than forty definitions for the term "heavy metals" are commonly accepted, but generally all the metals beginning with vanadium are considered as "heavy". Most of them are transition metals, capable to form stable complex compounds. The heavy metal cations are among of the most aggressive pollutants in the environment. They may occur even in food and drinks (including those of traditional recipes). These cations are highly toxic, provoking different intoxication symptons. For this and other reasons, the heavy metals concentration determination and removal is actual, and the electrochemical methods may be a good solution for this problem. In this work, the possibility of anodic heavy metal cations removal on a polyphenolic conducting polymer. It's important to mention that the mushrooms *Cortinarius Orellanus, Paxillus Involutus* and the yellow stainer *Agaricus Xanthodermus*, which contain phenolic compounds, capable of being used as monomers for economical and green conducting polymers (Fig. 1) may be an efficient font for the conducting polymer, capable of heavy metals cation removal:
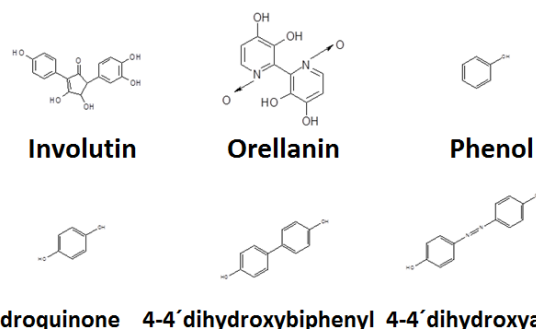
Figure 1. The phenolic mushroom toxins, potentially used as monomers.

This list includes interesting compounds, including 4-4´-dihydroxyazobenzene, the only endogenous azo-dye, found in nature. Moreover, considering the possibility for two tautomeric forms for orellanin (Fig. 2):
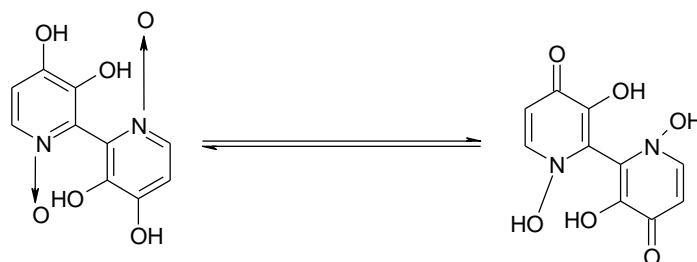
Figure 2. Two tautomeric forms for orellanin

It is possible to conclude that the orellanin unit may be used to coordinate heavy-metal cation in stable complexes and, in some cases, even coordination polymers. Therefore, in this work we investigate theoretically the possibility of the use of conducting (co)polymers of mushrooms phenols for heavy metal cations concentration measurement and removal in galvanostatic mode. In the simplest case the complex formation with the phenoles is be given in the first stage on the metal lower oxidation state, being the cation thereby electrooxidized yet in the polymer phase. This, at its turn, will be accompanied by the attraction between the macromolecules, which will bring the surface aspect to the system's behavior (Fig. 3)
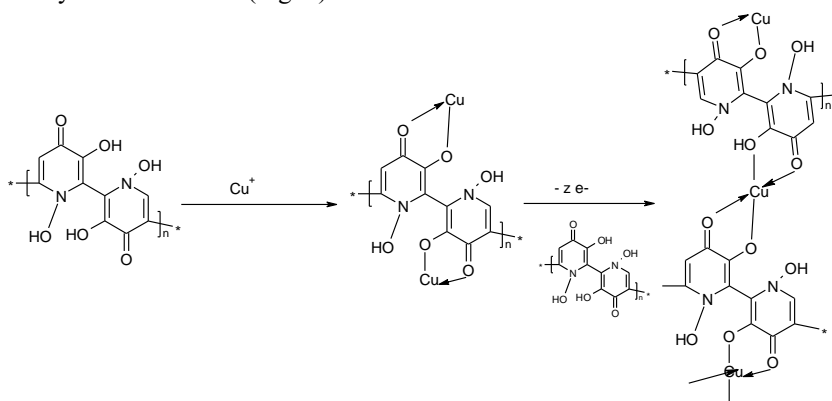

Figure 3. The scheme for retention and detection of heavy metal cation by two macromolecules. Example of copper (I) and orellanin unit.

