



February 07–08, 2026 / Istanbul, Türkiye
Istanbul Beykent University, Taksim Campus

2nd INTERNATIONAL CONGRESS ON NATURAL SCIENCES AND APPLIED MATHEMATICS

ABSTRACTS BOOK

EDITORS

Prof. Dr. Bahaddin SİNSOYSAL
Assoc. Prof. Dr. Ethem İlhan ŞAHİN

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CONGRESS ID

TITLE OF CONGRESS

2nd INTERNATIONAL CONGRESS ON NATURAL SCIENCES AND APPLIED
MATHEMATICS

PARTICIPATION

Keynote & Invited

DATE - PLACE

February 07-08, 2026

Istanbul Beykent University,
Taksim Campus, Cihangir Sıraselviler Street, No: 65, 34433, Taksim-
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Istanbul Beykent University, Istanbul, Türkiye

&

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TOTAL ACCEPTED ARTICLE: 190

The number of accepted article from foreign countries: **99**

The number of accepted article from Türkiye: **91**

Number of rejected papers: **42**

LANGUAGES

Turkish, English

PRESENTATION

Hybrid

Congress Topics

1. Smart Materials and Applications

Smart Materials

Functional Graded Materials

Nanomaterials and Nanomanufacturing

Shape Memory Alloys and Polymers

Smart Material Systems Using Biomimetics and Bioinspiration

Design and Characterization of New Materials

Fundamentals of Smart Materials

Application of Smart Materials

Micro and Nano Systems

Smart Optical Materials for Modification of Spectral Shifts and Refractive Index Shifts

Application to Automation and Robotic Systems Using Smart Material Systems

Intelligent Material Systems Using Biomimetics and Bioinspiration

Intelligent Optical Materials for Modification in Spectral Shifts Refractive Index Shifts

Nanofabrication, Nanometrology and Applications

Smart Materials and Intelligent Manufacturing Processes

2. Materials and Manufacturing Technologies

Casting and Solidification

Innovative Composite Materials

Micro and Nano Manufacturing

Fiber and Paper Technology

Metallurgy and Materials

Abrasion

Processing

Lubrication Mechanisms

Semiconductor Material Manufacturing

Powder Metallurgy and Ceramic Forming

Machine Tools Technology

Precision Mold Processes

Manufacturing Tribology

Surface Tribology

Superconductors

Unconventional Material Removal Operations

Design and Characterization of New Material Systems (Polymers, Alloys and Composites)
to Improve Sustainability and Flexibility

Phase Boundaries and Boundary Layers

Coatings and Surface Engineering

Electro and Magnetorheological Materials

Fiber and Paper Technology

Functional Grade Materials

Laser Technology and Applications

Material Applications

Material Behavior
Material Characterization
Material Consolidation
Material Forming
Material Recycling and Other Related Topics
Merging Processes
Metrology and Measurement
Microstructural Characterization
Surface, Underground and Interface Events
Trends and Developments in Composite Materials
Tribology of Machine Elements
Wear

3. Production Technologies

Advanced Production Technology
Additive Manufacturing
Laser Based Manufacturing
Non-Traditional Production
Concurrent Engineering
Modeling, Analysis and Simulation of Manufacturing Processes
Material Handling and Product Manufacturing
Lean Production
Application of Evolutionary Computing Techniques in Manufacturing Processes
Medium and Micro Production Equipment and Processes
Midsize and Micro Manufacturing Equipment and Processes
Computer Integrated Manufacturing Systems
Laminated Manufacturing
On-site Monitoring of Production Processes
Processing and Forming Technology
Product and Processing Technology
Rapid Production Technologies
Additive and Hybrid Manufacturing Processes
Unconventional Production

4. Engineering Disciplines

Electrical and Electronics Engineering
Electronics and Communication Engineering
Mechanical Engineering
Industrial Engineering
Geological Engineering
Environmental Engineering
Chemical Engineering
Computer Engineering
Bioengineering
Petroleum Engineering
Geophysical Engineering
Marine and Ship Engineering
Material Science and Engineering
Mathematical Engineering
Mining Engineering
Molecular and Genetics
Naval Engineering

Interface Events
Failure Analysis
Forest Industry Engineering
Nuclear Engineering
Mechatronics Engineering
Biosystems Engineering
Aerospace Engineering
Geotechnical Engineering
Map Engineering
Food Engineering
Physics Engineering
Precision Engineering, Inspection, Measurement and Metrology
Value Engineering
Atmospheric and Meteorological Engineering
Other Engineering Branches

5. Technology and Innovation

R&D Management
Technology Trade and International Marketing
Technology Transfer
Technology and Product Development
Technology Management and Innovation
Patent and Trademark Management
Smart Manufacturing
Smart Systems

6. Environment and Sustainability

Environment and Waste Management
Sustainable Manufacturing Processes and Systems
Sustainability and Green Production
Material-Environment Interactions and Conservation

7. Robotics and Automation Technologies

Robotics, Mechatronics and Manufacturing Automation
Actuators and Controllers
Sensors and Smart Material Systems
Applications of Artificial Intelligence and Machine Learning to Materials Design and Manufacturing Processes

8. Developing Technologies

Energy Storage Materials
Renewable Energy Technologies
Electric Vehicle Technologies and Charging Infrastructure Applications
Energy Systems Analysis and Modeling
Electric Power Systems and Smart Grids

9. Engineering Management

Management Engineering
Industrial Design
Quality Management Systems
Logistics and Supply Chain
Maintenance Management and Applications

Competition and Strategy Implementation
Decision Making and Operations
Design and Product Cost
Engineering and Economics Management
Product Development and Software
Production and Planning
Total Quality Management

10. Textiles and Materials

Textile Sciences Engineering
Textile Manufacturing Machinery
Textile Materials
Textile Technology

11. Analysis and Design

Computer Aided Design, Manufacturing and Engineering
Machining and Forming Technology
Modeling and Performance
Mathematical Applications in Engineering
Manufacturing and Design

12. Inspection and Quality Control

Destructive and Non-Destructive Testing
Advanced Destructive and Non-Destructive Testing Techniques of Materials and Products
Statistical Quality Control

13. Architecture and Construction Technologies

Architectural Design and Construction
Interior Architecture and Environmental Design
Structural Design and Building Materials
Urban Fixtures and Furnitures
Civil Engineering and Building Design
Earthquake Engineering
Hydraulic and Fluid Mechanics
Water Resources Management and Hydrology
Transportation and Infrastructure Systems
Geotechnics and Soil Mechanics
Project and Construction Management

14. Biomedical and Health Technologies

Biomedical Production
Medical Devices Design and Production
Health Technologies and Services

15. Production and Operations Management

Modeling and Simulation of Manufacturing Processes
Quality Management and Control
Occupational Health and Safety
Machining and Forming Technology
Ergonomics
Production Planning, Optimization and Simulation

Production Process Planning and Scheduling

16. Emerging Technologies

Nanotechnology and Nanomaterials

Electroactive Polymers

Electrochromic Materials

Self-Healing and Multifunctional Materials

Electro and Magnetostrictive Materials

Internet of Things (IoT) and Industry Applications

Artificial Intelligence and Deep Learning

Electric Vehicle Technologies and Charging Infrastructure Applications

Digital Signal Processing and Communication Systems

17. Applied Mathematics

Mathematical Applications in Engineering

Stochastic Processes

Differential Equations

Numerical Analysis

Optimization Problems

Statistical Analysis and Data Science

Mathematical modeling

Financial Mathematics

Computational Mathematics

Probability Theory

Kongre Konuları

1. Akıllı Malzemeler ve Uygulamaları

Akıllı Malzemeler

Fonksiyonel Dereceli Malzemeler

Nanomalzemeler ve Nanoüretim

Yarı İletken Malzeme İmalatı

Şekil Hafızalı Alaşımlar ve Polimerler

Biyomimetik ve Biyoilham Kullanan Akıllı Malzeme Sistemleri

Yeni Malzemelerin Tasarımı ve Karakterizasyonu

Akıllı Malzemelerin Temelleri

Akıllı Malzemelerin Uygulaması

Mikro ve Nano Sistemler

Spektral Kaymalarda ve Kırılma İndisi Kaymalarında Modifikasyon için Akıllı Optik Malzemeler

2. Malzeme ve İmalat Teknolojileri

Döküm ve Katılaştırma

Yenilikçi Kompozit Malzemeler

Mikro ve Nano İmalat

Lif ve Kâğıt Teknolojisi

Metalurji ve Malzeme

Aşınma

İşleme

Yağlama Mekanizmaları

Yarı İletken Malzeme İmalatı

Toz Metalurjisi ve Seramik Şekillendirme

Takım Tezgâhları Teknolojisi
Hassas Kalıp İşlemleri
İmalat Tribolojisi
Yüzey Tribolojisi
Süper İletkenler
Geleneksel Olmayan Malzeme Kaldırma İşlemi
Sürdürülebilirliği ve Esnekliği Artırmak için Yeni Malzeme Sistemlerinin (Polimerler, Alaşımlar ve Kompozitler) Tasarımı ve Karakterizasyonu
Faz sınırları ve sınır katmanları
Kaplamar ve Yüzey Mühendisliği

3. Üretim Teknolojileri
Gelişmiş Üretim Teknolojisi
Katmanlı Üretim
Lazer Tabanlı İmalat
Geleneksel Olmayan Üretim
Eş Zamanlı Mühendislik
Üretim Süreçlerinin Modellenmesi, Analizi ve Simülasyonu
Malzeme İşleme ve Ürün İmalatı
Yalın Üretim
Evrimsel Hesaplama Tekniklerinin İmalat İşlemlerinde Uygulanması
Orta Ölçekli ve Mikro Üretim Ekipmanları ve Süreçleri

4. Mühendislik Disiplinleri
Elektrik ve Elektronik Mühendisliği
Elektronik ve Haberleşme Mühendisliği
Makine Mühendisliği
Endüstri Mühendisliği
Jeoloji Mühendisliği
Çevre Mühendisliği
Kimya Mühendisliği
Biyomühendislik
Petrol Mühendisliği
Jeofizik Mühendisliği
Denizcilik ve Gemi Mühendisliği
Arayüz Olayları
Başarısızlık Analizi
Orman Endüstri Mühendisliği
Nükleer Mühendisliği
Mekatronik Mühendisliği
Biyosistem Mühendisliği
Havacılık ve Uzay Mühendisliği
Geoteknik Mühendisliği
Harita Mühendisliği
Gıda Mühendisliği
Fizik Mühendisliği
Değer Mühendisliği
Atmosfer ve Meteoroloji Mühendisliği
Diğer Mühendislik Dalları

5. Teknoloji ve İnovasyon
AR-GE Yönetimi

Teknoloji Ticareti ve Uluslararası Pazarlama
Teknoloji Transferi
Teknoloji ve Ürün Geliştirme
Teknoloji Yönetimi ve İnovasyon
İnovatif Kompozitler
Patent ve Marka Yönetimi

6. Çevre ve Sürdürülebilirlik
Çevre ve Atık Yönetimi
Sürdürülebilir Üretim Süreçleri ve Sistemleri
Sürdürülebilirlik ve Yeşil Üretim
Malzeme-Çevre Etkileşimleri ve Koruma

7. Robotik ve Otomasyon Teknolojileri
Robotik, Mekatronik ve İmalat Otomasyonu
Aktüatörler ve Kontrolörler
Sensörler ve Akıllı Malzeme Sistemleri
Yapay Zekâ ve Makine Öğreniminin Malzeme Tasarımı ve Üretim Süreçlerine Uygulamaları

8. Enerji Teknolojileri
Enerji Depolama Malzemeleri
Yenilenebilir Enerji Teknolojileri
Elektrikli Araç Teknolojileri ve Şarj Altyapı Uygulamaları
Enerji Sistemleri Analizi ve Modellemesi
Elektrik Güç Sistemleri ve Akıllı Şebekeler

9. Mühendislik Yönetimi
İşletme Mühendisliği
Endüstriyel Tasarım
Kalite Yönetim Sistemleri
Lojistik ve Tedarik Zinciri
Bakım Yönetimi ve Uygulamaları
Rekabet ve Strateji Uygulamaları
Karar Verme ve Yöneylem

10. Tekstil ve Malzeme
Tekstil Bilimleri Mühendisliği
Tekstil İmalat Makineleri
Tekstil Malzemeleri
Tekstil Teknolojisi

11. Analiz ve Tasarım
Bilgisayar Destekli Tasarım, İmalat ve Mühendislik
İşleme ve Şekillendirme Teknolojisi
Modelleme ve Performans
Mühendislikte Matematiksel Uygulamalar
İmalat ve Tasarım

12. Muayene ve Kalite Kontrol
Tahribatlı ve Tahribatsız Muayene
Malzeme ve Ürünlerin Gelişmiş Tahribatlı ve Tahribatsız Muayene Teknikleri

İstatiksel Kalite Kontrol

13. Mimarlık ve Yapı Teknolojileri

Mimari Tasarım ve Uygulama
İç Mimarlık ve Çevre Tasarımı
Strüktürel Tasarım
Yapı Malzemeleri
Kentsel Aksesuarlar ve Mobilyalar
İnşaat Mühendisliği
Deprem Mühendisliği
Hidrolik ve Akışkanlar Mekaniği
Su Kaynakları Yönetimi ve Hidroloji
Ulaştırma ve Altyapı Sistemleri
Geoteknik ve Zemin Mekaniği
Proje ve İnşaat Yönetimi

14. Biyomedikal ve Sağlık Teknolojileri

Biyomedikal Üretim
Tıbbi Cihazlar Tasarımı ve Üretimi
Sağlık Teknolojileri ve Hizmetleri

15. Üretim ve Operasyon Yönetimi

İmalat Süreçlerinin Modellenmesi ve Simülasyonu
Kalite Yönetimi ve Kontrol
İş Güvenliği ve Çalışan Sağlığı
İşleme ve Şekillendirme Teknolojisi
Ergonomi
Üretim Planlama, Optimizasyon ve Simülasyon
Üretim Süreci Planlama ve Çizelgeleme

16. Gelişen Teknolojiler

Nanoteknoloji ve Nanomalzemeler
Elektroaktif Polimerler
Elektrokromik Malzemeler
Kendi Kendini İyileştiren ve Çok İşlevli Malzemeler
Elektro ve Manyetostriktif Malzemeler
Nesnelerin İnterneti (IoT) ve Endüstri Uygulamaları
Yapay Zekâ ve Derin Öğrenme
Elektrikli Araç Teknolojileri ve Şarj Altyapı Uygulamaları
Dijital Sinyal İşleme ve İletişim Sistemleri

17. Uygulamalı Matematik

Mühendislikte Matematiksel Uygulamalar
Stokastik Süreçler
Diferansiyel Denklemler
Sayısal Analiz
Optimizasyon Problemleri
İstatistiksel Analiz ve Veri Bilimi
Matematiksel modelleme
Finansal Matematik
Hesaplamalı Matematik
Olasılık Teorisi

PHOTO GALLERY



































Observer hall-1

Battery Cooling Methods

Cooling Methods

Passive

Active

Hybrid

PCM

$D = 18 \text{ mm}$
 $h = 65 \text{ mm}$
Insulated surface ($q = 0$)

Temperature/°C

Time/s

PCM Unit1
PCM Unit2

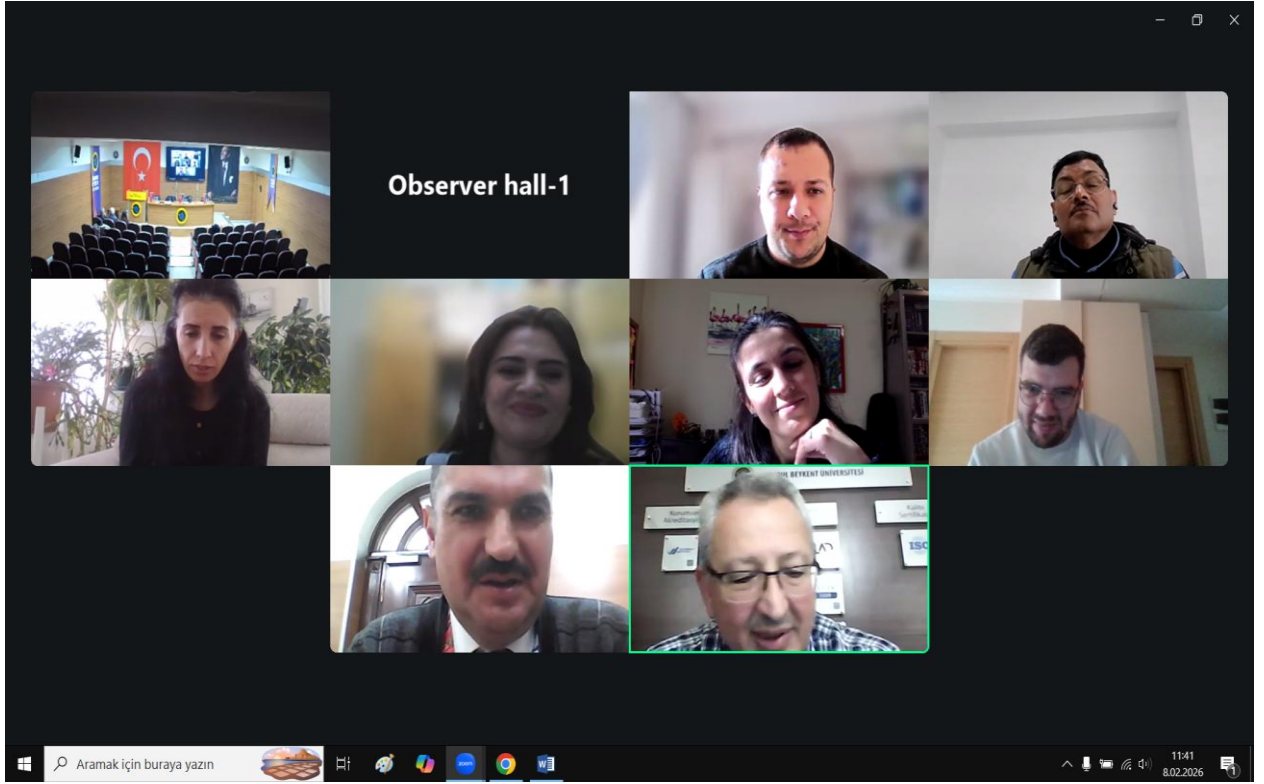
$T_{max} (K)$
 $\Delta T_{max} (K)$
Time/s

Fig. Surface temperature with/out PCM (Alma'asfa et al., 2025)

Fig. Temperature difference with PCM (Wang et al., 2021)



Aramak için buraya yazın

1555
8.02.2026



zoom Workplace Toplantı HALL-3, SESSION-1 jule Eriç Hor... Giriş yapın Kayıt Görüntüle

general observe... HALL-3, Mustafa Cemil... HALL-3, SESSION-1 jule E... HALL-3, kübra göleli... Fatih Kutlu (H3-ST1) HALL-3, kübra.degerli



Rethinking Intrauterine Device Design for Effective Prevention of Intrauterine Adhesions

DR JULE ERIÇ HORASANLI

Necmettin Erbakan University, Faculty of Medicine, Department of Obstetrics and Gynecology, KONYA, TURKEY

Ses Video Katılımcılar Sohbet Tepki ver Paylaş Toplantı bilgileri Dokümanlar Ara odalar Daha fazla

Diagnosis of Intrauterine Adhesions (IUA)

The evaluation of intrauterine adhesions (IUA) involves the use of various imaging techniques, with or without intracavitary contrast, as well as hysteroscopy for direct visualization.

Ultrasonography, particularly three-dimensional ultrasonography, enhances detection capabilities by providing more detailed information about the presence, extent, location, and density of adhesions.

Hysterosonography and **hysterosalpingography** are effective in demonstrating the presence and location of adhesions in the uterine cavity, although they do not provide information about the density of fibrous tissue.

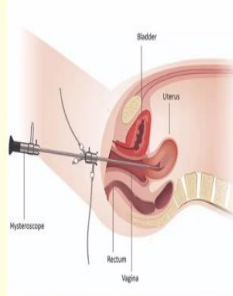
Magnetic resonance imaging (MRI) may suggest the presence of adhesions but lacks the ability to definitively locate and determine their density.

Hysteroscopy remains the definitive diagnostic method, allowing for direct visualization of the uterine cavity and detailed evaluation, including the extent, location, and density of adhesions.



Indication for hysteroscopy?

- Uterine anomaly
- Recurrent implantation failure
- Recurrent pregnancy loss
- Intracavitary lesions-Adhesions, Polyp



Hysteroscopy also provides a "see and treat" approach to intrauterine adhesions, making it possible to diagnose and remove adhesions in the same procedure.



zoom Workplace Toplantı - HALL 7 Giriş

general observe... Observer Hall-7 sevdaozdemir

general observer H8-S3 Observer Hall-7 sevdaozdemir Davood Ahmadian IKSAD Global

Davood Ahmadian

Ses Video Katılımcılar Sohbet Tepki ver Paylaş Toplantı bilgileri Dokümanlar Yardım iste Daha fazla Ayır

Workplace Toplantı Observer Hall-7 adlı kişinin ekranı

Emotional_Dynamics_Investment... X

C:/Users/Neslihan/Downloads/Emotional_Dynamics_Investment_Behavior.pdf

BEYOND THE RATIONAL ACTOR

THE OLD PARADIGM

STATIC NOISE
Homo Economicus
Emotion as Error

THE PARADIGM SHIFT

DYNAMIC DRIVERS
Homo Sapiens
Emotion as Process

Ses Video Katılımcılar Sohbet Tepki ver Paylaş Toplantı bilgileri Dokümanlar Yardım İste Daha fazla

Emotional_Dynamics_Investment... X

C:/Users/Neslihan/Downloads/Emotional_Dynamics_Investment_Behavior.pdf

THE ENGINE: LATENT AFFECTIVE POTENTIALS

$$dX_t = \theta(\mu - X_t)dt + \sigma dW_t$$

THE ELASTICITY
(Homeostasis Speed)
Inter Regular/Medium is The elasticity, the on Elasticity (Homeostasis Speed)

THE BASELINE
(Resting State)
Inter Regular/Medium mean-reverting force tra collecting the range of movement.

THE VOLATILITY
(Reactivity to Shock)
Inter Regular/Medium mean-reverting force and the function tioxen the range of movement.

general observe...
general observer H8-S3
Observer Hall-7
Observer Hall-7
sevdaozdemir
sevdaozdemir

Observer Hall-6

Hall-6, Furkan Terzi

Observer Hall-6

Hall 6 - Iulia STEPAN

Hall-6, Abdeladim Khriiss

Hall-6, Ceren Öçal Dirican

Hall-6, Aslam Khan

Hall 6-S1-Mohamed EL MORSY

Hall 6 - Zeynep Altan

Vedat Zeki Yenien

Hall 6 Session 1 Gökçen Bayram

Salon-6, Seda B...

3 atanmamış katılımcı

Hall-6, Shaymaa Farooq Tayeb Alsaadawi

Ses Video Katılımcılar Sohbet Tepki ver Paylaş Uygulamalar Ara odalar Kaydı duraklat/durdur Beyaz Tahtalar Dokümanlar Daha fazla Odadan çık

10:46 8.02.2026

zoom Workplace Toplantı - HALL 6 Giriş yapın Kaydediliyor... Görüntüle

Observer Hall-6

Jihane hilali hall 6

Observer Hall-6

Hall-6, Shaymaa Farooq Tayeb Alsaadawi

ROCHOI DABE

Kshitz Kandel, Hall 6

H-6 Granthali P. Shape

Ses Video Katılımcılar Sohbet Tepki ver Paylaş Uygulamalar Ara odalar Kaydı duraklat/durdur Beyaz Tahtalar Dokümanlar Daha fazla Odadan çık

12:47 8.02.2026

zoom
Workplace

Toplantı - HALL 6

Giriş yapın Kaydediliyor... Görüntüle

Observer Hall-6

Hall 6-SAMAR MAHMOUD-Session3

Observer Hall-6

Kshitz Kandel_SessionChair_Hall6

Hall-6 Shaymaa farooq taye Alsaadawi

Hall-6 alpaslankarabacak

Hall - 6 | Ahmet...

Ses Video Katılımcılar Sohbet Tepki ver Paylaş Uygulamalar Ara odalar Kaydı duraklat/durdur Beyaz Tahtalar Dokümanlar Daha fazla Odadan çık

Ara

15:01
8.02.2026

Observer hall-1

Hall-1, Amira S...

Gözde Narin

HALL-1-FD

H-1 Ahmed Att...

HALL1-SESSION 2

Aramak için buraya yazın

12:43
8.02.2026

Observer hall-1

H-1 Ahmed Att...

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Outline Slides

Varsayalım Bölüm

1. DETERMINATION OF THE CONCENTRATIONS OF HARMFUL HEAVY METALS, PAHs, AND VOCs IN THE VAPORS OF DIFFERENT TYPES OF ASPHALT AT DIFFERENT TEMPERATURES IN THE AIR
FARKLI ASFALT TÜRLERİNİN BUHARLARINDAKİ ZARARLI AĞIR METAL, PAH VE VOC'LERİN FARKLI SICAKLIKLARDA, HAVADA ULAŞIKLARI YOĞUNLUKLARININ BELİRLENMESİ

2. [Graph showing data trends]

3. [Graph showing data trends]

Click to add notes

Slide 1 / 25 Ofis Teması

73%

12:55 8.02.2026

Aramak için buraya yazın

Observer hall-1

Hall 1-52-Burcu Kılıç Çetiner

1305 8.02.2026

Aramak için buraya yazın

Observer hall-1

Kavun-Çekirdeği-Çayının-Ultrason-Destekli-ve-Geleneksel-Demleme-Yöntemleriyle-Karşılaştırmalı-Analiz (1) - Microsoft PowerPoint (Ürün Etkinleştirilmedi)

EndNote 21

Geçerli Çözünürlüğü K...
Gösterileceği Monitör:
Sunucu Görünümünü Göster
Monitörler

1 2 3 4 5

1. Kavun Çekirdeği Çayının Ultrason Destekli ve Geleneksel Demleme Yöntemleriyle Karşılaştırmalı Analizi

2. Fenolik İçerik ve Antioksidan Aktivite Üzerine Kapsamlı Bir Araştırma

3. YEŞİL EKSTRAKSYON 4. FENOLİK İÇERİKLER

Merhaba, hoş geldiniz.

Slayt 1 / 9 "Office Theme" Türkiye

Aramak için buraya yazın

13:17 8.02.2026

Observer hall-1

2nd INTERNATIONAL CONGRESS
ON NATURAL SCIENCES AND
APPLIED MATHEMATICS
February 07-08, 2026 / Istanbul Beykent University, Istanbul, Türkiye

Microstructure and Hardness Changes of Al-40Zn-3Cu Bearing Alloys with Sn Addition

Sn İlaveli Al-40Zn-3Cu Yatak Alaşımlarının Mikro Yapı ve Sertlik Değişimi

Dr. Öğr. Üyesi Mustafa KOÇ
Dr. Öğr. Üyesi Bekir YAVUZER

Aramak için buraya yazın

15:38 8.02.2026

Observer hall-1

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Game Bar
Sistem
Google Chrome

Üretkenlik
Fotoğraflar
Keşfet
Microsoft Store
Oynat/Vürüt
Geri Dönüşüm Kütüsü

NOVEL COOPERATIVE ALGORITHM FOR UNMANNED AERIAL VEHICLE SWARMS TO SEARCH UNKNOWN ENVIRONMENTS WITH CONSIDERING THE ENERGY CONSUMPTION

Asst. Prof. Mert Sinan TURGUT
Assoc. Prof. Oğuz Emrah TURGUT

Aramak için buraya yazın

1526
8.02.2026

Observer hall-1

Dashboard | Prezi
Green Production of Cobalt Oxide
Giriş - Zoom

prezi.com/p/9r1z2j9agb/?present=1

Green Production of Cobalt Oxide Nanoparticles via Plant-Extract-Assisted Synthesis

İSTANBUL BEYKENT ÜNİVERSİTESİ
MathSci
MARMARA ÜNİVERSİTESİ

Green Production of Cobalt Oxide Nanoparticles via Plant-Extract-Assisted Synthesis

Mehmet Cagan Ogunlar, Yakup Mahmutoglu, Yusuf Benk Turan, Gulay Arslan Cene, Ridvan Yildirim, Burcu Nilgun Cetiner, Gokcen Bayram

Aramak için buraya yazın

1305
8.02.2026

2nd INTERNATIONAL CONGRESS ON NATURAL SCIENCES AND APPLIED MATHEMATICS

February 07-08, 2026 / Istanbul Beykent University, Istanbul, Türkiye



CONGRESS PROGRAM

Istanbul Beykent University

Taksim Campus, Cihangir Siraselviler Street, No: 65, 34433, Taksim-Beyoğlu, Istanbul, Türkiye

FACE TO FACE AND ONLINE PRESENTATIONS

Zoom Meeting ID: 833 1287 1999

Zoom Passcode: 080808

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Prof. Dr. Bahaddin SINSOYSAL

Dean of the Engineering Faculty, Istanbul Beykent University

KEYNOTE SPEAKERS

Saturday, February 7, 2026, between 10:00-12:00 in Adem CELIK Conference Hall, Taksim Campus

Prof. Dr. Nihan ALIYEV

(Baku State University, Faculty of Applied Mathematics and Cybernetics, Baku, Azerbaijan)

*Subject Title “**NEW TRENDS IN MATHEMATICAL RESEARCH**”*

Prof. Dr. Allaberen ASHYRALYEV

*(Bahcesehir University, Faculty of Engineering and Natural Sciences, Department of Mathematical Engineering
Istanbul, Türkiye)*

*Subject Title “**WELL-POSEDNESS OF DIFFERENCE SCHEMES FOR ELLIPTIC NBVPS**”*

Prof. Dr. Adnan MAZMANOGLU

(Toros University, Engineering Faculty, Department of Industrial Engineering, Mersin, Türkiye)

*Subject Title “**INVESTIGATION OF EFFECTIVE COMMUNICATION FACTORS BETWEEN SURVIVING
PARENTS AND THEIR CHILDREN AFTER EARTHQUAKE DISASTER: A PRINCIPAL COMPONENT FACTOR
ANALYSIS STUDY**”*

Prof. Dr. Mahir RASULOV

(Ministry of Science and Education of Azerbaijan, Institute of Oil and Gas, Baku, Azerbaijan)

*Subject Title “**THE CLASSICAL SOLUTION OF A $(6,1/12)$ -ORDER SEQUENTIAL FRACTIONAL DIFFERENTIAL
EQUATION WITH LOCAL BOUNDARY CONDITIONS**”*

FACE-TO-FACE PRESENTATIONS / 07.02.2026



ISTANBUL LOCAL TIME - 13³⁰ : 16⁰⁰



HALL-1



Istanbul Beykent University, Taksim Campus,
Cihangir Sıraselviler Street, No: 65, 34433,
Taksim-Beyoğlu, İstanbul, Türkiye

HEAD OF SESSION: Assist. Prof. Dr. Cengiz OZBEK

AUTHORS	AFFILIATION	TOPIC TITLE
Abdi KUKNER	Istanbul Beykent University (Türkiye)	A PROCESS-BASED ENERGY EFFICIENCY AND WASTE HEAT RECOVERY ASSESSMENT FOR A LARGE-SCALE AUTOMOBILE MANUFACTURING PLANT
Siddık SENER; Kadir Can SENER; Yasar AVCI; Mustafa Hulusi OZKUL	Istanbul Beykent University (Türkiye); Auburn University (USA)	TORSIONAL FRACTURE TESTING OF PLAIN AND POLYPROPYLENE REINFORCED CONCRETE BEAMS
Ahmet CIHAN; Dincer AKAL	Istanbul Beykent University (Türkiye); Trakya University (Türkiye)	ENHANCING PHOTOVOLTAIC PANEL PERFORMANCE USING A SELF-CLEANING HYDROPHILIC NANO-COATING: AN EXPERIMENTAL STUDY
Serap OZHAN DOGAN; Mucahit DEMIRCIOGLU; Ahmet CIHAN	Istanbul Beykent University (Türkiye)	A SURVEY-BASED ANALYSIS OF MATHEMATICS AND UNIT KNOWLEDGE PROFICIENCY IN ENGINEERING EDUCATION
Cengiz OZBEK; Omur Can OZGUNEY	Istanbul Beykent University (Türkiye); Istanbul University-Cerrahpasa (Türkiye)	EXPERIMENTAL DESIGN, CONTROL AND NEURAL NETWORK MODELLING OF SERVO MECHANISMS FOR UNMANNED AERIAL VEHICLES
Omur Can OZGUNEY; Cengiz OZBEK	Istanbul University-Cerrahpasa (Türkiye); Istanbul Beykent University (Türkiye)	DESIGN AND CONTROL OF AN AERO-PENDULUM MECHANISM: EXPERIMENTAL SETUP AND ARTIFICIAL NEURAL NETWORK (ANN) MODELLING

FACE-TO-FACE PRESENTATIONS / 07.02.2026



ISTANBUL LOCAL TIME - 13³⁰ : 16⁰⁰



HALL-2



Istanbul Beykent University, Taksim Campus,
Cihangir Sıraselviler Street, No: 65, 34433,
Taksim-Beyoğlu, Istanbul, Türkiye

HEAD OF SESSION: Asst. Prof. Dr. Serkan Yasar ERDINC

AUTHORS	AFFILIATION	TOPIC TITLE
Sen YUKSEL; Ayse SAT	Istanbul Beykent University (Türkiye)	ENVIRONMENTAL TRANSFORMATION ANALYSES IN THE CONTEXT OF THE GOLDEN HORN INTERVENTIONS
Sen YUKSEL; Hatice SAVAS DEMIR; Sinan YILDIZ	Istanbul Beykent University (Türkiye)	DIGITAL TRANSFORMATION INTERIOR ARCHITECTURE DESIGN EDUCATION: ACHIEVEMENTS, OUTCOMES, AND FUTURE PREDICTIONS
Urun BICER	Istanbul Beykent University (Türkiye)	THE GEOMETRY OF CHAOS: THE AESTHETICS OF TIME AND DECAY ON ARCHITECTURAL SURFACES
Gokcen ERKOYUNCU BARIS	Istanbul Beykent University (Türkiye)	ARCHITECTURE AGAINST TIME: REDEFINING FUNCTION FROM SACRED TO PUBLIC
Gizem Nur SAN	Istanbul Beykent University (Türkiye)	ISOLATION IN SEVERANCE: SPATIAL MANIPULATION OF BEHAVIOR IN THE OFFICE SPACE
Yuzyıl Nevin AYDIN	Istanbul Beykent University (Türkiye)	MEMORY OF FACADES: CERAMIC PANELS IN FLORYA
Serkan Yasar ERDINC	Istanbul Beykent University (Türkiye)	ALGORITHMIC AESTHETICS: MATHEMATICAL LOGIC BEHIND AI-DRIVEN BIO-ARCHITECTURE

FACE-TO-FACE PRESENTATIONS / 07.02.2026



ISTANBUL LOCAL TIME - 13³⁰ : 16⁰⁰



HALL-3



Istanbul Beykent University, Taksim Campus, Cihangir Sıraselviler Street, No: 65, 34433, Taksim-Beyoğlu, Istanbul, Türkiye

HEAD OF SESSION: Assoc. Prof. Dr. Mucahit AKBIYIK

AUTHORS	AFFILIATION	TOPIC TITLE
Allaberen ASHYRALYEV; Ozgur YILDIRIM	Bahcesehir University (Türkiye); Yildiz Technical University (Türkiye)	UNIFORM DIFFERENCE SCHEME AND ASYMPTOTIC FORMULAS FOR HYPERBOLIC PERTURBATION PROBLEMS
Betul OZBAY ELIBUYUK; Tofigh ALLAHVIRANLOO	Kirklareli University (Türkiye); Istinye University (Türkiye)	ON THE SOLUTION OF Z^{+-} -NUMBER VALUED FRACTIONAL DIFFUSION EQUATIONS VIA GRANULAR DIFFERENTIABILITY
Seyma Firdevs HIZAL; Tukur Abdulkadir SULAIMAN; Hasan BULUT	Firat University (Türkiye)	M-TRUNCATED OPTICAL WAVE STRUCTURES FOR NONLINEAR SCHRÖDINGER-HIROTA EQUATION
Funda TURK	Bartın University (Türkiye)	NONLINEAR WAVE PROPAGATION IN THE HAMILTONIAN AMPLITUDE EQUATION WITH GEOMETRIC INTERPRETATION
Benan SAKRUK; Nihal OZDOGAN	Bursa Technical University (Türkiye)	ON INTEGRAL TRANSFORMS AND THEIR APPLICATIONS
Mahir RASULOV; Nihan ALIYEV Garib JALALOV; Bahaddin SINSOYSAL	Ministry of Science and Education of Azerbaijan; Baku State University; Istanbul Beykent University	STEPHAN'S INVERSE PROBLEM FOR ANTI-PARABOLIC EQUATION
Nida ORUÇ ÜNAL; Dogan YILDIZ; Muzaffer GOZTAS	Istanbul Topkapi University (Türkiye); Yildiz Technical University (Türkiye)	AN ENTROPY BASED ANALYSIS OF CLASS DISTRIBUTIONS USING TSALLIS ENTROPY
Mucahit AKBIYIK; Jeta ALO; Seda YAMAC AKBIYIK	Istanbul Beykent University (Türkiye); Istanbul Topkapi University (Türkiye)	ON SPATIAL GENERALIZED OCTONIONIC CURVES AND SYMBOLIC COMPUTATIONS

FACE-TO-FACE PRESENTATIONS / 07.02.2026



ISTANBUL LOCAL TIME - 13³⁰ : 16⁰⁰



HALL-4



Istanbul Beykent University, Taksim Campus,
Cihangir Sıraselviler Street, No: 65, 34433,
Taksim-Beyoğlu, Istanbul, Türkiye

HEAD OF SESSION: Assist. Prof. Dr. Ayhan GOLCUKCU

AUTHORS	AFFILIATION	TOPIC TITLE
Yesim OK; Satuk Bugra KILIC	Ataturk University (Türkiye)	ASSESSING THE CAUSES AND CONSEQUENCES OF GLOBAL CLIMATE CHANGE USING Q-RUNG PICTURE FUZZY AHP AND MAIRCA METHODS
Fuat CANDAN	Istanbul Beykent University (Türkiye)	VIRTUALIZATION OF SYSTEMS IN INDUSTRIAL PRODUCTION WITH DIGITAL TWINS
Yildirim DURSUN; Mehmet Naci EFE	Istanbul Gedik University (Türkiye); Istanbul Beykent University (Türkiye)	THE IMPACT OF ARTIFICIAL INTELLIGENCE ON ORGANIZATIONAL COMMITMENT
Yildirim DURSUN; Kursat DURAN; Serdar ATES; Veyssel SIVRI; Atillah ELESKIRTLI; Hasret AL	Istanbul Gedik University (Türkiye); Istanbul Metropolitan Municipality (Türkiye)	THE IMPACT OF TRANSFORMATIONAL LEADERSHIP ON THE QUALITY OF LIFE OF FIREFIGHTERS
Ahmet NAYIR; Furkan SAHINOGLU; Salih Emre UNSAL	Istanbul Beykent University (Türkiye)	DESIGN OF AN ESP RAINMAKER-BASED SMART HOME SECURITY SYSTEM TO REDUCE CAREGIVER BURDEN AND MINIMIZE PROBLEM RESPONSE TIME IN ELDERLY CARE
Ayhan GOLCUKCU	Istanbul Beykent University (Türkiye)	THE RISE OF LOCAL INDEXES: A SYSTEMATIC ANALYSIS OF STUDIES FROM TÜRKİYE IN THE INTERNATIONAL INDEXES WOS & SCOPUS WITH TRDIZIN UNDER THE CONTEXT OF DEA

FACE-TO-FACE PRESENTATIONS / 07.02.2026



ISTANBUL LOCAL TIME - 13³⁰ : 16⁰⁰



HALL-5



Istanbul Beykent University, Taksim Campus,
Cihangir Sıraselviler Street, No: 65, 34433,
Taksim-Beyoğlu, İstanbul, Türkiye

HEAD OF SESSION: Dr. Evren OSMA

AUTHORS	AFFILIATION	TOPIC TITLE
Mohammad JAHANSHAHI	Azerbaijan Shahid Madani University (Iran)	FUNDAMENTALS OF MATHEMATICAL MODELLING FOR PHYSICS AND ENGINEERING PROBLEMS BASED ON HISTORICAL AND PHILOSOPHICAL CONSIDERATIONS
Sinem YILDIRIM GUVEN; Selma YILDIRIM UCAN	Nigde Omer Halisdemir University (Türkiye)	SYNTHESIS, CHARACTERIZATION AND PHOTOCATALYTIC ACTIVITY OF CU(II) COMPLEX OF SCHIFF BASE CONTAINING CHLOROACETYL CHLORIDE
Evren OSMA; Burak DURSUN	Istanbul Beykent University (Türkiye)	QUANTITATIVE ANALYSIS OF DEFENSE ARCHITECTURES IN CYBER-PHYSICAL SYSTEMS: IMPACT ASSESSMENT FROM DETECTION TO RECOVERY