Therefore, one more type of polymerization will be added (coordination polymerization), and the metallic cation will be oxidized, and two macromolecules will be bonded by ionic and coordination bonds via metallic cation. Therefore, the surface factor, absent to the similar systems, but observed in some experimental processes, enters the process, enhancing the probability of the oscillatory behavior in this case. We describe the galvanostatic behavior of this system by a bivariant balance differential equation-set (1):

$$\begin{cases} \frac{dc}{dt} = \frac{2}{\delta}\left(\frac{\Delta}{\delta}(c_0 - c) - r_{c1} - r_{c2}\right) \\ \frac{dp}{dt} = \frac{1}{P}(r_{c1} + r_{c2} - r_O) \\ \frac{dq}{dt} = i - i_F \end{cases} \tag{1}$$

From the behavior investigation of the system with the heavy metal cations electrochemical detection and elimination, assisted by a conducting polymer, based on mushroom polyphenols, based on *C. orellanus, P. involutus* and *A. Xanthodermus* it was possible to conclude that the polyphenolic conducting polymer, based on natural source, may be na efficient anode modifier for heavy metal cation removal and determination in natural waters and wastewaters. The behavior of the process becomes more accomplished, due to the presence of the surface instability, augmenting the probability of the oscillatory behavior. Nevertheless, it is na efficient process, controlled by kinetics of the chemical and electrochemical reactions, which make part of it.

Keywords — *Heavy Metals, Environment Safety, Mushrooms, Polyphenols Electrochemical Removal.*

Structural and Electronic Characterization of *m*-Fluoroaniline and *m*-Iodineaniline: A Density Functional Theory Study

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Abstract

This study aimed to investigate the electronic and structural characteristics of four molecules, namely m-fluoroaniline, and m-iodineaniline. Density functional theory (DFT) and CAMB3LYP/LanL2DZ methods were employed to determine various properties such as the highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO) energy levels, chemical reactivity descriptors, nonlinear optical properties, Mulliken population analysis, molecular electrostatic potential map, thermodynamic properties, and UV-Vis spectral analysis. In addition, the research explored the vertical and adiabatic ionization energy parameters of these molecules by constructing singly charged cation radicals using the same level theory. The obtained results were compared with experimental data from the literature.

Keywords — *DFT, Molecular properties, HOMO, LUMO, NLO, Uv-Vis, Adiabatic Ionization, Vertical Ionization.*

An Approach for Estimation of *β*-delayed Neutron Emission Probability

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Abstract

β-delayed neutrons can occur in neutron-rich nuclei when *β*-decay can populate high-lying states above the neutron separation energy in the daughter nucleus. The *β*-delayed one neutron emission probability, P_n, is an important quantity in the field of nuclear physics, astrophysics, and nuclear reactor physics. From our information on atomic masses there should be over 600 nuclei where *β*-delayed neutron emission. However, there are just over two hundred nuclei with measured P_n values. More accurate P_n values can provide to describe the nuclear structure of neutron-rich nuclei, nuclear waste and optimization of nuclear reactors. On the other hand, many applications on nuclear data by using different machine learning methods have been employed successfully during last two decades. In this study, we present an effective usage of machine learning methods such as Random Forest (RF), Extreme Gradient boosting (XGBoost), Cubist model, and Multivariate Adaptive Regression Splines (MARS) to estimate the *β*-delayed one neutron emission probability. For this purpose, we have used experimental data of *β*-decay half-lives, one&two neutron emission *Q* values, proton&neutron numbers of precursor nuclei as effective parameters on the *β*-delayed one neutron emission probability for training of our models, our results show that Cubist model is quite successful for correct prediction of unknown P_n values.

Keywords *— Beta Delayed Neutrons, Machine Learning, Artificial Intelligence.*

Investigation of Production Cross-Sections of ^{73}Se Radioisotope Via Proton Inducated Reaction Channels

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Abstract

Today, many radioisotopes are used for diagnosis and treatment in nuclear medicine. In line with the development of technology and the increasing need, studies on radioisotopes that are used and have the potential to be used in this field are still up to date. In this study, possible production mechanisms of ^{73}Se radio isotope, which can be used in positron emission tomography (PET), were investigated. Within the framework of the TALYS nuclear reaction calculation code, generation cross sections, reaction efficiencies and total activation values up to 60 MeV beam energy values were calculated and their compatibility with the data in the literature was examined.