ONLINE PRESENTATIONS / 08.02.2026



ISTANBUL LOCAL TIME - 10⁰⁰ : 12⁰⁰



ZOOM ID: 833 1287 1999



HALL-1, SESSION-1

ZOOM PASSCODE: 080808

HEAD OF SESSION: AYHAN GOLCUKCU

AUTHORS	AFFILIATION	TOPIC TITLE
Mahir HASANSOY	Istanbul Beykent University (Türkiye)	A COVERING APPROACH TO EIGENVALUE BOUNDS FOR THE FRACTIONAL P-LAPLACIAN
Makbule CAKIL; Sebaheddin SEVGİN	Van Yüzüncü Yıl University (Türkiye)	MATHEMATICAL MODELLING AND OPTIMAL CONTROL OF HYDATID DISEASE
Neslihan Aysen OZBAY	Cankaya University (Türkiye)	ON THE ALGEBRAIC PROPERTIES OF MATRICES OVER DUAL NUMBERS
Ali Sercan KARAKAS; Nuri Murat YAGMURLU	Inonu University (Türkiye)	ROBIN BOUNDARY-CONDITIONED COMPARISONS OF NUMERICAL RESULTS FROM HERMITE BASIS COLLOCATION FINITE ELEMENT METHODS OF DIFFERENT ORDERS
Ali Sercan KARAKAS; Nuri Murat YAGMURLU	Inonu University (Türkiye)	INVESTIGATION OF HERMITE BASIS FUNCTIONS OF DIFFERENT DEGREES UNDER NEUMANN-TYPE BOUNDARY CONDITIONS USING LEGENDRE AND CHEBYSHEV POLYNOMIAL ROOTS
Ugur Can KOCTURK	Istanbul Beykent University (Türkiye)	SOME PROBLEMS OF TRIGONOMETRIC APPROXIMATION ON HEXAGONAL DOMAINS
Aytan Natiq QULIYEVA (ZULFUQAROVA)	Baku Engineering University (Azerbaijan)	ASYMPTOTIC DYNAMICS AND GENERALIZED SOLUTIONS IN ODE-PDE BASED MODELING OF NATURAL PROCESSES
Ansar HUSAIN	University of Lucknow (India)	GENERALIZATION OF PÁL (1;0) TYPE INTERPOLATION PROCESS

ONLINE PRESENTATIONS / 08.02.2026



ISTANBUL LOCAL TIME - 10⁰⁰ : 12⁰⁰



ZOOM ID: 833 1287 1999



HALL-2, SESSION-1

ZOOM PASSCODE: 080808

HEAD OF SESSION: Nurcan GUCUYENEN KAYMAK

AUTHORS	AFFILIATION	TOPIC TITLE
Merve BULUT YILGOR	Altinbas University (Türkiye)	SKEW CYCLIC CODES OVER A NON-CHAIN RING
Hüseyin Can EZER	Ankara Yıldırım Beyazıt University (Türkiye)	A NEW SOFT CRYPTOSYSTEM BASED ON KEY-DETERMINED COLUMN PERMUTATIONS
Nurcan GUCUYENEN KAYMAK	Dogus University (Türkiye)	TAYLOR WAVELET METHOD TO NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS
Hatice KUSAK SAMANCI; Mustafa CANAN	Bitlis Eren University (Türkiye)	DIFFERENT TYPES OF QUATERNION ALGEBRA CALCULATOR
Fulya YORUK DEREN; Tugba SENLIK CERDIK; Amine Dilbeste UYSAL;	Ege University (Türkiye); Istanbul Beykent University (Türkiye)	ON THE EXISTENCE AND STABILITY OF POSITIVE SOLUTIONS FOR HADAMARD FRACTIONAL DIFFERENTIAL EQUATIONS ON THE HALF-LINE
Gozde OZYURT	Istanbul Beykent University (Türkiye)	INVESTIGATING NECTARINE MATRICES USING SPLIT-COMPLEX MATRICES
Zeeshan ASGHAR	Prince Sultan University (Saudi Arabia)	GLIDING DYNAMICS OF MICROSWIMMERS IN NON-NEWTONIAN FLUIDS
M. Varshana Deepa; K. Priyanka; S. Shapna; K. Varshitha; D. Ragavarshini; S. Dhanavanthari	RMK Engineering College (India)	APPLICATION OF TRANSFORMS IN SOLVING DIFFERENTIAL AND DIFFERENCE EQUATIONS
Sibel DOGAN; Salih DOGAN	Erzincan Binali Yıldırım University (Türkiye)	STRUCTURAL VARIATIONS IN SOME DORSAL BODY SETAE OF LEDERMUELLERIOPSIS TOLERATUS (ACARIFORMES: STIGMAEIDAE)

ONLINE PRESENTATIONS / 08.02.2026



ISTANBUL LOCAL TIME - 10⁰⁰ : 12⁰⁰



ZOOM ID: 833 1287 1999



HALL-3, SESSION-1

ZOOM PASSCODE: 080808

HEAD OF SESSION: Mustafa Cemil BISGIN

AUTHORS	AFFILIATION	TOPIC TITLE
Mustafa Cemil BISGIN	Recep Tayyip Erdoğan University (Türkiye)	COMPACTNESS PROPERTIES OF QUINTUPLE BAND MATRIX OPERATOR
Mustafa Cemil BISGIN	Recep Tayyip Erdoğan University (Türkiye)	SPECTRAL PROPERTIES OF QUADRUPLE BAND MATRIX OPERATOR DEFINED ON THE SEQUENCE SPACE cs
Kübra DEGERLI	Bahcesehir University (Türkiye)	SOLUTIONS OF FRACTIONAL DIFFERENTIAL EQUATIONS VIA THE RESIDUAL POWER SERIES METHOD
Sabiha AVSAR; Fatma KARACA	Yildiz Technical University (Türkiye)	INTERPOLATING SESQUI-HARMONIC SUBMANIFOLDS ON GENERALIZED SASAKIAN SPACE FORMS
Kubra GOLELI; Fatih KUTLU	Van Yuzuncu Yil University (Türkiye)	GRAPH ATTENTION NETWORKS WITH TOPOLOGICAL INFORMATION FOR NODE CLASSIFICATION ON CORA
Fatih KUTLU; Kubra GOLELI; Feyza OZTURKCU; Hatice ERASLAN	Van Yuzuncu Yil University (Türkiye)	BRAIN TUMOR CLASSIFICATION FROM MRI IMAGES VIA DEEP FEATURE EXTRACTION AND INTUITIONISTIC FUZZY LOGIC INTEGRATION
Sanjeev GUPTA	GLA University (India)	APPROXIMATION SOLUTION OF GENERALIZED VARIATIONAL INCLUSION
Sanjeev GUPTA	GLA University (India)	EXTENDED NONLINEAR VARIATIONAL INEQUALITIES
Jule Eric HORASANLI	Necmettin Erbakan University	RETHINKING INTRAUTERINE DEVICE DESIGN FOR EFFECTIVE PREVENTION OF INTRAUTERINE ADHESIONS

ONLINE PRESENTATIONS / 08.02.2026



ISTANBUL LOCAL TIME - 10⁰⁰ : 12⁰⁰



ZOOM ID: 833 1287 1999



HALL-4, SESSION-1

ZOOM PASSCODE: 080808

HEAD OF SESSION: Tugba YAVUZ

AUTHORS	AFFILIATION	TOPIC TITLE
Ilyasse JOUBBI; Fatima AQEL; Nour Eddine ALAA	Hassan First University (Morocco); Cadi Ayyad University (Morocco)	LEARNING-BASED SOLVERS FOR DISCRETE NONLINEAR ANISOTROPIC P-LAPLACIAN EQUATIONS
Muhammad Sajjad SHABBIR	University of Poonch Rawalakot (Pakistan)	NONLINEAR DYNAMICS AND CHAOS CONTROL IN A DISCRETE PREDATOR-PREY SYSTEM: STABILITY ANALYSIS, BIFURCATION STRUCTURE, AND NUMERICAL INVESTIGATIONS
Na ELAH, Peer Bilal AHMAD; Zehra SKINDER	Islamic University of Science and Technology (Pakistan)	GENERALIZATION OF ONE PARAMETER CONTINUOUS MODEL WITH APPLICATION IN ACCELERATED LIFE TESTING DATA
Tugba YAVUZ	Istanbul Beykent University (Türkiye)	NEW SUBFAMILIES OF MEROMORPHIC FUNCTIONS: ANALYTIC CONDITIONS AND COEFFICIENT ESTIMATES
Sadiya Baban-Mairam ABDULLAHI; Georginia C. IMO; Yusuf A. MUSTAPHA	University of Jos (Nigeria)	ASSESSMENT OF PSYCHOMETRIC PROPERTIES OF MATHEMATIC BASIC EDUCATION CERTIFICATE EXAMINATION ITEMS IN PLATEAU NORTH SENATORIAL ZONE NIGERIA
Yakwal ISTIFANUS; Clementina Hashimu BULUS	University of Jos (Nigeria)	INFLUENCE OF FORMATIVE ASSESSMENT ON STUDENTS' MATHEMATICS TEST ANXIETY AND PERFORMANCE IN JOS EAST, PLATEAU STATE, NIGERIA
Fatima L. BELOCURA	University of the Visayas (Philippines)	ASSESSING THE EFFICACY OF DIFFERENTIATED MATH INSTRUCTION TRAINING USING THE SOLOMON FOUR- GROUP DESIGN
Zhumayev ZHOLDYBAY	Yessenov University (Kazakhstan)	TRAINING OF MARINE ENGINEERS THROUGH MULTIMEDIA SIMULATOR PROGRAMS AND HUMAN CAPITAL DEVELOPMENT
Balzhan DUISEKEYEVA; Gulzhan NIYAZOVA	Khoja Akhmet Yassawi International Kazakh-Turkish University (Kazakhstan)	AN EMPIRICAL STUDY OF PERSONALIZED COMPUTER SCIENCE INSTRUCTION IN KAZAKHSTANI SECONDARY SCHOOLS

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ISTANBUL LOCAL TIME - 10⁰⁰ : 12⁰⁰



ZOOM ID: 833 1287 1999



HALL-5, SESSION-1

ZOOM PASSCODE: 080808

HEAD OF SESSION: Ayse Gulsah KUTUKCUOGLU

AUTHORS	AFFILIATION	TOPIC TITLE
Betul UNTUC	Istanbul Beykent University (Türkiye)	SIMULATION-BASED EXAMINATION OF WINDOW THERMAL INSULATION PERFORMANCE IN A RESIDENTIAL BUILDING RENEWED THROUGH URBAN TRANSFORMATION
Ayşe Gulsah KUTUKCUOĞLU	Istanbul Beykent University (Türkiye)	MATERIAL-MODEL RELATIONSHIP IN COMPLEX ARCHITECTURAL FORMS OF THE 21st CENTURY: AN EXAMINATION OF SMART MATERIALS AND EMERGING DESIGN APPROACHES
Bilge YILDIRIM GONUL	Istanbul Beykent University (Türkiye)	REPRESENTATION OF INDUSTRIAL MEMORY: HISTORIC RAILWAY WORKSHOPS IN TÜRKİYE
Natyra LOSHI; Burcu TAN	Istanbul Beykent University (Türkiye)	SUSTAINABLE PUBLIC SPACES; AN ASSESSMENT BASED ON INTERNATIONAL EXAMPLES
Mahamudur RAHMAN	University of Dhaka (Bangladesh)	ROLE AND IMPORTANCE OF ARCHITECTS IN ENHANCING LANDSCAPE DESIGN IN CITIES
Victor Hyellamoda YOHANNA; Charles Yakubu MAKUN	Federal University of Technology (Nigeria)	INTEGRATION OF NATURAL LIGHTING IN THE DESIGN OF ONCOLOGY CENTRE IN MINNA, NIGER STATE, NIGERIA
Seyma Busra GUNCU; Emine Rumeysa EREN	Istanbul Beykent University (Türkiye); Marmara University (Türkiye)	FUNCTIONAL ADAPTATION OF TEXTILE PRODUCTS IN UPCYCLING PROCESS: AN EXPERIMENTAL PRODUCTION APPLICATION

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ISTANBUL LOCAL TIME - 10⁰⁰ : 12⁰⁰



ZOOM ID: 833 1287 1999



HALL-6, SESSION-1

ZOOM PASSCODE: 080808

HEAD OF SESSION: Vedat Zeki YENEN

AUTHORS	AFFILIATION	TOPIC TITLE
Gokcen BAYRAM; Burcu Nilgün CETINER; Vedat Zeki YENEN	Istanbul Beykent University (Türkiye); Marmara University (Türkiye)	ARTIFICIAL INTELLIGENCE APPLICATIONS IN THE CIRCULAR ECONOMY: A LITERATURE REVIEW ON MATHEMATICAL APPROACHES
Furkan TERZI; Zeynep ALTAN	Istanbul Beykent University (Türkiye)	CORRECTING THE TURKISH SPELLING ERRORS ON THE BROWSER
Zeynep ALTAN	Istanbul Beykent University (Türkiye)	EXPLAINABILITY IN ARTIFICIAL INTELLIGENCE APPLICATIONS
Mohamed EL MORSY; Laila AFIA	Ibnou Zohr University (Morocco)	ARTIFICIAL INTELLIGENCE-BASED APPROACHES FOR SUSTAINABLE WASTEWATER TREATMENT
Stepan IULIA-MARIA; Hurbean LUMINITA	West University of Timisoara (Romania)	ARTIFICIAL INTELLIGENCE ADOPTION IN INFORMATION SYSTEMS IN TIMES OF TURBULENCE
Seda BULUT; Sukriye Ceren OCAL DIRICAN	Istanbul Beykent University (Türkiye)	DETECTION OF THE PRE-METASTATIC STATE AND IDENTIFICATION OF THE CRITICAL TRANSITION THRESHOLD IN BREAST CANCER BY INTEGRATING DYNAMIC NETWORK BIOMARKERS AND CFDNA FRAGMENTOMICS
R.KAMALAM ; M.DEVIBALA; S.SELVAM	NMS S.Vellaichamy Nadar College (India)	AI IN CANCER DIAGNOSIS: MACHINE LEARNING APPROACHES
Abdelaadim KHRISS; Aissa Kerkour ELMIAID; Mohammed BADAOU	Mohammed Premier University (Morocco)	OPTIMAL TRANSPORT-BASED BALANCING IN HYBRID QUANTUM-CLASSICAL NEURAL NETWORKS FOR MEDICAL DATA CLASSIFICATION
Aslam KHAN; Shahid RAHMAN	University of Buner (Pakistan)	A COMPARATIVE ANALYSIS OF FEATURE SELECTION TECHNIQUES FOR EARLY BREAST CANCER PREDICTION USING MACHINE LEARNING CLASSIFICATION MODELS

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ISTANBUL LOCAL TIME - 12³⁰ : 14³⁰



ZOOM ID: 833 1287 1999



HALL-1, SESSION-2

ZOOM PASSCODE: 080808

HEAD OF SESSION: Pelin EROGLU

AUTHORS	AFFILIATION	TOPIC TITLE
Ahmed ATTAHIRU; Bashar ATTAHIRU	Abdullahi Fodio University of Science and Technology (Nigeria); Federal College of Education (Nigeria)	CHEMICAL SCIENCES AT THE INTERSECTION OF ETHICS, POLICY, AND CULTURE
Ahmed ATTAHIRU; Bashar ATTAHIRU	Abdullahi Fodio University of Science and Technology (Nigeria); Federal College of Education (Nigeria)	CHEMISTRY, SOCIETY, AND SUSTAINABLE FUTURES
Pelin EROGLU	Mersin University (Türkiye)	DETERMINATION OF THE ANTIOXIDANT POTENTIAL OF AVOCADO SEED (PERSEA AMERICANA) SEED EXTRACTS OBTAINED BY SOXHLET EXTRACTION
Sebnem ATES; Hasan Ugur ONCEL	Istanbul Gedik University (Türkiye)	DETERMINATION OF THE CONCENTRATIONS OF HARMFUL HEAVY METALS, PAHS, AND VOCs IN THE VAPORS OF DIFFERENT TYPES OF ASPHALT AT DIFFERENT TEMPERATURES IN THE AIR
Mehmet Cagan OGUZLAR; Yakup MAHMUTOGLU; Yusuf Berk TURAN; Gulay Arslan CENE; Rıdvan YILDIRIM; Burcu Nilgun CETINER; Gokcen BAYRAM	Marmara University (Türkiye); Istanbul Beykent University (Türkiye)	GREEN PRODUCTION OF COBALT OXIDE NANOPARTICLES VIA PLANT-EXTRACT-ASSISTED SYNTHESIS
Vildan EYIZ; Ayşenur ACAR	Necmettin Erbakan University (Türkiye) Selcuk University (Türkiye)	COMPARATIVE ANALYSIS OF ULTRASOUND-ASSISTED AND CONVENTIONAL BREWING OF MELON (CUCUMIS MELO L.) SEED TEAS: PHENOLIC CONTENT AND ANTIOXIDANT ACTIVITY
Ebru Gundes DINCER; Amira SHEYKH ALI; Ceyda SIMSEK; Gozde Nisa NARIN; Gulsum OZCELİK; Ferda CIVAN CAVUSOGLU	Istanbul Beykent University (Türkiye)	EFFICIENT REMOVAL OF CATIONIC DYE METHYLENE BLUE FROM AQUEOUS MEDIA USING A BENTONITE-ACTIVATED CARBON-Fe ₃ O ₄ MAGNETIC COMPOSITE
Beyda ANBAR; Hayat TOPCU; Murat DEVECI	Tekirdag Namık Kemal University (Türkiye)	MOLECULAR MARKER DETECTION OF DROUGHT-RELATED GENE REGIONS IN TOMATOES

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	HALL-2, SESSION-2		ZOOM PASSCODE: 080808

HEAD OF SESSION: Muqaddas ASHRAF

AUTHORS	AFFILIATION	TOPIC TITLE
Maria ZAFAR; Shazia SHUKRULLAH; Abdul GHAFAR	University of Agriculture Faisalabad (Pakistan)	FABRICATION OF ZNO-M-COFe ₂ O ₄ (M = TiO ₂ , SiO ₂ , CuO) HETEROJUNCTION PHOTOCATALYSTS FOR DEGRADATION OF ORGANIC POLLUTANTS
Soukaina AMEUR; Assiya ATIF; Abdellah ZEROUAL	Chouaïb Doukkali University (Morocco)	REACTIVITY AND THERAPEUTIC POTENTIAL OF 1H-PYRROLE-2,3-DIONE CYCLOADDITION DERIVATIVES: ADMET PREDICTIONS AND MOLECULAR DOCKING
Brahim AMJOUR; Younesse AMRANE; Soufiane ZERRAFES; Younes ABOUD	University of Hassan II Casablanca (Morocco)	THEORETICAL ELUCIDATION OF ACID CORROSION INHIBITION BY 8-HYDROXYQUINOLINE DERIVATIVES: A DFT/MC/MD STUDY
TEBBOUNE Wassila; TEBBOUNE Wafa; BOUKABRINE Fouzia; ROZALE Habib; CHAHED Abbes	University of Sidi Bel Abbes (Algeria)	SILVER OXIDE DOPED WITH SULFUR FOR CATALYTIC APPLICATION
Mounaim BENCHEIKH; Larbi EL FARH	Mohammed First University (Morocco)	ENHANCED HIGH-TEMPERATURE POWER CONVERSION EFFICIENCY OF THALLIUM SULFIDE MONO- AND HOMO-BILAYERS: A FIRST-PRINCIPLES STUDY
Saeeda MUBASHRA; Tanzeela RIAZ; Matloob AHMAD	Government College University (Pakistan)	ARYLATED CARBAZOLE DERIVATIVES: SYNTHETIC STRATEGIES AND POTENTIAL APPLICATIONS
Tanzeela RIAZ; Sana ASLAM; Matloob AHMAD	Government College University (Pakistan); Government College Women University (Pakistan); Government College University (Pakistan)	ADVANCES IN THE SYNTHESIS OF DIVERSELY SUBSTITUTED THIAZOLIDIN-4-ONE DERIVATIVES
Muqaddas ASHRAF; Tanzeela RIAZ	Government College University (Pakistan)	SYNTHESIS OF FURAN DERIVATIVES BY MULTICOMPONENT REACTION

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ZOOM ID: 833 1287 1999



HALL-3, SESSION-2

ZOOM PASSCODE: 080808

HEAD OF SESSION: Noura AZZI

AUTHORS	AFFILIATION	TOPIC TITLE
Beddach YOUNES; Kachbou YOUSRA; Rahhou ABDELAZIZ; Rabichi IMAD; Izghri ZAINA; Yaacoubi Fatima EZZAHRA; Ounas ABDELAZIZ; Yaacoubi ABDELRAHMAN; Ennaciri KARIMA; Bacaoui ABDELAZIZ	Cadi Ayyad University (Morocco); Euromed University (Morocco)	METALS-DOPED ACTIVATED BIOCHAR FROM AGRO-WASTE RESIDUES FOR ENERGY-STORAGE APPLICATIONS
Akinyosoye T. S.; Kavya M.; Anupama A. R.; Nidhina K.; Nishana J.; Nisha P.; Nwokocha L. M.	University of Ibadan (Nigeria); CSIR-National Institute of Interdisciplinary Science & Technology (India)	OPTIMIZATION OF EXTRACTION OF PECTIN FROM AFRICAN STAR APPLE (CHRYSOPHYLLUM ALBIDUM) RESIDUE USING MICROWAVE-ASSISTED METHOD
Noura AZZI; Rachid El BOUAYADI; Redouane MGHAIUINI	Ibn Tofail University, (Morocco)	APPLICATIONS OF MAGNETIC AND ELECTROMAGNETIC FIELDS IN WATER TREATMENT AND DESALINATION PROCESSES
Lazima G; Ranjani S; S. Hemalatha	Abdur Rahman Crescent Institute of Science and Technology (India)	GREEN SYNTHESIS OF MELIA DUBIA MEDIATED SILVER NANOPARTICLES AND EXPLORING IT'S ANTIBACTERIAL PROPERTY IN MASTITIS PATHOGENS
Fatima Ezzahra OUJAHIA; Brahim ACHIOU; Saad Alami YOUNSSI; Mohamed OUAMMOU	University Hassan II of Casablanca (Morocco)	COMPARISON OF HYDROTHERMAL AND GREEN SOL-GEL SYNTHESIS OF TiO ₂ NANOPARTICLES FOR KAOLINITE-BASED CERAMIC MEMBRANES IN WASTEWATER TREATMENT
Sara Ouadi IDRISSIA; Dounia BEQQOURA; Saad Alami YOUNSSI; Adiba RAISA; Brahim ACHIOU; Mohamed OUAMMOU	University Hassan II of Casablanca (Morocco)	DEVELOPMENT OF POLYCARBAZOLE-BASED FUNCTIONAL CERAMIC MEMBRANES FOR WATER TREATMENT
Marouane BOUKHARI; Dounia BEQQOUR; Adiba Rais; Mohamed OUAMMOU; Brahim ACHIOU; Saad Alami YOUNSSI	University Hassan II of Casablanca (Morocco)	PREPARATION AND PERFORMANCE EVALUATION OF PERLITE-PHOSPHATE CERAMIC MICROFILTRATION MEMBRANES
Nouhaila MAKROUNI; Brahim ACHIOU; Dounia BEQQOUR; Mohamed OUAMMOU; Saad Alami YOUNSSI	University Hassan II of Casablanca (Morocco)	MEMBRANE TECHNOLOGIES FOR WASTEWATER TREATMENT: APPLICATION OF MXENE-BASED MEMBRANES

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	HALL-4, SESSION-2		ZOOM PASSCODE: 080808

HEAD OF SESSION: Abdelmajid AGNAOU

AUTHORS	AFFILIATION	TOPIC TITLE
Salisu NUHU; Hudu SAAD; Mustapha BASIRU	Hussaini Adamu Federal Polytechnic (Nigeria)	PRODUCTION AND CHARACTERIZATION OF BIODEGRADABLE POLYESTER FROM PLANTAIN STEM WASTE
Oussama SALHI; Mohamed OUAMMOU; Abdellah AADDANE; Jamal BENNAZHA; Saad Alami YOUNSSI	University Hassan II of Casablanca (Morocco)	FROM NANO- HYDROXYAPATITE TO HIGH- PERFORMANCE CERAMIC MEMBRANES: APPLICATIONS IN DOMESTIC AND INDUSTRIAL WASTEWATER TREATMENT
Abdelmajid AGNAOU; Wafaa MHAIRA; Rachida ESSALIM; Abdelaziz AMMAR	Cadi Ayyad University (Morocco)	STRUCTURAL AND OPTICAL PROPERTIES OF NON-STOICHIOMETRIC $\text{Bi}_4\text{Six}/2\text{Snx}/2\text{V}_{2-x}\text{O}_{11-3x/4}$ ($0.1 \leq x \leq 0.5$)
Safir Ullah KHAN	University of the Punjab Lahore (Pakistan)	PREPARATION AND CHARACTERIZATION OF FIBER GLASS FOR ADVANCE APPLICATION
Kovendan M; Ranjani S; S. Hemalatha	Abdur Rahman Crescent Institute of Science and Technology (India)	NANO ENGINEERING-BASED DEVELOPMENT OF FOOD PACKING MATERIAL TO INCREASE SHELF LIFE AND PROTECT FROM PATHOGENS
Amisha, Shabir SIDHU	I.K Gujral Punjab Technical University (India)	ADDRESSING IRON DEFICIENCY THROUGH FOOD FORTIFICATION: DEVELOPMENT OF AN IRON- ENRICHED NUTRITIONAL BAR
Huma IKRAM; Rumaisa ZAKIR; Darakhshan J. HALEEM	University of Karachi (Pakistan)	RESPONSIVENESS OF $5\text{HT}_{-1\text{A}}$ RECEPTORS IN ADULT RATS FOLLOWING PRENATAL STRESS INDUCED SUSCEPTIBILITY TO APOMORPHINE ADDICTION

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ISTANBUL LOCAL TIME - 12³⁰ : 14³⁰



ZOOM ID: 833 1287 1999



HALL-5, SESSION-2

ZOOM PASSCODE: 080808

HEAD OF SESSION: Hatice CAGLAR YILMAZ

AUTHORS	AFFILIATION	TOPIC TITLE
S. B. AHMED; K. O. BASHIRU; S. A. KOLO; J. J. MUSA	Federal University of Technology (Nigeria)	NOVEL APPROACHES TO CONVERTING PLASTIC WASTE INTO ECO-FRIENDLY CONSTRUCTION MATERIALS
Abdelaadim KHRISS; Aissa Kerkour ELMIAD; Mohammed BADAOU; Mimoun YANDOUZI; Mounir GRARI; Alae-Eddine BARKAOUI; Yassine ZARHLOULE	Mohammed Premier University (Morocco)	LEVERAGING ARTIFICIAL INTELLIGENCE FOR SUSTAINABLE OCEANS: DEEP LEARNING APPLICATIONS IN MARINE PLASTIC DETECTION AND THEIR IMPLICATIONS FOR ENVIRONMENTAL POLICY
ELYAMANY Khadija; EL BAGHDADI Mohamed; Maria EL-HARRAM; EL HASSANIA EL HAMZAOUI	Sultan Moulay Sliman University (Morocco)	EVALUATION OF METEOROLOGICAL DROUGHT USING THE SPI INDEX AT DIFFERENT TIME SCALES
Aysegul YUCEL; Hatice CAGLAR YILMAZ	Iskenderun Technical University (Türkiye); Malatya Turgut Ozal University (Türkiye)	SUSTAINABLE RESOURCE CYCLE FROM MINING WASTE
Chaimae LAMIRI; Jamal MABROUKI; Khadija EL-MOUSTAQIM; Younes ABROUKI	Mohammed V University (Morocco); Ibn Tofaïl University (Morocco)	SUSTAINABLE APPROACH TO WATER SCARCITY IN ARID AREAS BY USING RENEWABLE ENERGY FOR DESALINATION
Ketevan GORDEZIANI; Lasha KAVELASHVILI; Zaal TSINADZE	Shota Rustaveli National Science Foundation of Georgia (Georgia)	MODERNIZING WATER AND SANITATION INFRASTRUCTURE IN GURJAANI, GEORGIA
Nadia AKRAM	Government College University (Pakistan)	BIOPLASTICS: A GREEN APPROACH IN MATERIALS FOR GREEN ENVIRONMENT

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ZOOM ID: 833 1287 1999



HALL-6, SESSION-2

ZOOM PASSCODE: 080808

HEAD OF SESSION: Shaymaa FAROOQ TAYEB ALSAADAWI

AUTHORS	AFFILIATION	TOPIC TITLE
Rochdi DAIBI; Jihane HILALI; Youssef SQALLI; HOUSSAINI; El Mokhtar ELOUALI; Abdelhalem MESFIOUI	Ibn Tofail University (Morocco); Hassan I University (Morocco);	ASSOCIATION BETWEEN PRIOR-NIGHT SLEEP DURATION AND ACUTE 2- BACK WORKING-MEMORY CHANGE DURING HIIT IN ADOLESCENTS
Babita GUPTA	Integral University (India)	REVOLUTIONIZING CANCER DIAGNOSIS: THE POTENTIAL OF 3D PRINTED NANOSENSORS
Jihane HILALI; Rochdi DAIBI; Anas ANAYOUB; Mariam BEN SAGUA; Lamiae ZEROUAL; Amina El IMAM; Amine ARFAOUI; Bouchra TAIB	Ibn Tofail University (Morocco); Laboratory of Nervous System Diseases, Neurosensory Disorders, and Disability; Mohammed V Military Teaching Hospital; Mohammed VI University of Health Sciences; Moulay Ismail University	PERCEPTIONS AND BARRIERS TO PHYSICAL ACTIVITY IN DEMENTIA CARE AMONG HEALTHCARE PROFESSIONALS: A CROSS-SECTIONAL STUDY
Shaymaa FAROOQ TAYEB ALSAADAWI; Sevtap TIRINK; Hulya BOKE OZKOC	Salahaddin University (Iraq); Igdir University (Türkiye); Ondokuz Mayis University (Türkiye)	INTEGRATING METAGENOMIC FUNCTIONAL PROFILING TO EVALUATE PUBLIC HEALTH RISKS DERIVED FROM PTE- CONTAMINATED RIVER SEDIMENTS
Sevtap TIRINK; Kshitiz KANDEL	Igdir University (Türkiye); University of Chinese Academy of Sciences (China)	USE OF MULTIVARIATE STATISTICAL METHODS IN ENVIRONMENTAL MONITORING RESEARCH: A BIBLIOMETRIC ANALYSIS
Granthali SHAPE; Abhinay YADAV; Poonam YADAV	SND College Of Pharmacy Yeola Nashik (India)	THE NANO-ASSAULT: ENGINEERING NEW DELIVERY FRONTIERS FOR OVARIAN CARE
Iram LIAQAT	Government College University (Pakistan)	QUORUM SENSING INHIBITION BY ALGAL COMPOUNDS AGAINST MARINE BIOFILMS

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ZOOM ID: 833 1287 1999



HALL-1, SESSION-3

ZOOM PASSCODE: 080808

HEAD OF SESSION: Mert Sinan TURGUT

AUTHORS	AFFILIATION	TOPIC TITLE
Hakan KESKIN; Fatih SELIMEFENDIGIL	Manisa Celal Bayar University (Türkiye)	OPTIMIZATION OF HEAT EXCHANGER PERFORMANCE USING BAFFLE CONFIGURATION AND NANOFLUID ENHANCEMENT
E. O. FATUNMBI; S. A. ODUNLAMI; J. K. ODEYEMI	Federal Polytechnic Ilaro (Nigeria)	SECOND-ORDER SLIP-CONTROLLED MHD MICROPOLAR NANOFLUID FLOW OVER A STRETCHING PLATE WITH SUCTION AND NONLINEAR CONVECTION
Laman N. YUSIBOVA	Baku State University (Azerbaijan)	SIMULATION OF THE GAS-LIQUID PROCESS MIXTURES TAKING INTO ACCOUNT PHASE TRANSITIONS
Mert Sinan TURGUT; Oguz Emrah TURGUT	Izmir Democracy University (Türkiye); Izmir Bakircay University (Türkiye)	A NOVEL COOPERATIVE ALGORITHM FOR UNMANNED AERIAL VEHICLE SWARMS TO SEARCH UNKNOWN ENVIRONMENTS WITH CONSIDERING THE ENERGY CONSUMPTION
Mustafa KOC; Bekir YAVUZER	Istanbul Beykent University (Türkiye)	MICROSTRUCTURE AND HARDNESS CHANGES OF AL-40ZN-3CU BEARING ALLOYS WITH SN ADDITION
Ekramul HASAN; Jamal Uddin AHAMED; Sajal Chandra BANIK	Chittagong University of Engineering & Technology (Bangladesh)	EFFECT OF INFILL PATTERN ON TENSILE AND IMPACT PERFORMANCE OF FDM-PRINTED PLA+
Abdullah Cihan OZDEMİR; Fatih SELIMEFENDIGIL	Dogus University (Türkiye); Manisa Celal Bayar University (Türkiye)	BATTERY THERMAL MANAGEMENT SYSTEM USING PHASE CHANGE MATERIALS UNDER VARIOUS THICKNESS AND DISCHARGE RATES

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ISTANBUL LOCAL TIME - 15⁰⁰ : 17⁰⁰



ZOOM ID: 833 1287 1999



HALL-2, SESSION-3

ZOOM PASSCODE: 080808

HEAD OF SESSION: Pegah GHORBANPOUR

AUTHORS	AFFILIATION	TOPIC TITLE
Pegah GHORBANPOUR; Mohammad Mahdi BARGI	University of Tabriz (Iran)	METHODOLOGICAL APPROACHES TO MEASURING ENERGY EFFICIENCY: A FOCUS ON DATA ENVELOPMENT ANALYSIS
Suleymanova LILIYA; Nurubeyli TARANA; Jafarova FIRUZA; Tagieva ZENFIRA; Huseynova SABINA; Akhadova SEVIL	Mingachevir State University (Azerbaijan); Azerbaijan National Academy of Sciences, Physics Institute (Azerbaijan)	ENERGY-EFFICIENT PRODUCTION OF HYDROGEN AND SULFUR FROM HYDROGEN SULFIDE IN DIELECTRIC BARRIER DISCHARGE PLASMA
Tagieva ZENFIRA; Jafarova FIRUZA; Huseynova SABINA; Akhadova SEVIL	Azerbaijan National Academy of Sciences, Physics Institute (Azerbaijan)	APPLICATION OF NANOTECHNOLOGY TO HIGH- VOLTAGE INSULATION MATERIALS
Ibrahim Olagbewo IGOCHE	Federal University of Technology (Nigeria)	INTEGRATION OF ENERGY EFFICIENT PRINCIPLES IN THE DESIGN OF FIVE STAR HOTEL IN ABUJA, NIGERIA
Z. AHAL; H. EL MOUMNI; K. MASMAR	Ibnou Zohr University (Morocco)	CHARGED PARTICLE DYNAMICS AS A MECHANISM FOR HF-QPOS IN MICROQUASARS AND ACTIVE GALACTIC NUCLEI

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HALL-3, SESSION-3

ZOOM PASSCODE: 080808

HEAD OF SESSION: Furkan DISKAYA

AUTHORS	AFFILIATION	TOPIC TITLE
Furkan DISKAYA; Emre UZUN; Zeynep Melike SEVER	Istanbul Beykent University (Türkiye)	EVALUATION OF CRITERIA ENABLING DIGITAL TRANSFORMATION SUCCESS FACTORS FOR SUSTAINABLE PERFORMANCE IN LOGISTICS SECTOR
Gokhan DOGRU; Furkan DISKAYA	Istanbul Beykent University (Türkiye)	PERFORMANCE ANALYSIS FOR INDUSTRIAL PRODUCTION USING DATA ENVELOPMENT ANALYSIS AND MALMQUIST INDEX METHODS: A CASE STUDY IN THE CEMENT SECTOR
Buse KAYA; Ataberk OZCAN; Selin YALCIN	Istanbul Beykent University (Türkiye)	ERGONOMIC EVALUATION OF HEAVY LOAD HANDLING SYSTEMS FROM AN INDUSTRY 4.0 PERSPECTIVE
Palash Kumar DAS	Hajee Mohammad Danesh Science and Technology University, (Bangladesh)	AN APPLICATION OF MIXED- INTEGER LINEAR PROGRAMMING TO MINIMIZE THE COST OF UNIVERSITY STUDENTS REQUIRED BASIC NUTRITIONAL REQUIREMENTS
Muhammad UMAR	University Of Sargodha (Pakistan)	ENHANCING TRANSPORTATION EFFICIENCY AND COST REDUCTION THROUGH AI- ASSISTED DIGITAL MAINTENANCE SYSTEMS
Evren OZ; Burak YILDIZ; Emre SUMER	Baskent University (Türkiye)	SIMULATION-BASED ANALYSIS OF THE TRADE PERFORMANCE OF DIFFERENT RSI DERIVATIVES ON THE BTCUSD FINANCIAL TIME SERIES

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HALL-4, SESSION-3

ZOOM PASSCODE: 080808

HEAD OF SESSION: Seda KILICER

AUTHORS	AFFILIATION	TOPIC TITLE
Dogan SENGUL; Sükriye DALKILIC	Istanbul Sabahattin Zaim University (Türkiye)	LEARNING WHEN NOT TO ADAPT: DECISION-AWARE AUTONOMOUS MORPHING VIA RANDOM FOREST REGRESSION
Dogan SENGUL; Ebrar Nur SISMEN; Fikriye Ipek USUMUS; Beyzagul YILDIRIM	Istanbul Sabahattin Zaim University (Türkiye); Istanbul Bilgi University (Türkiye)	MACHINE LEARNING-BASED NUTRITIONAL BALANCE PREDICTION FOR MULTI-CRITERIA DECISION SUPPORT: A DATA MINING APPROACH USING THE OPEN FOOD FACTS DATABASE
Manel FEMMAM; Mohamed Elkabir FAREH	Biskra University (Algeria); University Center of Barika (Algeria)	AI-DRIVEN MODELLING AND OPTIMIZATION OF PROCESS PLANS IN SUSTAINABLE RECONFIGURABLE MANUFACTURING SYSTEMS
Seda KILICER; Rüya SAMLI	Istanbul Beykent University (Türkiye); Istanbul University-Cerrahpasa (Türkiye)	COMPARISON OF THE EFFECT OF DIFFERENT PARAMETERS ON ACCURACY RATE
Davood AHMADIAN; Sevda OZDEMIR CALIKUSU; Fevzi ERDOGAN; Nihal INCE; Vildan ASLAN; Vahid NOROUZI	University of Tabriz (Iran); Van Yuzuncu Yil University (Türkiye); Eskisehir Technical University (Türkiye);	CLUSTERING THE MARKET MIND: A K-MEANS MACHINE LEARNING APPROACH TO INVESTOR TYPOLOGIES
Guneykan INCE	Gebze Technical University (Türkiye)	PREDICTING USER CONSENT-BASED CONTEXT SHARING IN MOBILE APPLICATIONS USING MACHINE LEARNING
Irem ACET; Atınç YILMAZ	Istanbul Beykent University (Türkiye); Marmara University (Türkiye)	MRF-BASED MAP BINARY LABELING AND STRUCTURAL RELIABILITY SCORING FOR OBJECT-TEXTURE DISCRIMINATION IN INDUSTRIAL VISUAL INSPECTION
Merve DEDE; Ebru INAN BARUTCU	Istanbul Beykent University (Türkiye)	COMPARING LINEAR AND ENSEMBLE-BASED ARTIFICIAL INTELLIGENCE MODELS FOR PREDICTING ACADEMIC PERFORMANCE IN NOISY AND MULTILEVEL DATA


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HEAD OF SESSION: Aytac Ugur YERDEN

AUTHORS	AFFILIATION	TOPIC TITLE
Sinan ESEN; Aytac Ugur YERDEN	Istanbul Gedik University (Türkiye)	THE IMPACT OF SMART OHS TOOLS AND ARTIFICIAL INTELLIGENCE-SUPPORTED MONITORING SYSTEMS ON OCCUPATIONAL HEALTH AND SAFETY
Fazıl BAYAT; Ismail OZDEMIR	Istanbul Gedik University (Türkiye)	A SYSTEMATIC REVIEW OF STUDIES ON THE EFFECT OF PERCEIVED OHS PRACTICES ON ORGANIZATIONAL COMMITMENT
Haji KHALILOV; Mustafa YAGIMLI	Istanbul Gedik University (Türkiye)	THE EVOLUTION OF OCCUPATIONAL HEALTH AND SAFETY CULTURE IN THE EUROPEAN UNION: A COMPARATIVE ANALYSIS WITH TURKEY
Asena Kubra IMREN; Aysin ASKIN	Istanbul Beykent University (Türkiye); Canakkale Onsekiz Mart University (Türkiye)	A DESIGN-ORIENTED OCCUPATIONAL HEALTH AND SAFETY APPROACH TO STREET-LEVEL RISKS: THE CASE OF VARNALI STREET
Kigbu A. LAWRENCE; Charles. Y. MAKUN	Federal University of Technology (Nigeria)	INTEGRATING LANDSCAPE ELEMENTS IN THE DESIGN OF REHABILITATION CENTRE IN MINNA, NIGER STATE, NIGERIA
Nashin Saiyara TEOTHY; Abid ALAM; Gourab HALDER; Md Omik HASAN; Md Sazibur RAHMAN;	Rajshahi University of Engineering & Technology (Bangladesh)	A SPATIAL AND SOCIO-ECONOMIC ANALYSIS OF REGIONAL COMPETITIVENESS IN NORTHERN BANGLADESH
Ajayi O. MARVELLOUS; Abubakar D. ISAH	Federal University of Technology (Nigeria)	EVALUATION OF OUTDOOR LEARNING SPACES AS A STRATEGY FOR ENHANCING STUDENT ENGAGEMENT IN THE DESIGN PROPOSAL OF A MODEL SECONDARY SCHOOL IN ABUJA, NIGERIA
Simpa, Abbas ABDULAZIZ; Abubakar D. ISAH	Federal University of Technology (Nigeria)	EXPLORING CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN (C.P.T.E.D) PRINCIPLES IN THE DESIGN PROPOSAL OF A BUS TERMINAL, NASARAWA STATE, NIGERIA