Keywords — Selenium-73, Proton Induced Reactions, Cross-Section, Reaction Yield.

Quality Control of Radiation Dose Estimation by Using Treatment Plans on 3d Phantom

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Abstract

Nowadays, CyberKnife® radiosurgery systems are commonly used in treatment plan. Herein, we have investigated this application by comparing the irradiation of all metastases at once and the protocols of irradiation of metastases separately in multiple brain metastases. We have used new 3d head phantom; multiple brain metastases were determined over the spaces where the luminescence (OSL) dosimeters with BeO were placed. Computed tomography (CT) images of the head phantom were taken, tumors and 3 critical organs were drawn (contouring) on the image. In the treatment planning system, the dose was written, and irradiation plans were created to be done separately with a single irradiation. Dosimeters were removed from the phantom after each irradiation and the count value obtained from the dosimeter reader device was recorded. For quality control, homogeneity index (HI), conformity index (CI), new conformity index (nCI), duration of treatment, and gradient index (GI) values of irradiation at one time and separately were investigated. We have reported that irradiation of tumors with a separate treatment plan was more advantageous by means of CI, nCI, HI, and coverage values. As a conclusion, a single plan was more reliable in terms of gradient index and duration.

Keywords — *3d Phantom, Brain Tumors, Dose Estimation, BeO Dosimetry.*

U1F Transition Properties for K-44 Isotope by pn-QRPA

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Abstract

The aim of this work to present a analysis of the $2^- \rightarrow 0^+$ β-transition from K-44. The ground states of K-44 ($J^\pi = 2^-$) populate the ground states of Ca-44 with $J^\pi = 0^-$, through unique first forbidden β decay with logft = 9.474 ± 0.005 and 9.61 ± 0.68, respectively [1]. The theoretical basis consists of the proton-neutron half-particle random phase approximation (pn-QRPA) in the particle hole (ph) channel. Transition probabilities based on Woods-Saxon potential were calculated. As a result of the calculations, the unique first forbidden B-decay log*ft* values were found to be in better agreement with the experimental data.

Keywords — *U1F Transition, pn-QRPA, Woods-Saxon Potential.*

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Gamow-Teller Transition Properties for Tc-100 Isotope by Pyatov Method

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Abstract

Nuclear beta decay includes properties of the weak, strong, and electromagnetic forces and has provided more information about these fundamental building blocks of the nucleus than any other nuclear process [1]. Due to the L orbital angular momentum carried by the beta (β) particle and the neutrino, β decay is classified as allowed (L=0), first forbidden (L=1). The selection rules for allowable beta decay are total angular momentum change, ±1 and no parity change between initial (decaying) and final (populated) states [2]. The Gamow-Teller (GT) transition is one of the nuclear weak processes of the spin-isospin ($\sigma\tau$) type. Spin-isospin excitations in nuclei, especially Gamow-Teller (GT) excitations, are important for the investigation of nuclear structure [3]. Gamow–Teller transitions are important in many astrophysical processes: they govern, for example, electron capture during the core collapse of supernovae [4]. The β^- logft value of ^{100}Tc to the ground state of Ru-100 is known from the half-life and decay branch to the ground state [5]. In this study, Gamow-Teller transition properties of Tc-100 nuclei were investigated by Pyatov method within the scope of proton-neutron Quasiparticle Random Phase Approximation (pn-QRPA) formalism. Our calculations were based on the Woods-Saxon (WS) potential. The obtained log*ft* value was compared with the data in the literature and discussed.

Keywords — Beta Decay, Gamow-Teller Transition, pn-QRPA, Pyatov Method, Woods-Saxon Potential.

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Simulation of Air Pollutant Dispersion Around Afşin Elbistan-A Thermal Power Plant, Türkiye Using Gaussian Plume Model In *Freemat*

Yusof-den Jamasali[1,2*], Şeref Turhan[2], Aybaba Hançerlioğulları[2] and Aslı Kurnaz[2]

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Abstract

This study focuses on the simulation of air pollutant dispersion around Afşin Elbistan – A Thermal Power Plant (AEATPP), one of the largest power plants in Türkiye. The dispersion of air pollutants was simulated in Freemat software using the Gaussian Plume Model. The model input data included effective stack height, mass rate of emission of the pollutant, wind speed and direction, and atmospheric stability. The simulations were performed for different meteorological conditions and emission scenarios. The results showed that the highest concentration of pollutants occurred in the direction of prevailing winds. The study also examined the impact of the power plant on the surrounding environment and evaluated the effectiveness of potential mitigation strategies. Overall, the study provides valuable insights into the air quality impact of the AEATPP and can inform future policy decisions aimed at reducing emissions and improving air quality in the region.