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HEAD OF SESSION: Kshitiz KANDEL

AUTHORS	AFFILIATION	TOPIC TITLE
Rahimova YULDUZ	Oguz Han Engineering and Technology University (Turkmenistan)	SYNTHESIS IN NANOSCALE AND ITS PROBLEMS
Rahimova YULDUZ; Nazarov KERIM	Oguz Han Engineering and Technology University (Turkmenistan)	SERVO CLOCK ON ARDUINO
Aswathi Sunil KUMAR	Government College of Engineering (India)	SURVEY OF QUANTUM COMPUTING AND QUANTUM PROCESSORS
Samar Jamal Hassan MAHMOUD; Noor Maizura Binti Mohamad NOOR; Zuriana ABU BAKAR	University Malaysia Terengganu (Malaysia)	AN ADAPTIVE USER-CENTERED USABILITY MODEL FOR ACCESSIBLE E-TRANSPORTATION APPLICATIONS
Z. KARI; H. SHALL; A. SIBILINI; J.J. ROUSSEAU	Djilali Liabes University (Algeria); Technopôle du Madrillet, Avenue Galilée (France); Jean Monnet, University (France)	SIMULATION AND MEASUREMENT OF THE MAGNETIC FIELD RADIATION FOR A PLANAR INDUCTOR
Zhumayev Asset ZHOLDYBAIULY	L.N. Gumilyov Eurasian National University (Kazakhstan)	QUANTUM TECHNOLOGIES OF NANOSTRUCTURED MATERIALS: THEIR IMPACT ON SOCIAL DEVELOPMENT IN THE FIELDS OF RADAR, ELECTRONICS AND TELECOMMUNICATIONS
Sabrine AZELMAT; Jamal MABROUKI	Mohammed V University (Morocco)	COLD START OF AN IOT-BASED SMART GREENHOUSE: SYNTHETIC DATA GENERATION, SENSOR-FAULT INJECTION, AND LIGHTWEIGHT ANOMALY DETECTION
Ahmet GUZEL	Batman University (Türkiye)	IMPACT OF THE WILLIAMS PARAMETER ON NUMERICAL ACCURACY: A COMPARATIVE ANALYSIS OF RA AND RAW TIME FILTERS
Elif OVER; Sevval PEKDEMİR; İlayda YUKSEL; Mustafa Alpaslan KARABACAK	Istanbul Beykent University (Türkiye)	DESIGN AND IMPLEMENTATION OF A BLUETOOTH MESH-BASED WIRELESS CONTINUITY TEST SYSTEM FOR AIRCRAFT CABLE HARNESES

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HEAD OF SESSION: K. Kumar LOKESH

AUTHORS	AFFILIATION	TOPIC TITLE
S. Shalini; Merlin Kercial; G. Varsa; M. Arulmozhi; S. Saathvika	R.M.K. Engineering College (India)	MATRICES IN COMPUTER GRAPHICS AND ANIMATIONS
S. Aishwarya; N. Reshma; P. Tharunikaa; M. Tarnekaa; S. K. Nivethitha; R. K. Samiksha	R.M.K. Engineering College (India)	APPLICATION OF MATRICES IN NETWORK ANALYSIS
S. Janaardan; R. Jeyanth; S. Chandran Barani; T. Lokeshwaran; C. Santhosh; S. Bharathi	R.M.K. Engineering College (India)	A STUDY ON MATRICES AND CALCULUS FOR ENGINEERING APPLICATIONS
K. Rishivanthan; E. Praveen; V. Mukeshkumar; M. Mohanaganesan; P. J. Neeraj; N. Gowtham Prathu	R.M.K. Engineering College (India)	VECTOR CALCULUS OPERATORS AND INTEGRAL THEOREMS IN ENGINEERING APPLICATIONS
Al Amin	International Islamic University (Malaysia)	INVESTIGATING THE IMPACT OF SUB-Tg, NEAR-Tg, AND POST-Tg HEAT TREATMENTS ON BAND GAP AND REFLECTION INTENSITY
G. Dharsan; K. Sanjay; M. L. Naveenkumar	R.M.K. Engineering College (India)	ANALYTICAL APPROACHES TO DOUBLE AND TRIPLE INTEGRALS IN CARTESIAN COORDINATES
J. Nanda Kishore; Nagaraj P. G.; Narasapuram Neeraj; Rahul Sai Bujji; Rahul T.; Revanth Kumar N. S.	R.M.K. Engineering College (India)	MULTIPLE INTEGRALS AND CHANGE OF ORDER OF INTEGRATION-AREA ENCLOSED BY CARTESIAN COORDINATES IN ENGINEERING APPLICATIONS
M. Kannan Murali; D. Rohith; G. Mitulraamsundar; M. K. Praveenganth	R.M.K. Engineering College (India)	THE LAPLACE TRANSFORM IN ENGINEERING MATHEMATICS
K. Kumar LOKESH; T. KARAN	R.M.K. Engineering College (India)	COMPARATIVE ANALYSIS OF EIGENVALUE COMPUTATION IN MATLAB AND R

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HEAD OF SESSION: Manal CHANA-YOURAF

AUTHORS	AFFILIATION	TOPIC TITLE
Manal CHANA-YOURAF; Said ALAHIANE	Ibn Zohr University (Morocco)	METAL-ORGANIC FRAMEWORKS (MOFS) AS CATALYSTS/PHOTOCATALYSTS FOR ORGANIC SYNTHESIS
Y. EL GHALI; J. IGBIDA; N. ELHARRAR; A. KADDAR	Chouaïb Doukkali University (Morocco)	NONLOCAL ELLIPTIC EQUATIONS WITH SINGULAR SOURCES
Ngueya ESSALLAMI; Ahmed KHOUYA; M'barka EL MOUEDDEN	Abdelmalek Essaâdi University (Morocco); Mohammed V University in Rabat (Morocco);	EVALUATING THE EVOLUTION AND OPTIMIZATION PATHWAYS OF RENEWABLE ENERGY-DRIVEN DESALINATION
Kinga Korniejenko	Cracow University of Technology (Poland)	THE INFLUENCE OF NANO-ADDITIVES ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF GEOPOLYMER COMPOSITES: A COMPREHENSIVE REVIEW
Anik Biswas; Farhan Tanvir	Trine University (USA); University of Michigan Dearborn (USA)	AI-DRIVEN CYBER THREAT DETECTION FRAMEWORK FOR PROTECTING CRITICAL INFRASTRUCTURE IN THE UNITED STATES
Natalia Kondruk; Serhii Hetsko	Uzhhorod National University (Ukraine)	TITLE: HYBRID DECISION SUPPORT SYSTEMS FOR FOREX TRADING USING FUZZY AND BINARY LOGIC
Felipe CHAVES; Willian MAIA; Douglas Oliveira CAMPOS; Rafael PACHECO; Danilo Brito ALMEIDA; Lucas dos Santos RIBEIRO; Samuel FREITAS	Instituto Federal da Bahia (IFBA) (BRAZIL); Universidade Federal de Minas Gerais (UFMG) (BRAZIL)	THE IMPORTANCE OF PERFORM EMC PRE-COMPLIANCE TEST IN SEMI-ANECHOIC CHAMBER OR OPEN AREA TEST SITE (OATS)
Abul Hasnat; Farhan Tanvir; Umme Salma Tinni	Daffodil International University Dhaka, (BANGLADESH); University of Michigan Dearborn Michigan (USA)	PREDICTING HYPERTENSION RISK USING ENSEMBLE MACHINE LEARNING MODELS: A COMPARATIVE AND STACKING-BASED APPROACH



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NEW TRENDS IN MATHEMATICAL RESEARCH

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ABSTRACT

To achieve a deeper understanding of the processes occurring in life, there is a need to update and deepen scientific and technological processes. This, in turn, requires the creation of more adequate mathematical models and the search for adequate solutions. In the first part of the presentation, consisting of three distinct new perspectives, give innovative methods for naturally expanding the set of real numbers, which is one of the fundamental concepts of mathematics. Using these concepts, new ideas of both the powerative derivative and integral are introduced, and their connection with multiplicative and additive derivatives and integrals is established. For mathematical models to accurately describe the physical phenomena, certain necessary conditions arising from the problem formulation must be met. In order to demonstrate the necessity of these necessary conditions, several simple problems were formulated and analysed. Finally, in the third part of the presentation by modifying the series written by Mittag-Leffler' series as an analogue of the function $e^{\lambda x} = \sum_{k=0}^{\infty} \frac{x^k}{k!}$ which is invariant with respect to the derivative operator introduced by Euler, that it was achieved by author to have invariant series with respect to fractional derivative that fractional order equations were also algebraization [1-2].

Keywords: Occupational Safety Additive derivative and integral, multiplicative derivative and integral, powerative derivative and integral.

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WELL-POSEDNESS OF DIFFERENCE SCHEMES FOR ELLIPTIC NBVPS

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ABSTRACT

In the present work, we discuss on the first and second order of accuracy two-step difference schemes for the approximate solution of the nonlocal boundary value problem with Samarskii-Ionkin condition for the elliptic equation

$$-\frac{d^2u(t)}{dt^2} + Au(t) = f(t), \quad 0 < t < T,$$
$$u(0) = u(T) + \varphi, \quad u'(T) + \mu u(T) = \psi$$

in a Banach space E with the positive operator A and $\mu \geq 0$ are presented. The stability, almost coercive stability and coercive stability estimates for the solutions of difference schemes for elliptic equation are established. Abstract results are applied to construct stable difference schemes for various elliptic NBVPs. The theoretical statements for the solution of these difference schemes are supported by the results of numerical experiments.

Keywords: Elliptic equation, well-posedness, positive operator, Hölder spaces with weights.

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INVESTIGATION OF EFFECTIVE COMMUNICATION FACTORS BETWEEN SURVIVING PARENTS AND THEIR CHILDREN AFTER EARTHQUAKE DISASTER: A PRINCIPAL COMPONENT FACTOR ANALYSIS STUDY

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ABSTRACT

Major earthquakes in Türkiye, particularly the 1999 Gölcük and the 2023 Kahramanmaraş–Pazarcık events, caused not only large-scale physical destruction but also enduring psychosocial consequences, especially for children. While structural damage is immediate, emotional trauma persists and is strongly influenced by post-disaster family interactions. Children’s recovery largely depends on parental communication styles, emotional availability, and the ability of caregivers to provide a sense of safety and continuity. This study investigates key factors affecting parent child communication and emotional support in post-earthquake contexts. Data were collected through structured interviews with 48 parents from earthquake-affected regions. A standardized questionnaire consisting of 27 variables was employed, addressing communication behaviors, attitudes toward emotional support, educational background, professional skills, preparedness for traumatic events, and caregiving capacity under stress. Principal Component Analysis (PCA) was conducted using SPSS to identify latent structures among the variables. Components exhibiting high shared variance (≥ 0.90) were considered significant. Nine variables clustered into coherent components, revealing critical dimensions of family resilience following disasters. One prominent component highlighted the role of play-based interaction as an effective communicative medium through which children express emotions, reduce stress, and reestablish social connections during recovery. The findings also emphasize the necessity of child-centered protection facilities located outside disaster zones and staffed by trained educators, caregivers, nurses, and mental health professionals. Clear information flow during crises, early recognition of emotional distress, and structured play environments emerged as key elements supporting children’s psychological well-being. These results offer practical insights for developing community-based and institutional interventions aimed at enhancing post-disaster recovery for young survivors.

Keywords: Earthquake trauma, child mental health, play-based intervention



THE CLASSICAL SOLUTION OF A $(6,1/12)$ -ORDER SEQUENTIAL FRACTIONAL DIFFERENTIAL EQUATION WITH LOCAL BOUNDARY CONDITIONS

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ABSTRACT

Euler's pioneering work on integer-order differential equations with constant coefficients established the exponential function as an invariant of the classical derivative operator, thereby enabling the algebraization of ordinary linear homogeneous differential equations. Extending this framework to the fractional setting, Mittag-Leffler introduced a well-known fractional analogue of the exponential function. However, the Riemann–Liouville fractional derivative of the leading term of this series does not vanish, which limits its direct use in constructing invariant-based solution methods. To address this limitation, N. A. Aliyev proposed a modified Mittag-Leffler–type function that restores the invariance property with respect to the fractional derivative operator. Building on this modification, the present study develops an algebraization approach for fractional linear homogeneous differential equations with constant coefficients. Within the proposed framework, a classical solution is derived for a multi-term fractional differential equation of mixed orders under a local boundary condition. The results demonstrate that the modified invariant structure provides an effective analytical tool for solving fractional differential equations with real coefficients, and it extends the classical exponential-based methodology to a broader fractional context.

Keywords: Sequential fractional differential equation, Mittag-Leffler functions, local boundary condition.

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A PROCESS-BASED ENERGY EFFICIENCY AND WASTE HEAT RECOVERY ASSESSMENT FOR A LARGE-SCALE AUTOMOBILE MANUFACTURING PLANT

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ABSTRACT

Industrial facilities with high production capacities exhibit significant energy consumption and substantial waste heat losses, particularly in continuous and high-temperature processes. In this study, a comprehensive energy efficiency and waste heat recovery assessment is conducted for a large-scale automobile manufacturing plant. Process-based energy analyses are performed to identify major waste heat sources, including painting ovens, pressing lines, body shop welding processes, air compressors, and HVAC systems. The recoverable waste heat potential is quantitatively evaluated using a structured calculation framework based on operational data and realistic efficiency assumptions. The results indicate that the total recoverable waste heat potential of the facility reaches approximately 58.5 GWh/year (210.6 TJ/year). Painting ovens are identified as the dominant contributors due to their high operating temperatures and continuous production characteristics. Several waste heat recovery technologies, such as heat exchangers, waste heat boilers, compressor heat recovery systems, and low-temperature solutions including heat pumps and Organic Rankine Cycle (ORC) systems, are evaluated in terms of energy, economic, and environmental performance. The economic analysis reveals that heat exchangers and compressor heat recovery systems offer the shortest payback periods, ranging between 2 and 3 years, making them highly feasible for short-term implementation. Although ORC and heat pump systems exhibit longer payback periods, they provide strategic benefits in terms of electricity generation and long-term carbon emission reduction. Environmental impact assessments demonstrate that the proposed recovery scenarios could prevent approximately 19,000 tons of CO₂ emissions annually. The findings highlight the significant role of waste heat recovery systems in improving energy efficiency and supporting sustainable production strategies in the automotive industry.

Keywords: Waste Heat Recovery; Energy Efficiency; Automobile Manufacturing; Industrial Energy Analysis; Process-Based Assessment; Organic Rankine Cycle (ORC); Economic and Environmental Evaluation



TORSIONAL FRACTURE TESTING OF PLAIN AND POLYPROPYLENE REINFORCED CONCRETE BEAMS

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ABSTRACT

This study investigates the size effect on the torsional strength of plain and polypropylene fiber-reinforced concrete beams with dimensions. Concrete specimens with size of 25x25x125mm, 50x50x250 mm and 100x100x500mm were tested to analyze the size effect on torsional failure. To examine the torsional behavior of both plain and fiber-reinforced beams, loads were applied at predetermined points. For each size, three specimens were tested. All concrete beams were tested using an MTS testing machine with load capacity of 50 kN. Concrete is a brittle material with low tensile strength and limited tensile strain capacity. These shortcomings can be improved by incorporating fibers with superior mechanical properties. In this study, polypropylene fibers were added to the concrete mixture at volume fractions of 1% and 2%. The fresh and hardened properties of polypropylene fiber-reinforced concrete were evaluated. The results showed that increasing fiber content led to improved strength properties. Similarly, capillary water absorption resistance of the concrete was positively affected by the addition of polypropylene fibers. Test results showed that there is size effect under the torsional loading.

Keywords: Size Effect; Torsional Failure; Concrete; Tests; Polypropylene Fibers



ENHANCING PHOTOVOLTAIC PANEL PERFORMANCE USING A SELF-CLEANING HYDROPHILIC NANO-COATING: AN EXPERIMENTAL STUDY

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ABSTRACT

In recent years, interest in electricity generation from solar energy has exhibited a marked increase worldwide. This trend is particularly reflected in the widespread adoption of photovoltaic (PV) panels for individual use rather than the construction of large-scale solar power plants. Nevertheless, the energy conversion efficiency of PV panels significantly declines over time due to dust accumulation and various surface contaminants. Furthermore, cleaning PV panels installed on the rooftops of residential and commercial buildings poses both practical challenges and potential occupational safety risks. In this study, a solar energy conversion system consisting of two polycrystalline PV panels, each with a rated power of 100 W, was designed and implemented. Within the experimental setup, one panel (PV Panel A) was maintained in its standard condition as a reference, while the surface of the other panel (PV Panel B) was treated with a self-cleaning hydrophilic nano-coating with a specialized chemical composition aimed at reducing dust and contamination, as well as minimizing irradiance-related losses. The experimental investigation was conducted over a one-month period, during which voltage and current values from both panels were recorded at five-minute intervals. Following the completion of the experiment, the electrical data from the panels were analyzed, and daily as well as monthly energy production values were determined and graphically presented. The experimental results indicated that PV Panel B, treated with the self-cleaning hydrophilic nano-coating, generated approximately 9% more electrical energy compared to the untreated reference panel, PV Panel A. This application not only enhanced energy efficiency but also provided a significant sustainability benefit by eliminating the need for water in panel cleaning.

Keywords: Energy, Photovoltaic panel, Nano-coating, Energy efficiency



A SURVEY-BASED ANALYSIS OF MATHEMATICS AND UNIT KNOWLEDGE PROFICIENCY IN ENGINEERING EDUCATION

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ABSTRACT

Over the past few years, research in engineering education has paid more attention to assessing students' mathematical knowledge, since it is linked to their academic results and to how they approach engineering problems. Mathematics underpins most engineering fields, yet students' skills and views about mathematics often differ by department and by stage in their studies. This study reports a survey that assesses undergraduate engineering students' mathematical knowledge and their views about mathematics. The questionnaire was designed to assess students' knowledge of key mathematics topics, including limits, derivatives, integrals, linear algebra, and differential equations. It also includes items on how students view the place of mathematics in engineering education, the difficulties they face in mathematics courses, and their own assessments of their mathematical skills. The data were analysed with standard statistical tests, and the findings indicate that students' mathematics knowledge varies across departments and years of study. The findings suggest that students who hold positive attitudes toward mathematics tend to take a more analytical and systematic approach when solving engineering problems. In this study, the survey-based assessment method produced clear results for identifying the mathematical competencies of engineering students. To strengthen the evidence, future research should include larger samples and participants from multiple institutions

Keywords: Engineering Education;, Mathematical Knowledge; Survey Study; Student Perception; Academic Performance



QUANTITATIVE ANALYSIS OF DEFENSE ARCHITECTURES IN CYBER-PHYSICAL SYSTEMS: IMPACT ASSESSMENT FROM DETECTION TO RECOVERY

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ABSTRACT

Industrial Control Systems (ICS) and Cyber-Physical Systems (CPS) are increasingly becoming targets of complex and sophisticated cyberattacks. However, existing machine learning-based approaches fail to deliver the desired performance particularly in evaluating system resilience due to issues such as data scarcity, limited generalizability, and lack of interpretability. In contrast, ICS and CPS should be examined within the framework of cyber resilience metrics, as these metrics are critical for both types of systems. In this context, the study defines four different defense scenarios: an unprotected system, a system equipped only with an Intrusion Detection System (IDS), a system integrated with IDS and Endpoint Detection and Response (IDS+EDR), and a comprehensively hardened system architecture. Within these scenarios, the quantitative impacts on Time to Detect (TTD), Time to Recover (TTR), and Average Production Loss (APL) are analyzed using Monte Carlo simulation. The findings indicate that the use of an IDS significantly reduces TTD; however, the primary factor determining TTR largely independent of other defense layers is the system's ability to restore operations reliably and rapidly, particularly through the presence of a Signed Backup (SB) mechanism. In addition to this indication, the study not only presents a technical result but also provides scientific evidence that, in ICS environments, the priority of security investments should shift from attack detection toward recovery capability (RC).

Keywords: Industrial Cyber-Security; IDS; EDR; TTD; TTR; Cyber Resilience



EXPERIMENTAL DESIGN, CONTROL AND NEURAL NETWORK MODELLING OF SERVO MECHANISMS FOR UNMANNED AERIAL VEHICLES

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ABSTRACT

This study focuses on control and artificial neural network (ANN) modelling of servo-based peripherals for quadrotor unmanned aerial vehicles (UAVs). To that end, a quadrotor was built from the scratch as an experimental setup. An Arduino-driven servo-camera mechanism is proposed. Camera position was measured using an IMU sensor (MPU6050) and then, a low-pass filter was utilized so as to have a smooth signal. PI controller was chosen for control action since it eliminates steady-state error, offers robustness against measurement noise and provides low computational cost. Findings demonstrated that a satisfactory trajectory tracking performance was achieved. Afterwards, this control action was trained to artificial neural network using Levenberg–Marquardt supervised learning algorithm. A time-domain analysis was made and the results proved that the prediction of the model has been significantly achieved. The results also revealed that an explicit mathematical model of the servo mechanisms may not be required for future research in this field.

Keywords: Quadrotors; Servo Mechanisms; Neural Network Modelling; PI Control; System Identification



**DESIGN AND CONTROL OF AN AERO-PENDULUM MECHANISM:
EXPERIMENTAL SETUP AND ARTIFICIAL NEURAL NETWORK (ANN)
MODELLING**

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ABSTRACT

The present study investigates how to solve modelling issues of experimental setup for a given mechanical system as an alternative method. An experimental aero-pendulum mechanism was designed and constructed in order to check the performance of artificial neural networks (ANN) on modelling mechanical systems. An RS2205 2300 KV brushless DC (BLDC) motor equipped with a three-blade propeller was used to create the thrust force. An MPU6050 inertial measurement unit (IMU) sensor incorporated with a complementary filter was used to measure pendulum angle. Afterwards, PID control technique was chosen herein thanks to its capabilities on being quite understandable, easy to implement and being effective. Besides, it is well-known that the PID controllers are more preferable for an Arduino operated mechanical system due to computational cost and memory issues of the board. Once the control goal is achieved, the data obtained from experimental setup were recorded. Finally, Levenberg–Marquardt supervised learning algorithm was used to learn the model of experimental setup through artificial neural network. The evidence from this study verified that an estimation of the model has been remarkably achieved. This result has further strengthened the confidence in modelling of mechanical systems without using an explicit mathematical model. Thus, one can easily use the model obtained through artificial neural networks in developing more advanced control approaches.

Keywords: Aero-pendulum; Neural Network Modelling; Machine Learning; Experimental Setup



ENVIRONMENTAL TRANSFORMATION ANALYSES IN THE CONTEXT OF THE GOLDEN HORN INTERVENTIONS

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ABSTRACT

Throughout history, the Golden Horn has been one of Istanbul's important settlements, trade, and production areas. The functions of the region have evolved due to changes in physical and environmental conditions. Used as a military and commercial centre during the Byzantine period, the Golden Horn acquired a recreational and living area identity during the Ottoman period with the mansions and waterfront houses built along its shores. In the 18th century, under the influence of industrialization, the shores of the Golden Horn became densely populated with industrial structures such as workshops, shipyards, and factories, and during the Republic period, the region transformed into a vast industrial zone. Following planning decisions after 1985, a large portion of the industrial structures in the region were demolished, and the coastal areas were cleaned and opened to public use. Since the 1990s, the repurposing of derelict industrial structures for cultural and artistic purposes has initiated a new phase of transformation in the region's identity. This research was conducted to answer questions such as, "What have these changes on the shores of the Golden Horn brought to the city and its inhabitants, and what are their positive and negative environmental impacts?" Qualitative methods were used in the study; The physical and social dimensions of the environmental transformation in the Golden Horn have been evaluated through archival records, planning documents, and maps. The changes and transformations that the Golden Horn has undergone in different periods have been analysed in the context of the physical and social environment, through planning decisions and intervention processes. Presenting the current situation, where transformations are still ongoing, will constitute important data for future studies.

Keywords: Golden Horn; Golden Horn Interventions; Cultural Heritage; Physical Environment; Social Environment



DIGITAL TRANSFORMATION INTERIOR ARCHITECTURE DESIGN EDUCATION: ACHIEVEMENTS, OUTCOMES, AND FUTURE PREDICTIONS

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ABSTRACT

The accelerating pace of technological advancement is leading to significant transformations in educational processes. Interior architecture design education is also undergoing a major transformation due to the impact of digitalization and technological developments. Computer-aided design (CAD), three-dimensional modeling, parametric design, virtual and augmented reality (VR/AR), artificial intelligence-supported design tools, and digital manufacturing techniques (CNC, 3D printers) have become fundamental components of educational processes. Digitalization is not only a technical transformation but also a social and cultural change that profoundly affects working methods, production processes, communication, and decision-making mechanisms. As this definition of digitalization suggests, in interior architecture design education, these technologies are significantly changing not only the form of representation but also the design methods. Traditional drawing and model-focused approaches are giving way to a multi-layered learning process integrating tools such as digital modeling, parametric design, simulation, and virtual reality. This transformation enables students not only to visualize spaces but also to simultaneously evaluate the functional, environmental, and user-oriented consequences of design decisions. The integration of technology into interior architecture education not only enhances students' professional competencies but also supports their adaptation to current industry expectations. However, technology must be considered not as an end in itself, but as a tool to enhance design thinking, while maintaining a creative, critical, and user-centered approach. It should not be forgotten that design education has historically transformed its design tools to keep pace with the developments of the era. This paper will describe a design model implemented in interior architecture education for the past four years, utilizing digital tools. In this context, the digital transformation in interior architecture education will be discussed, along with its gains and outcomes. This paper aims to develop future predictions for interior architecture education. This study is a qualitative study conducted using literature research, observation, and interview methods. The study is significant in terms of evaluating the digital transformation process in interior architecture education.

Keywords: Interior Architecture; Design Education; Digital Transformation; Virtual Reality; Design Tools



THE GEOMETRY OF CHAOS: THE AESTHETICS OF TIME AND DECAY ON ARCHITECTURAL SURFACES

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ABSTRACT

In architecture, crisis is generally perceived as an "event" like earthquake, fire, demolition. However, from a thermodynamic perspective, crisis is an increase in entropy spread over time. Modern architecture, with its "white cube" ideal, attempts to abstract material from time; consequently, every crack and every stain is viewed as a crisis. With the advent of modernity, the architectural discipline has coded aging, deterioration, and external shocks as "errors," confining design to a pursuit of static perfection. Current architectural paradigms are predicated on "resilience", that is, the attempt to remain unchanged in the moment of a crisis. However, any structure that attempts to remain unchanged is fragile. Increasing environmental disasters and urban fragilities are compelling the relationship architecture establishes with crisis to evolve from "resistance" to "adaptation". The study employs the oxidation process of "corten" (weathering steel) as a metaphor and model for managing moments of architectural crisis. It seeks to answer the question, "can corten steel, which transforms crisis (degradation) into a structural layer rather than avoiding it, offer a new ontological model for architectural design and urban transformation?" The study is structured in three stages following an interdisciplinary methodology. First, the chemical phase transition of corten steel is examined, and the formation of the patina layer is correlated with defense and healing mechanisms in biological systems. This process demonstrates that although the crisis (corrosion) initially appears as destruction, it moves the system toward a more durable equilibrium state against external threats via a logarithmic attenuation curve. The study proposes that when this material behavior is evaluated within the fields of architecture and materials through the lens of "antifragile" theory, which states that "the fragile is harmed by stress, the robust remains unaffected, and the antifragile benefits from stress", it can be adapted into crisis strategies such as post-disaster housing and urban regeneration. Ultimately, the study reveals that when the destructive energy of a crisis is attenuated through correct design parameters, it can be transformed into a "time layer" that protects the structure. In this context, rust is not an indicator of negligence, but tangible proof of the constructive dialogue architecture establishes with time and crisis.

Keywords: Architectural Crisis; Materiality in Architecture; Corten Steel; Antifragility; Resilience and Adaptation.



ARCHITECTURE AGAINST TIME: REDEFINING FUNCTION FROM SACRED TO PUBLIC

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ABSTRACT

Architectural design can be understood as the construction of a future to be lived. While it can be approached as a critical, experimental, and enabling tool for thought, architectural design can also function by fixing life and the future into predetermined forms, thereby closing off possibilities. These static designs, whose function are fixed and which fail to engage with the future and the unpredictable nature of life, remain inactive, unable to respond to changing individual and social dynamics, and become ghost-like structures in urban memory. The aim of this study is to foreground the potential of probabilistic and experimental approaches in contrast to the authoritarian understanding of architectural design and to redefine the details of structures' stance against time. Methodologically following a qualitative case study approach, this study examines selected examples of heritage sites through spatial analysis based on Giorgio Agamben's theory of profanation. When examining modernist period structures where function and reason are at the forefront, we see designs that are entirely predetermined, unable to connect with the future, and incapable of transforming according to evolving needs over time. However, life is an unpredictable and unplannable flow. The dominance of function and spatial rules restricts the interactions that the subject establishes with space, cutting off future scenarios. For this reason, it is necessary to first rid architectural design of its authoritarian identity. Giorgio Agamben explains the concept of profanation as removing the sacredness from something and returning it to use. When defined in the context of architecture as the suspension of fixed functions and the introduction of new forms of use, profanation is approached as a method of resistance against the passage of time in a space. When evaluated through this theoretical approach, even static structures representing the institutional and industrial functionalities of the past can be transformed into public and timeless spaces of liberation through profanation. In Turkey, examples such as CerModern, Müze Gazhane, Santralİstanbul and SALT Galata can be understood as visionary practices of 'repurposing' that dissolve the frozen temporality of space, opening it up to public use and the uncertainty of the subject.

Keywords: Spatial Continuity; Profanation; Adaptive Reuse



ISOLATION IN SEVERANCE: SPATIAL MANIPULATION OF BEHAVIOR IN THE OFFICE SPACE

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ABSTRACT

In this study, the spatial configuration of the Lumon corporation in the series *Severance* will be examined in relation to isolation, focusing on its guiding and segregating effects on employees. In the narrative, employees' memory is spatially divided through the "severance" procedure. In other words, employees cannot remember their outside lives while inside the office space; likewise, when they are outside, they cannot recall what takes place within the office. This fictional premise functions not merely as a narrative theme, but as an experiential field that is directly supported and made visible through the design of the office environment. Here, isolation is considered not only as an individual feeling or psychological condition, but as a situation that is experienced and sustained through spatial organization. The study is based on the spatial analysis of selected representations from the series and on interpreting space as an active element that directs user behavior. In this context, strategies such as corridor configurations that generate continuity and disorientation, controlled permeability, repetitive surfaces and object usage, spatial separations constructed through doors and thresholds, and spatial productions with an isolating character will be investigated through the office setting. Ultimately, the study argues that the Lumon office is not merely a background; rather, it has the capacity to direct behavior, shape experience, and intensify isolation by compelling users into particular modes of interaction.

Keywords: Severance; Isolation; Office Space; Spatial Experience; Manipulative Effect



MEMORY OF FACADES: CERAMIC PANELS IN FLORYA

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ABSTRACT

Florya, since the early years of the Republic, has been shaped as a summer resort area, distinguished by its summer residences and low density settlement pattern. During this period, residential facades were considered not only as the outer shell of the building, but also as an architectural expression, an aesthetic pursuit, and a part of the relationship established with daily life. In this context, ceramic panels emerge as an important facade element that makes visible the interaction between architecture and art. This study examines the ways in which ceramic panels are used in Florya through archival documents, visual materials, and field observations. In early examples, it is seen that ceramic panels were mostly considered as original designs, giving identity to the building through color, texture, and composition. These panels emphasize individuality at the facade scale and contribute to the relationship the residence establishes with its environment. However, with Florya's transformation into a permanent residential area over time, speed, standardization, and cost-oriented approaches became decisive in housing production. In this transformation process, it is observed that ceramic panels gradually decreased, sometimes becoming standard materials or disappearing completely. Thus, the facade has been reduced from a space for artistic and spatial expression to a more neutral and repetitive surface.

Keywords: Florya; Ceramic Panels; Summer Resort



ALGORITHMIC AESTHETICS: MATHEMATICAL LOGIC BEHIND AI-DRIVEN BIO-ARCHITECTURE

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ABSTRACT

Architecture and design disciplines have shared a complex relationship with nature since their inception. From antiquity to modernism, this relationship was largely based on "mimesis", the formal imitation of nature's visible surface. From leaf motifs on column capitals to facade arrangements emulating organic forms, architecture has historically treated nature as an aesthetic point of reference. However, the 21st-century computational design revolution and the leaps in artificial intelligence technologies have fundamentally altered this relationship. Architecture is now capable of replicating the "logic of formation" (morphogenesis) rather than just the "appearance" of nature. The "algorithmic aesthetics" paradigm proposed in this study redefines aesthetics not as a subjective criterion of taste or a tool for ornamentation, but as the inevitable result of mathematical, biological, and structural necessity, namely, "optimization". Structures evolved by AI, which prioritize structural performance and material economy, possess a "mandatory beauty" that goes beyond mere decoration. Because an AI-optimized structure remains faithful to nature's mathematical rules, it evokes a sense of familiarity in the human brain, which is perceived as "beautiful." Consequently, the "aesthetics" discussed within the scope of this work is not an arbitrary choice of the architect, but rather a product of the resonance between mathematical accuracy and human perception. In this context, the study examines the transformative impact of artificial intelligence technologies on architectural aesthetics on a theoretical and conceptual plane. The research argues that AI-assisted bio-geometric structures are not merely visual innovations, rather, they present a new ontological reality built upon differential growth algorithms, genetic evolution simulations, and the neuro-aesthetic foundations of human perception. The study handles the processes of transforming biomimetic design principles into architectural structures through mathematical algorithms and AI technologies within an interdisciplinary framework. Furthermore, it discusses how computational processes change the traditional concept of the "designer subject" and alter the status of the architectural object. Through the "mathematical necessity" and "aesthetics of optimization" represented by AI-optimized bio-geometric forms, the study critically analyzes the phenomenological shift created in human perception. Within this framework, the study aims to present a speculative approach that reconfigures aesthetics, not as a criterion for visual taste, but as a state of "truth" rooted in biology and mathematics.

Keywords: AI in Architecture; Morphogenesis; Aesthetics of Optimization; Neuro-aesthetics; Bio-geometric Forms; Biomimicry



UNIFORM DIFFERENCE SCHEME AND ASYMPTOTIC FORMULAS FOR HYPERBOLIC PERTURBATION PROBLEMS

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ABSTRACT

This study investigates a class of singularly perturbed hyperbolic differential equations in a Hilbert space H , characterized by the abstract Cauchy problem

$$\begin{aligned}\varepsilon^2 u''(t) + Au(t) &= f(t), \\ u(0) = \varphi, u'(0) &= \psi\end{aligned}$$

where A is a self-adjoint positive definite operator and $\varepsilon \in (0, \infty)$ represents a small perturbation parameter associated with the highest-order derivative. We develop an asymptotic expansion for the solution as $\varepsilon \rightarrow 0$, providing a rigorous analytical description of the problem's behavior. We propose a high-order accurate, two-step uniform difference scheme specifically constructed to maintain stability and precision across varying scales of ε . Theoretical results are verified by the numerical experiments.

Keywords: Hyperbolic Equations; Nonlocal Boundary Value Problem; Asymptotic Formula; Uniform Difference Scheme



FUNDAMENTALS OF MATHEMATICAL MODELLING FOR PHYSICS AND ENGINEERING PROBLEMS BASED ON HISTORICAL AND PHILOSOPHICAL CONSIDERATIONS

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ABSTRACT

As we know, natural sciences have two main goals to conquer nature for human welfare and comfort:

- 1- Identification of independent substances in nature.
- 2 - Identification of unknown variable scientific laws in nature.

The first one is actually the elements of the Russian chemist Mendeleev's table, which has so far discovered about 112 independent elements in nature. In fact, the rest of the materials used in various industries are a combination of these materials. This branch is not related to our discussion. The second case is the identification of the laws of the unknown variable in nature, which is the main purpose of our discussion about creating different calculus in mathematics, in order to model physics and engineering problems and other natural, biological, economic and demographic phenomena.

Keywords: Mathematical Modeling; Different Calculus; Physics and Engineering Problems; Differential Equations; Scientific Cycle

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ON THE SOLUTION OF Z^+ -NUMBER VALUED FRACTIONAL DIFFUSION EQUATIONS VIA GRANULAR DIFFERENTIABILITY

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ABSTRACT

This study establishes a formal analytical framework for fractional diffusion equations within the Z^+ -number domain. While fractional-order operators are increasingly utilized to model anomalous transport dynamics, their primary strength lies in their non-local nature. Unlike classical integer-order derivatives, which are inherently local, fractional derivatives provide a rigorous mathematical tool to account for the entire history of a dynamical process. This characteristic is essential for capturing the hereditary properties and sub-diffusive behaviors often observed in complex systems. However, a significant challenge remains in modeling these processes when system parameters involve both vagueness and data reliability issues. To address this, we extend the theory by incorporating Z^+ -numbers, which allow for a simultaneous representation of uncertainty and information trust through underlying probability density functions. In this study, we utilize a granular space representation through the Horizontal Membership Function (HMF) approach. This methodology is specifically designed to bypass the 'increasing span' problem inherent in standard interval and fuzzy arithmetic, which often results in the overestimation of uncertainty. Within this setting, we define Caputo-type granular differentiability to ensure a precise treatment of the system's memory effects. By applying Z^+ -number valued Laplace and Fourier transforms, we successfully derive the fundamental triangular solution for the fractional diffusion equation. Our theoretical results demonstrate that the granular metric (D_{gr}) preserves the solution's structural integrity throughout fractional calculus operations and provides a robust basis for modeling transport phenomena in which non-local temporal dependencies and information reliability must be treated as inseparable variables.

Keywords: Z^+ -numbers; Fractional Diffusion Equation; Granular Computing; Caputo Fractional Derivative; Laplace Transform; Fourier Transform



M-TRUNCATED OPTICAL WAVE STRUCTURES FOR NONLINEAR SCHRÖDINGER–HIROTA EQUATION

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ABSTRACT

In this study, we investigate the fractional Schrödinger–Hirota (SHE) equation, a higher-order nonlinear model that accurately describes the propagation of ultra-short optical pulses in media dominated by third-order dispersion, nonlinear dispersion, self-steepening, and Raman-type effects. To incorporate memory and nonlocal characteristics of complex optical environments, the classical SHE equation is reformulated by employing the M -truncated fractional derivative. This fractional framework enables a more flexible mathematical representation of anomalous dispersion and hereditary response, extending the applicability of the model to a wider class of nonlinear wave phenomena. After applying an appropriate travelling-wave transformation, the fractional SHE equation is reduced to a nonlinear ordinary differential equation. To systematically construct analytical solutions of this reduced form, two powerful ansatz-based techniques the extended rational sine–cosine method and the extended rational sinh–cosh method are employed. The sine–cosine approach yields several families of periodic, trigonometric-type waves, while the sinh–cosh scheme produces hyperbolic-type structures, including bright, dark, kink-like and singular soliton solutions. Explicit analytical expressions for all obtained solutions are derived and presented in detail. Graphical analyses based on three-dimensional and density plots are performed for representative parameter choices, illustrating how variations in the fractional order τ influence the physical characteristics of the solutions. The results show that decreasing τ leads to broadened wave profiles, reduced peak amplitude, and weakened localization, indicating that fractional dynamics act as a dispersion-mediated smoothing mechanism. Periodic solutions become less oscillatory, whereas hyperbolic soliton structures display diminished steepness and wider transition regions. Overall, the study highlights the rich solution structure supported by the M -truncated fractional Schrödinger–Hirota equation and demonstrates the effectiveness of the extended rational sine–cosine and sinh–cosh techniques in generating diverse analytical waveforms. These findings provide deeper insight into the role of fractional calculus in nonlinear optical wave dynamics and offer valuable benchmark solutions for future stability studies and numerical simulations.

Keywords: Schrödinger-Hirota Equation; Sine-Cosine Method; Sinh-Cosh Method; Optical Solitons



NONLINEAR WAVE PROPAGATION IN THE HAMILTONIAN AMPLITUDE EQUATION WITH GEOMETRIC INTERPRETATION

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ABSTRACT

The symmetry structure, conservation laws, and Hamiltonian formulation of the Hamiltonian amplitude equation are examined in this paper. The multiplier approach allows us to directly derive power, momentum, and energy-conserved quantities. Using an extended Lagrangian formulation, the conservation rules produced match those from Noether's theorem. Lie-point symmetry generators of the Hirota equation are explicitly developed, incorporating time and space translations, phase rotation, Galilean invariance, and scaling symmetry. By putting the equation in a Hamiltonian-Poisson framework, we show a rigorous relationship between Lie, Noether, and Hamiltonian flows. The model's geometric structure is revealed by the preserved quantities' continuous symmetry transformations through the Poisson bracket. In addition, accurate one-soliton solutions are used to evaluate conserved values and verify their invariance numerically over time. However, the rational extended sinh-Gordon technique successfully extracts solitons that are dark, singular, mixed, dark-bright, mixed, singular, mixed-periodic, and mixed singular-periodic-singular. Soliton solutions are stable and shape-preserving, as shown by two-dimensional, three-dimensional, and contour plots. Results show that the Hirota equation is fully integrable and give a framework for symmetry analysis, conservation laws, and soliton dynamics.