Keywords — *Air Pollutants, Thermal Power Plant, Simulation, Gaussian Plume Model, Freemat.*

Radiological Assessment of Seyitömer Thermal Power Plant in Kütahya, Türkiye using RESRAD-ONSITE Code 7.2

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Abstract

The total dose rate of the contaminated Seyitömer Thermal Power Plant (STPP) site has been assessed using the RESRAD-onsite 7.2 code. The risk analysis simulation span over 1.0×10^3 years considering three cover scenarios of the contaminated site. The maximum total dose at STPP due to the ^{226}Ra, ^{232}Th, and ^{40}K radionuclides and their progenies is 1.435, 1.436, and 0.566 mSv y^{-1} at t = 1000 y for 0.5-m, 1.0-m and 2.0-m cover scenarios, respectively. Results also revealed that the total doses are less in thicker cover scenarios. Cancer risk data revealed that ^{232}Th is the major contributor to the risk in the scenarios considered. And external pathway is its major pathway contributor.

Keywords — *RESRAD Code, Radiation Dose, Activity Concentration, Excess Cancer Risk.*

AI-Based Early Identification of an Accident and Profiling Utilizing Driver Dependent Vehicle Driving Features: A Scheme for Critical Infrastructure Protection

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Abstract

Accident prediction is one of the most critical aspects of the modern intelligent transportation system for road safety. An accident is predicted before it happening and precautionary measures to be taken for its avoidance. Accident prediction methods' analysis is also popular for critical infrastructure protection. Recently, the Deep Learning (DL) techniques coupled with the classical Artificial intelligence (AI) methods have produced promising results in various domains. These methods have been used in many real-world applications for road safety and accident prediction, significantly when input data and outcome may change with different situations in diverse environments. This work presents a DL and AI-based system for the Light Transport Vehicles (LTVs) that generate early warnings before an anticipated accident. These warnings enable to avoid critical traffic accidents. The proposed system collects and learns various driver's LTV driving style patterns and afterward applies DL to classify the driver in one of the predefined classes. The proposed system consists of a custom-built driving simulator integrated with a computer that will provide the real-life driving experience for data recording. The miniature hardware simulator mimics an LTV consisting of a steering wheel, clutch, brake accelerator, gear assembly, and indicators. The recorded data is used to train the DL classifier. The proposed system can be used in modern LTVs to generate early warnings for drivers.

A Blockchain Based to Intrusion Detection System in Software-Defined Networking

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Abstract

The Internet of Things (I) is a large and intelligent communication network. The volume of traffic on the Internet of Things network is very high, and an intelligent switching network is needed to establish communication. Software-oriented network is a practical technology for switching data on the Internet of Things network. In the software-based network, the controllers are responsible for programming the network switches. One of the applications of software-based networking is the analysis of network traffic in connected switches. Each switch in the software-based network can also play the role of an intrusion detection system and analyze network traffic. The challenge of software-based network intrusion detection systems is to use all characteristics of network traffic to detect anomalies in network traffic.

Keywords — Intrusion Detection System, Internet of Things, Feature Selection, Artificial Neural Network.

An Approach to Alzheimer Disease Classification Based on The Artificial Neural Network

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Abstract

Alzheimer's disease is one of the most dangerous diseases in the world that killed many people. The first symptoms of the disease are memory loss, comprehension, and functional difficulties. Alzheimer's patients lose the ability to do the simplest human behavior correctly. In this paper for Alzheimer's disease diagnosis, we used artificial neural networks. Artificial neural networks have been shown to be quite successful in extracting common shapes in medical imaging. These networks can be used to detect Alzheimer's symptoms in the brain early with MRI images. In this study, MR! It is recommended to apply the backpropagation algorithm in brain imaging.

Keywords — *ANN, Classification, Alzheimer, MLP.*

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