Keywords: Hamiltonian Amplitude Equation; Soliton Solutions; Multiplier; Lie Point Symmetry; Hamiltonian Poisson



ON INTEGRAL TRANSFORMS AND THEIR APPLICATIONS

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ABSTRACT

Integral transforms play a crucial role in many scientific and engineering disciplines, including fluid dynamics, classical mechanics, electrical engineering, marine engineering, mechanical engineering, and medical sciences. They provide powerful analytical tools for simplifying complex mathematical models by converting differential and integral equations into more manageable algebraic forms. In this study, we investigate two relatively recent integral transforms, namely the Kamal transform and the Anuj transform, and demonstrate their effectiveness in solving various types of equations arising in applied mathematics. The Kamal transform, introduced by Abdelilah Kamal in 2016, is reviewed in terms of its fundamental definition and key operational properties. In addition, the Anuj transform, proposed by Kumar et al. (2021), is presented together with its transformation rules and inverse transform. Special emphasis is placed on the practical application of both transforms to differential equations and integral equations. Furthermore, we illustrate how these transforms can be employed to solve initial value problems in ordinary differential equations through a collection of representative examples. The study also extends their applicability to fractional ordinary differential equations, as well as to Volterra integral equations of the first kind and Abel's integral equation, highlighting their analytical advantages. Finally, selected applications to partial differential equations are provided to show the broader potential of these transforms in mathematical modeling. Overall, the findings confirm that the Kamal and Anuj transforms constitute efficient and flexible tools for solving a wide range of linear and fractional problems in applied mathematics and engineering.

Keywords: Differential Equations; Kamal Transform; Anuj Transform; Fractional Differential Equations



STEPHAN'S INVERSE PROBLEM FOR ANTI-PARABOLIC EQUATION

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ABSTRACT

Free boundary problems arise in many areas of fluid dynamics where both the state variable and the moving boundary must be determined simultaneously. The mathematical analysis becomes substantially more challenging when the governing process is described by anti-parabolic type equations in a domain with two unknown moving boundaries. Such problems are of particular interest due to their strong nonlinearity and coupling between the solution and the boundary dynamics [1].

In this study, a free boundary value problem for an anti-parabolic equation with double unknown boundaries is investigated. The initial condition and boundary data are assumed to be given by continuous functions, while both the field variable and the boundary trajectories are treated as unknowns. By employing an analytical transformation procedure, the original problem is reduced to a system of Volterra integral equations of the second kind for the unknown functions [1-2].

Keywords: Free Boundary Problem; Anti-Parabolic Equation; Inverse Stefan Problem

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AN ENTROPY BASED ANALYSIS OF CLASS DISTRIBUTIONS USING TSALLIS ENTROPY

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ABSTRACT

Shannon entropy is considered the most common and established measure of uncertainty in the literature. However, the assumption that Shannon entropy is the universally best measure of uncertainty for every data structure is not always valid. Especially when class distributions exhibit unbalanced, skewed, or overlapping structures, evaluations based on a single entropy measure may be limited. In this context, whether Tsallis entropy, which has an adjustable parameter, can reflect the structural characteristics of class distributions more accurately than Shannon entropy constitutes the main research question of this study. In this study, a comparative analysis was performed using the Palmerpenguins dataset. To obtain probability distributions from continuous variables, an equal frequency discretization approach was adopted to avoid parametric assumptions. After this process, conditional class probabilities were calculated; Shannon entropy and Tsallis entropy were calculated from the resulting distributions under different parameter values of q . To comprehensively evaluate the variable-based uncertainty levels, the entropy values were combined using weighted averages. The findings reveal that Shannon entropy exhibits a relatively stricter and limited sensitivity to class structure, whereas Tsallis entropy shows a high degree of sensitivity to features such as dominance, imbalance, and heterogeneity in class distributions. In particular, in cases where classes are distinctly separated, sharp decreases in Tsallis entropy values were observed with increasing q parameter. Conversely, in more complex structures with significant overlap between classes, Tsallis entropy was found to more effectively capture uncertainty components that Shannon entropy could not adequately distinguish. In conclusion, it can be said that thanks to its adjustable nature, Tsallis entropy offers a more flexible and explanatory measure of uncertainty, especially in datasets with imbalanced and complex class distributions. This feature makes Tsallis entropy a more sensitive and generalizable alternative compared to traditional entropy measures.

Keywords: Shannon Entropy; Tsallis Entropy; Class Uncertainty



ON SPATIAL GENERALIZED OCTONIONIC CURVES AND SYMBOLIC COMPUTATIONS

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ABSTRACT

In this work, we investigate non-null spatial generalized octonionic curves. Spatial generalized octonionic curves are curves in a seven-dimensional space determined by spatial generalized octonionic-valued functions of a single variable. Generalized octonions include real, split, semi, split semi, quasi, split quasi, and para octonions. We construct a novel moving frame, called G_2 -frame, for this class of curves by using the inner product and vector product in seven-dimensional semi-Euclidean space, together with the derivative formulas associated with this frame. Using MATLAB, we perform symbolic computations for spatial generalized octonionic curves with respect to the G_2 -frame.

Keywords: Generalized Octonions; G_2 -Frame; Matlab



ASSESSING THE CAUSES AND CONSEQUENCES OF GLOBAL CLIMATE CHANGE USING Q-RUNG PICTURE FUZZY AHP AND MAIRCA METHODS

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ABSTRACT

Global climate change is one of the most critical global problems affecting human life through its environmental, economic, and social dimensions. This study focuses on the application of applied mathematics and multi-criteria decision-making approaches to an environmental problem. Global climate change arises from multiple interrelated factors such as fossil fuel consumption, industrialization, deforestation, and unsustainable agricultural practices, resulting in complex cause–effect relationships. Problems of this nature, which involve high uncertainty and multiple criteria, can be effectively analyzed using multi-criteria decision-making (MCDM) methods. In this study, the causes and consequences of global climate change are evaluated using Q-Rung Picture Fuzzy Analytic Hierarchy Process (AHP) and the MAIRCA method. First, the main causes and consequences of global climate change are identified through an extensive literature review and expert opinions. Since expert evaluations are generally expressed in linguistic terms and involve uncertainty, they are modeled using the Q-Rung Picture Fuzzy Set approach. The Q-Rung Picture Fuzzy AHP method is then applied to determine the relative importance weights of the cause criteria. Subsequently, the obtained weights are integrated into the MAIRCA method to rank the consequences based on their distances from ideal solutions. The results of the study provide a priority ranking of the major causes of global climate change and their associated consequences. The proposed integrated approach demonstrates that combining Q-Rung Picture Fuzzy AHP and MAIRCA yields effective and reliable results for environmental decision-making problems under uncertainty. It is expected that the findings of this study will contribute to the academic literature and support policymakers and decision-makers in developing effective strategies to mitigate the impacts of global climate change.

Keywords: Global Climate Change; Q-Rung Picture Fuzzy Sets; Multi-Criteria Decision Making; AHP; MAIRCA



SYNTHESIS, CHARACTERIZATION AND PHOTOCATALYTIC ACTIVITY OF Cu(II) COMPLEX OF SCHIFF BASE CONTAINING CHLOROACETYL CHLORIDE

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ABSTRACT

Dyes, widely used in the textile, food, paint, plastic, and cosmetic industries, pose serious threats to the environment and living organisms when discharged into wastewater. Due to their complex chemical structures, classical purification methods are often insufficient for their removal. Therefore, more economical and sustainable treatment methods are needed for the removal of dyes from wastewater. The photocatalytic method offers a promising solution with its high efficiency, energy saving, low cost, and environmentally friendly structure. The aim of this study was to synthesize a new Schiff base ligand and its Cu(II) complex, to elucidate their structures, and to investigate the photocatalytic activity of the Cu(II) complex in the removal of methylene blue from aqueous solution. In the first stage of this study, a new compound was synthesized from the reaction of N,N'-Bis(2-hydroxybenzylidene)-phenylene-1,2-diamine and (2-chloro-N-naphthalen-1-yl)acetamide. The Cu(II) complex was synthesized by reacting the resulting ligand with Cu(II) acetate. The structures of the ligand and the complex were elucidated by elemental analysis, FT-IR, UV-Vis and SEM-EDX methods. In the UV-Vis spectra of the synthesized compounds, the observation of peaks belonging to d-d transitions in the copper(II) complex, unlike the ligand, indicated that the Cu(II) ion bound to the ligand. Using elemental analysis and FT-IR spectroscopic data, it was shown that the Cu(II) complex has a square planar geometry. Job's method was used to determine the metal-to-ligand ratio of the Cu(II) complex. According to Job's method, the metal-to-ligand ratio of the Cu(II) complex was found to be 1:1. In addition, the synthesized copper(II) complex was used as a catalyst in the photocatalytic removal of methylene blue from aqueous solution. In this study, it was determined that the copper(II) complex exhibited 75% photocatalytic activity in the removal of methylene blue. This result shows that the complex we synthesized can be considered as a photocatalyst in methylene blue dye removal applications.

Keywords: Photocatalytic Activity; Dye Removal; Cu(II) Complex; Schiff Base



VIRTUALIZATION OF SYSTEMS IN INDUSTRIAL PRODUCTION WITH DIGITAL TWINS

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ABSTRACT

Digital twins are increasingly used to virtualize industrial production systems by coupling high-fidelity models with live operational data for monitoring, prediction, and decision support. This paper proposes a layered methodology for production-system virtualization that combines asset and process models, data pipelines, synchronization mechanisms, and closed-loop decision services. We also present an illustrative simulation of a three-machine serial line with degradation and buffering to demonstrate how a twin-in-the-loop policy can improve throughput stability and maintenance timing. The paper concludes with implementation guidelines and evaluation criteria for accuracy, latency, and operational impact.

Keywords: Digital Twin, Industry 4.0; Cyber-Physical Systems; Production Systems; Virtual Com-Missioning; Predictive Maintenance; Co-Simulation



THE IMPACT OF ARTIFICIAL INTELLIGENCE ON ORGANIZATIONAL COMMITMENT

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ABSTRACT

The increasing prevalence of Artificial Intelligence technologies in organizations is having significant effects not only on productivity and efficiency but also on employees' attitudes and behaviors towards the organization. The aim of this study is to examine the effects of Artificial Intelligence applications on organizational commitment within a theoretical framework. The study is designed as a qualitative research based on a literature review. The findings show that AI-supported applications can strengthen the emotional and normative dimensions of organizational commitment, especially by increasing the perception of fairness, transparency, and consistency. However, job security concerns arising from increased automation and decreased human interaction can have negative effects on organizational commitment. In conclusion, the effect of artificial intelligence on organizational commitment is directly related to the way the technology is used and the organization's human-centered management approach.

Keywords: Artificial Intelligence; Organizational Commitment; Digital Transformation



THE IMPACT OF TRANSFORMATIONAL LEADERSHIP ON THE QUALITY OF LIFE OF FIREFIGHTERS

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ABSTRACT

Firefighting organizations are institutions in which employees' quality of life is a direct determinant of organizational effectiveness and service continuity due to high risk, intense stress, the necessity for rapid decision-making, and vital responsibilities. The aim of this study is to examine the effects of the transformational leadership approach on the quality of life of firefighters within a theoretical and conceptual framework. The research was conducted using a qualitative design based on a systematic literature review, and it holistically addresses the historical development of transformational leadership, its role in the organizational context, and its relationship with emotional intelligence. The findings indicate that transformational leadership enhances firefighters' psychological resilience, reduces stress and burnout levels, and strengthens job satisfaction and organizational commitment. In particular, it is concluded that transformational leaders with high levels of emotional intelligence play a critical role in sustaining employees' quality of life in high-risk working environments. The study emphasizes that leadership approaches in firefighting organizations should be considered not only as a managerial issue but also as a policy domain grounded in occupational health and safety.

Keywords: Transformational Leadership, Firefighters, Quality of Life



DESIGN OF AN ESP RAINMAKER-BASED SMART HOME SECURITY SYSTEM TO REDUCE CAREGIVER BURDEN AND MINIMIZE PROBLEM RESPONSE TIME IN ELDERLY CARE

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ABSTRACT

With the increasing elderly population today, a significant burden of responsibility is placed on family members or caregivers who undertake the care of these individuals. The need to constantly check whether the elderly individual is safe when alone at home becomes both a physical and psychological burden for caregivers. This study focuses on the design of a smart home system that aims to ensure the safety of the elderly individual while enabling caregivers to manage this process more comfortably and without worry. Eliminating the privacy issues created by existing camera-based systems, this design offers a monitoring mechanism based entirely on sensor data. The system's core communication backbone is built on the ESP Rainmaker platform, in accordance with the Internet of Things (IoT) concept. This platform creates the most critical communication bridge of the project by enabling the instantaneous processing and transmission of data from different sensors to the caregiver. A multi-sensor structure is used in the system for in-home security monitoring. At doorways, two VL53L0X (ToF) proximity sensors, which provide more accurate results compared to traditional methods, are used to detect a person's entry and exit movements from the house. Monitoring of signs of life inside the room is provided by PIR sensors that detect changes in ambient temperature. In addition, an MQ-2 gas sensor and a DS18B20 temperature sensor are integrated into the system as a precaution against household accidents. In case of danger or abnormality, the system operates a two-stage warning mechanism. In the first stage, the Active Buzzer located inside the house activates with a loud alarm, alerting the elderly individual or their immediate surroundings. Simultaneously, an instant notification is sent to the caregiver's mobile device via the ESP Rainmaker infrastructure. Thus, even if the caregiver is not physically present, they can be informed about the elderly person's condition (such as inactivity, gas leaks, or sudden temperature changes) within seconds. This developed prototype, with its low cost and modular structure, aims to both preserve the independence of the elderly person and make the caregiver's life easier by using technology as an aid.

Keywords: Elderly Care; ESP Rainmaker; Smart Home; Active Buzzer; Communication Protocols



**THE RISE OF LOCAL INDEXES: A SYSTEMATIC ANALYSIS OF STUDIES
FROM TÜRKİYE IN THE INTERNATIONAL INDEXES WOS & SCOPUS WITH
TRDIZIN UNDER THE CONTEXT OF DEA**

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ABSTRACT

In academic world it must be essential for a study to be indexed for an extensive impact. Therefore, authorities encourage researchers to publish in indexed journals, and it is given priority in appointment and promotion criteria. For this reason, international indexes are considered particularly important due to their broad accessibility. However, in today's technological era local indexes also have a chance of widespread impact. For instance, SciELO, originally a local index from Latin America, has begun to be included as a category in the Web of Science due to its impact. In this context, TRDizin, a local index in Türkiye, is becoming increasingly widespread as a scientific index accessible not only to local researchers but also to international scholars due to its accessibility on the internet. In this study systematic analysis of studies will be carried out under DEA context originated from Türkiye and indexed in Web of Science, Scopus and TRDizin. The records of the mentioned indexes are combined and a holistic view of DEA research in Türkiye and ensures a thorough understanding of DEA research in Türkiye. Within the scope of the statistical analysis in this research, author and affiliation analysis brought out the local and international collaboration, citation analysis revealed the impact, and key word analysis narrated the main research focus. Moreover, the results are visualized with tables and graphs with numerous additional performed analyses of the dataset.

Keywords: Data Envelopment Analysis; DEA; Systematic Analysis; Statistical Tests



A COVERING APPROACH TO EIGENVALUE BOUNDS FOR THE FRACTIONAL P-LAPLACIAN

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ABSTRACT

We study Weyl type eigenvalue bounds for the variational eigenvalues of the following nonlocal weighted eigenvalue problem involving the fractional p-Laplacian on a bounded domain $\Omega \subset \mathbb{R}^n$ with Lipschitz boundary

$$\begin{cases} (-\Delta_p)^s u = \lambda w(x) |u|^{p-2} u, & \text{in } \Omega \\ 0, & \text{in } \mathbb{R}^n \setminus \Omega, \end{cases} \quad (1)$$

where $s \in (0,1)$, $p \in (1, \infty)$, and $w(x) \in L_r(\Omega)$ with $w(x) \geq 0$ and $r \in [1, \infty)$. The fractional p-Laplacian is defined by

$$(-\Delta_p)^s u(x) = 2P.V. \int_{\mathbb{R}^n} \frac{|u(x) - u(y)|^{p-2} (u(x) - u(y))}{|x - y|^{n+sp}} dy.$$

Using a covering argument, we establish lower bounds for the eigenvalues. Our main result is formulated in the following theorem.

Theorem 3.1. Let Ω be a bounded domain with Lipschitz boundary and $\beta := \frac{s}{n} - \frac{1}{pr} = 0$.

Then, the following inequality holds for the lower bound of the variational eigenvalues of problem (1),

$$\lambda_m(w) \geq C \left(\int_{\Omega} w^r(x) dx \right)^{\frac{1}{r}} m^{\frac{sp}{n}}, \quad (2)$$

where $C = C(s, p, n, r)$. Particularly, setting $w = 1$ in (2) and using the condition $\frac{1}{r} = \frac{sp}{n}$ we obtain the following Weyl-type lower bound for the eigenvalues:

$$\lambda_m \geq C |\Omega|^{-\frac{sp}{n}} m^{\frac{sp}{n}}.$$

Keywords: Eigenvalue; Fractional p-Laplacian; Eigenvalue Bounds



MATHEMATICAL MODELING AND OPTIMAL CONTROL OF HYDATID DISEASE

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ABSTRACT

In this study, we developed a mathematical model to examine the dynamics of hydatid cyst disease, which falls within the scope of epidemiology, performed a qualitative analysis of the model, and applied optimal control to determine the most suitable strategy for reducing the disease. First, we developed a mathematical model representing the relevant biological process, incorporating compartments for intermediate hosts (humans and cattle-sheep), the final host (dogs), the parasite (*Echinococcus granulosus*) compartment, and the disease transmission and spread process based on existing biological information about the epidemiology of the disease, considering the transmission routes between populations. We performed a qualitative analysis of our model (basic reproduction number, disease-free equilibrium, endemic equilibrium stability, and sensitivity analyses). In addition, unlike studies in the literature, we performed sensitivity analyses on egg counts and infected populations. Subsequently, to determine the most appropriate strategy for reducing the disease, we included the optimal control variables we defined (public health education, vaccination for sheep, anthelmintic treatment for dogs) in the equation system and formulated the optimal control problem by defining an objective function suitable for the system. We obtained the necessary conditions that optimal control must satisfy by applying Pontryagin's Maximum Principle. Finally, we simulated our control model using data obtained from YYÜ Dursun Odabaş Medical Center, Van Regional Training and Research Hospital, Van Provincial Directorate of Agriculture, and Van Metropolitan Municipality to analyze the effectiveness of each control strategy on disease incidence. This simulation was performed in Matlab using the Forward-Backward Sweep Method.

Keywords: Hydatid Cyst; Forward-Backward Sweep Method; Mathematical Model; Optimal Control; Pontryagin's Maximum Principle



ON THE ALGEBRAIC PROPERTIES OF MATRICES OVER DUAL NUMBERS

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ABSTRACT

The ring of dual numbers, defined as $\mathbb{D} = \mathbb{R}[\varepsilon]$ where $\varepsilon^2 = 0$ is a fundamental algebraic structure in various fields, ranging from kinematic geometry to automatic differentiation. In this presentation, we investigate certain algebraic properties of matrices with dual number entries, denoted by $M_n(\mathbb{D})$. We aim to analyze the nil-clean property, which is whether a dual matrix can be written as the sum of an idempotent and a nilpotent element. For this, we characterize the idempotent and nilpotent matrices in this ring. First, for a dual matrix to be idempotent, we prove that its real part must be an idempotent matrix. In addition, we observe that the dual part is not arbitrary. We show that it must have a specific property based on the real part. Second, we establish the condition for a dual matrix to be nilpotent. Furthermore, we examine the index of nilpotency. We demonstrate that although the real part determines the nilpotency, the dual part can increase this index. These results characterize some of the essential building blocks of dual matrix algebra. Finally, we provide the necessary and sufficient conditions under which a dual matrix can be expressed as the sum of an idempotent and a nilpotent, and hence have the nil-clean property.

Keywords: Dual Numbers; Idempotent Matrices; Nilpotent Matrices; Nil-Clean Property



ROBIN BOUNDARY-CONDITIONED COMPARISONS OF NUMERICAL RESULTS FROM HERMITE BASIS COLLOCATION FINITE ELEMENT METHODS OF DIFFERENT ORDERS

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ABSTRACT

When the phenomena occurring in nature are carefully examined, it becomes obvious that they appear as mathematical formulas. These formulas are treated as problems and studied under certain constraints. In applied mathematics, equations appropriate to the research theme (the nature of the event being studied) are generally selected under specific initial-boundary conditions and studied numerically and analytically. The equation considered in this study is examined numerically. Contrary to the homogeneous boundary condition used by the majority of the studies found in the literature, a problem with Robin boundary conditions will be addressed to examine the behaviour, thus observing the behaviour under different types of boundary conditions. In addition to the different boundary conditions, the degrees of the basis functions used in the spatial discretization will be selected differently, and the behaviours under three different basis functions will be examined in the present study. The collocation method will be used in the calculations at the nodal points. Instead of approaching the solution region over the entire region, the approach is based on dividing the solution region into equal subintervals and establishing a system of equations that will reach the entire solution region through the typical element(s) equation. Thus, the effects of the solution region are investigated in a way that is reflected in the numerical approach in a more detailed and clear manner. After the numerical schemes are created, a solvable system of algebraic equations is obtained by applying the Robin boundary condition given with the problem, and the corresponding program code is written with the help of the MATLAB program along with these schemes. Thus, numerical results can be obtained for any desired number of partitions. Programs written with basis functions selected from these three different degrees are run, and the numerical results are presented in the study in the form of tables and graphs for comparative analysis.

Keywords: Robin Conditions; Cubic, Quintic and Septic Hermite Basis Functions; Finite Elements Method

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INVESTIGATION OF HERMITE BASIS FUNCTIONS OF DIFFERENT DEGREES UNDER NEUMANN-TYPE BOUNDARY CONDITIONS USING LEGENDRE AND CHEBYSHEV POLYNOMIAL ROOTS

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ABSTRACT

Natural phenomena generally appear before us as mathematical formulas. In applied mathematics, the equations suitable for the nature of the research are typically selected under specific initial and boundary conditions and studied numerically. Instead of the homogeneous boundary condition commonly used in the literature, a Neumann boundary condition problem will be addressed to examine the behaviour, thereby providing an opportunity to study the behaviour under different types of boundary conditions. With the boundary condition being different, the degrees of the basis functions used in the spatial discretization will be selected differently, and the behaviour under three different basis degrees will be observed for the same problem. The collocation method will be used in the calculations at the nodal points. Unlike classical basis applications, internal collocation points will be selected for each different basis degree at these nodal points. For example, when a cubic Hermite basis function is used, two internal collocation points will be selected; when a quintic Hermite basis function is selected, four different internal collocation points will be selected; and when a septic Hermite basis function is selected, six different internal collocation points will be selected for numerical calculations. In the calculations of these internal collocation points, the shifted roots of Legendre and Chebyshev polynomials will generally be used in this study. The finite elements method will be used to approach the solution region. Numerical schemes will be created, and by applying the Neumann boundary condition given by the problem to these schemes, a solvable system of algebraic equations will be obtained. Programs will be written using the obtained scheme and simulated for specific values. The results obtained from the simulation will be presented in the study in the form of graphs and tables, allowing for interpretations of the results.

Keywords: Neumann Type Condition; Hermite Basis Functions; Chebyshev and Legendre Polynomials Roots.

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SOME PROBLEMS OF TRIGONOMETRIC APPROXIMATION ON HEXAGONAL DOMAINS

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ABSTRACT

This study presents a systematic investigation of Fourier series constructed on lattice structures. In the first topic of presentation, fundamental concepts related to lattice structures are presented, and Fourier series defined with respect to these structures are analyzed. In the second topic of part, the notions of hexagonal lattices and hexagonal Fourier series are introduced in detail. Finally, the T-transformation of hexagonal Fourier series associated with matrix A is investigated, and the convergence behavior as well as the approximation rate in the uniform norm are examined.

Keywords: Hexagonal Fourier Series; Hexagonal Lattice; T-Transformation; A-Matrix; Rate of Approximation



ASYMPTOTIC DYNAMICS AND GENERALIZED SOLUTIONS IN ODE–PDE BASED MODELING OF NATURAL PROCESSES

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ABSTRACT

The study and research of differential equations at the doctoral level are not limited to classical solution methods; they are also applied in fields such as the dynamics of economic indicators, population growth charts, the variation of atmospheric pressure with altitude, and more. They form the foundation of both fundamental mathematical theory and modern applied sciences. Ordinary Differential Equations (ODE) (involving a single variable) play a crucial role in control theory, population dynamics, and mechanics. The following ODE models are utilized in population dynamics:

- 1) Exponential Model (Malthus equation)
- 2) Logistic Model (Verhulst equation)
- 3) Predator-Prey Model (Lotka-Volterra equations)
- 4) Spread of Diseases (SIR model)

Partial Differential Equations (PDE) (involving several variables) are applied in many processes such as fluid mechanics, climatology, electromagnetism, quantum mechanics, and heat transfer, as well as in Fourier series, vibration theory, space research, etc. The modern approach here is based on generalized solutions and the application of Sobolev spaces.

The term "differential equation" was first used by Leibniz in 1676. The foundations of this theory were laid in the 18th century by Leibniz and Newton. In fact, Newton discovered this for physics and motion, calling them "fluxions" (\dot{x} using dotted notation). Leibniz, on the other hand, provided a more mathematical notation (the $\frac{dy}{dx}$ form we use today). The primary objective of a differential equation is to determine the law of change of a dependent variable relative to an independent variable and to help predict the asymptotic behavior of the process by describing the rate of change of these quantities. To investigate the dynamic properties of such equations, we consider three aspects of the subject: theory, method, and application. In conclusion, it can be briefly stated that all processes and movements occurring around us are characterized by these equations, which constitute the core of many branches of science alongside modern mathematics.

Keywords: Ordinary Differential Equations (ODE); Partial Differential Equations (PDE); Predator-prey Model; Generalized Solutions; Asymptotic Behavior; Theory of Vibrations



GENERALIZATION OF PÁL (1;0) TYPE INTERPOLATION PROCESS

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ABSTRACT

The aim of this paper study a generalized Pál type interpolation problem when function values are prescribed on the zeros of $aW(x)+bW'(x)$ and the derivatives are prescribed on the zeros of $W(x)$. We obtain the existence , uniqueness and the explicit representation of the interpolatory polynomial. Say $R_{n+n^*-1}(x)$ of degree $\leq n+n^*-1$ and satisfying the following conditions.

$$\begin{aligned} R_{n+n^*-1}(x_k^*) &= y_k^* & k=1,2,3,\dots,n^* \\ R_{n+n^*-1}(x_k) &= y_k & k=1,2,3,\dots,n \end{aligned}$$

where y_k^* and y_k are the arbitrary given real numbers and x_k^* are the zeros of the $aW(x)+bW'(x)$ and x_k are the zeros of $W(x)$

2010 Mathematics subject classification: primary 41A05.

Keywords: Zeros; Interpolation; Pál Type Interpolation



SKREW CYCLIC CODES OVER A NON-CHAIN RING

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ABSTRACT

In this study, skew cyclic codes over the non-chain ring R are investigated. The ring R possesses a rich algebraic structure due to the coexistence of nilpotent elements and a nontrivial idempotent element. By defining a suitable ring automorphism θ on R , the associated skew polynomial ring $R[x; \theta]$ is constructed. Within this framework, skew cyclic codes of length n are characterized as left ideals of the quotient ring $R[x; \theta]/\langle x^n - 1 \rangle$.

Keywords: Non-chain Ring; Skew Cyclic Codes; Ring Automorphism



A NEW SOFT CRYPTOSYSTEM BASED ON KEY-DETERMINED COLUMN PERMUTATIONS

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ABSTRACT

This paper proposes a symmetric soft cryptosystem built on key-driven column permutations within the binary soft-matrix setting. Starting from Molodtsov's soft set framework, soft sets are represented as 0-1 matrices where columns encode parameters and rows encode elements of the universe. A shared key matrix is selected from the space $SM_{\{m \times n\}}$. From this key, a deterministic permutation is produced by mapping each key column vector to a decimal score through a fixed encoding and then ordering the columns from largest to smallest; ties are resolved by prioritizing the smaller column index. The resulting ordering is used to shuffle the columns of a message matrix. After the permutation step, the permuted message is left-multiplied by the key matrix under an XOR-based matrix product defined for the soft-matrix algebra. The same two-stage transformation (permutation followed by XOR multiplication) can be repeated for multiple rounds to strengthen diffusion. For decryption, we show that the XOR-based product is invertible under the stated construction, so the original soft matrix can be recovered by applying the inverse operations in reverse order. Finally, we discuss how the permutation rule and the iterative design influence the effective key space and outline basic security considerations, including determinism, collision behavior in column scoring, and the impact of round count on mixing.

Keywords: Soft Cryptography; Soft Matrices; Column Permutation; Symmetric Encryption; XOR-Based Product



TAYLOR WAVELET METHOD TO NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS

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ABSTRACT

Nonlinear partial differential equations (PDEs) play a crucial role in describing a wide range of physical phenomena and engineering processes. These equations have been solved using various analytical and numerical methods for the last two decades. Obtaining analytical solutions for nonlinear partial differential equations is generally challenging; therefore, numerical techniques are often employed to compute approximate solutions. In this study, Taylor wavelet method (TWM) is developed for the solutions of some nonlinear PDEs. Several supporting theorems are introduced to obtain main convergence theorem while demonstrating the reliability of the approach. One of the important advantages of TWM is that it operates without the need for spatial mesh generation, making it mesh-free. Additionally, the method simplifies the problem by converting the nonlinear partial differential equation into a system of algebraic equations. The resulting system was solved efficiently via MATLAB -2023b. The numerical results are presented by various tables and graphics and also compared to exact solutions and the existing numerical techniques. The numerical experiments demonstrate that TWM achieves reliable and stable solutions even for large time intervals and for relatively small matrix sizes. Moreover, the CPU times also confirm the computational efficiency of proposed method.

Keywords: Nonlinear PDEs, Taylor wavelet method, convergence, numerical analysis



DIFFERENT TYPES OF QUATERNION ALGEBRA CALCULATOR

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ABSTRACT

In this study, quaternions, which constitute an important algebraic structure extending complex numbers, are examined, and a GeoGebra-based algebraic calculator designed for performing operations on different types of quaternions is presented. Due to their non-commutative multiplication and abstract nature, quaternions are often perceived as difficult to understand, especially in the context of abstract algebra education. This study aims to contribute to the learning and teaching of quaternion algebra by providing an interactive and computation-oriented digital tool. The developed application enables users to perform fundamental algebraic operations such as addition, subtraction, multiplication, and inversion on various quaternion types, including real quaternions, pure quaternions, and unit quaternions. The calculator is implemented using GeoGebra's algebraic computation environment, allowing users to input quaternion components and instantly obtain the results of the corresponding operations. In this way, users can explore the algebraic properties of quaternions through direct computation rather than purely theoretical exposition. The application focuses exclusively on the algebraic structure and operational rules of quaternions, without incorporating any geometric or visual interpretations. This design choice allows learners to concentrate on understanding the formal definitions, properties, and operational behaviors of quaternion algebra. During the presentation, the mathematical foundation of the calculator, the implementation of quaternion operations within the GeoGebra environment, and sample computational demonstrations will be discussed. It is expected that the proposed algebraic calculator will serve as an effective supplementary tool for higher education courses in abstract algebra and related fields. Moreover, the study aims to provide an applied example of how dynamic mathematics software can be utilized to support the teaching and learning of advanced algebraic concepts.

Keywords: Quaternion Algebra; Geogebra; Algebraic Calculator; Abstract Algebra; Digital Mathematics Tools



ON THE EXISTENCE AND STABILITY OF POSITIVE SOLUTIONS FOR HADAMARD FRACTIONAL DIFFERENTIAL EQUATIONS ON THE HALF-LINE

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ABSTRACT

In recent years, fractional differential equations have become very popular among researchers. The main reason is that these equations provide more realistic and precise models of physical phenomena compared to ordinary derivatives. While classical derivatives describe the state of a system at a specific moment, fractional derivatives consider the past and memory of the system, they consider the whole history of the process. This feature allows us to build much more accurate models, especially in fields like viscoelastic materials, signal processing, and heat transfer. The primary aim of this presentation is to establish the existence-uniqueness results and the stability analysis for the fractional boundary value problem on an unbounded domain with the help of the Hadamard fractional derivative. Using the Leray-Schauder nonlinear alternative [1] and the Boyd-Wong type fixed point theorem [2], the existence and uniqueness of solutions to considered problem are investigated. Furthermore, we examine the Ulam-Hyers stability [3] of the solutions.

Acknowledgements

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Keywords: Fractional Differential Equations; Hyers-Ulam Stability; Unbounded Domain

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INVESTIGATING NECTARINE MATRICES USING SPLIT-COMPLEX MATRICES

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ABSTRACT

The algebra of real quaternions, also known as Hamiltonian quaternions, is a four-dimensional noncommutative algebra. Besides real quaternions, there exist other noncommutative algebraic structures, one of which is the nectarine algebra, which is also considered in this work. Real quaternions have become increasingly useful in both theory and practice, particularly in linear algebra and matrix analysis. However, the principal difficulty in the study of real quaternion matrices arises from the noncommutative nature of quaternion multiplication. To overcome this issue, a mapping that associates real quaternions with 2×2 complex matrices is introduced and extended to $n \times n$ real quaternion matrices. In particular, the study of real quaternion matrix problems is commonly equivalent to addressing pairs of complex matrices. The aim of this study is to represent a nectarine matrix in split-complex form and to investigate nectarine matrices by exploiting the commutative structure of the split-complex number algebra. First, a brief overview of split-complex numbers, also referred to as hyperbolic numbers, double numbers, perplex numbers, spacetime numbers, and tessarines is given. In addition, brief information on $m \times n$ split-complex matrices is provided. The main constraint in studying nectarine matrices, just as with real quaternions, is the noncommutative multiplication of nectarines. For this reason, a nectarine is represented by a 2×2 split-complex matrix. Then matrices with nectarine entries are investigated using split-complex matrices and their properties.

Keywords: Nectarine; Nectarine Matrix; Split-Complex Number; Split-Complex Matrix



GLIDING DYNAMICS OF MICROSWIMMERS IN NON-NEWTONIAN FLUIDS

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ABSTRACT

This study numerically analyzes the propulsion of a soft nano-robot, modeled as an undulating sheet, through a non-Newtonian fluid within a confining sinusoidal channel. Inspired by spermatozoa navigating the female reproductive tract, such artificial micro-swimmers have potential applications in targeted drug delivery and diagnostics, where motion is often controlled via external electric and magnetic fields. These fields, combined with complex fluid rheology, can modulate swimming speed, a critical factor in processes like fertility control. Using the Stokes flow and long-wavelength approximations, the governing equations are reduced to a fourth-order boundary value problem (BVP) for the stream function. The BVP, featuring the unknown flow rate and swimmer speed, is solved computationally in MATLAB using a modified Newton-Raphson method to enforce dynamic equilibrium. The resulting solution is used to evaluate the mechanical work performed by the microorganism.

Keywords: Microswimmer Propulsion; Electrohydrodynamics; Lubrication Theory; Viscoelastic Fluid; Numerical Boundary Value Problem



STRUCTURAL VARIATIONS IN SOME DORSAL BODY SETAE OF LEDERMUELLERIOPSIS TOLERATUS (ACARIFORMES: STIGMAEIDAE)

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ABSTRACT

Mites are highly diverse in terms of species richness and comprising numerous groups. One of these groups is the family Stigmaeidae, and it is the most species-rich family within the superfamily Raphignathoidea. While some members of this family are parasitic or phytophagous, most are free-living predators that feed on small arthropods. *Ledermuelleriopsis toleratus* Kuznetsov is a species of predatory mite in Stigmaeidae. This species is known to occur in Crimea, Russia, Türkiye and Ukraine. It can be recognized by the presence of vacuolated depressions on the dorsal ornamentation, heteromorphic dorsal body setae and a spine-like accessory claw, as well as the absence of ω solenidion on tarsus IV. During the examination of the Turkish specimens of *L. toleratus*, collected from Karasu Valley, Pülümür Valley and Sansa Gorge in Türkiye, some morphological variations were found in six dorsal body setae (ve , c_1 , d_{1-2} , e_{1-2}) some only female specimens, as well as an abnormality in seta f_1 in one female specimen. Morphological variations and abnormalities in mites can arise from a variety of factors. For instance, developmental errors may occur as a result of genetic effects during embryogenesis or metamorphosis or due to environmental factors such as humidity, temperature, nutritional deficiencies and exposure to toxic substances or parasitism by microorganisms (e.g. viruses, bacteria and protozoa). The anomaly observed in *L. toleratus* is reported for the first time for this species and represents a rare and unique example of abnormality within the genus *Ledermuelleriopsis*. The aim of this study is to document and describe some dorsal setal variations and an abnormality observed in the Turkish specimens of *L. toleratus*, to compare these findings with previous descriptions and to contribute to a better understanding of morphological anomalies within *Ledermuelleriopsis*.

The specimens from the Karasu Valley were obtained through a project supported by the Scientific and Technological Research Council of Türkiye (TÜBİTAK; Project no. 121Z986). Specimens from the Pülümür Valley were collected under TÜBİTAK (Project no. 118Z469), while those from the Sansa Gorge were obtained through a project funded by the Erzincan Binali Yıldırım University Scientific Research Projects Coordination Unit (EBYU-BAP; Project no. FBA-2019-642). The authors gratefully acknowledge TÜBİTAK and EBYU-BAP for their financial support.

Keywords: Acari; Anomaly; Environmental Factors; Female; Morphology



COMPACTNESS PROPERTIES OF QUINTUPLE BAND MATRIX OPERATOR

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ABSTRACT

Compactness is a very powerful property used in many different ways across various fields of mathematics. In functional analysis, especially in infinite dimensional normed spaces, the concept of the measure of noncompactness is widely used in determining the existence of solutions to systems of infinite differential equations. Many problems encountered in real life situations can be described and modeled using infinite systems of ordinary differential equations. Recently, Banaś and Lecko used the technique of measure of noncompactness to prove some existence results for infinite systems of differential equations defined in classical Banach sequence spaces c_0 , c and l_1 . This study has paved the way for the investigation of the compactness properties of various operators defined on some sequence spaces. Accordingly, in this study, we characterize the class of compact matrix operators from the sequence spaces $c_0(G)$, $c(G)$ and $l_\infty(G)$ into c_0 , c and l_∞ , respectively, with the notion of the Hausdorff measure of noncompactness, where G is quintuple band matrix.

Keywords: Matrix Transformations; Matrix Domain; Compact Operators; Hausdorff Measure of Noncompactness; Matrix Classes



SPECTRAL PROPERTIES OF QUADRUPLER BAND MATRIX OPERATOR DEFINED ON THE SEQUENCE SPACE cs

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ABSTRACT

Examined in terms of its historical development, spectral theory, which is directly or indirectly encountered in important disciplines such as geometry, algebra, functional analysis, physics, engineering and applied mathematics, has many applications in fields such as integral equations, linear equation systems, differential equations, Hilbert spaces, the problem of moments, Lebesgue spaces, quantum mechanics, atomic energy, wave equations, wave mechanics, Banach algebras, Fourier transforms, harmonic analysis, ring theory, topological spaces, sequence spaces, and more. Therefore, investigating the spectral properties of some operators encountered in various fields of mathematics and in some abstract spaces is of great importance both for filling gaps in the literature and for seeking solutions to problems that may be encountered in future studies. Based on this information, in this work, we determine the spectrum, point spectrum, residual spectrum, continuous spectrum, approximate point spectrum, defect spectrum, compression spectrum of the quadruple band matrix operator defined on the space of all convergent series, symbolized by cs . The quadruple band matrix is general form of the third order difference, triple band, second order difference, double band (generalized difference) and difference matrices.

Keywords: Spectrum of An Operator; Resolvent Set; Perturbed Operator; Quadruple Band Matrix; Sequence Spaces



SOLUTIONS OF FRACTIONAL DIFFERENTIAL EQUATIONS VIA THE RESIDUAL POWER SERIES METHOD

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ABSTRACT

Fractional differential equations have attracted considerable attention due to their ability to model memory and hereditary effects in various applied problems. In this paper, the Residual Power Series Method (RPSM) is employed to obtain analytical approximate solutions of fractional differential equations in the sense of the Caputo fractional derivative. The method constructs the solution in the form of a fractional power series and determines the unknown coefficients through the residual function, leading to rapidly convergent series solutions. To illustrate the effectiveness of the method, several fractional differential equations are considered. The results indicate that the Residual Power Series Method is a simple, systematic, and efficient technique for solving a wide class of fractional differential equations.

Keywords: Fractional Derivative; Residual Power Series Method; Differential Equations



INTERPOLATING SESQUI-HARMONIC SUBMANIFOLDS ON GENERALIZED SASAKIAN SPACE FORMS

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ABSTRACT

Harmonic and biharmonic maps have attracted increasing attention in various areas of research. For example, they play an important role in variational problems in geometric analysis and in various branches of theoretical physics, such as the study of critical points of nonlinear sigma models and elasticity theory. Recently, interpolating sesqui-harmonic maps have been defined as a generalization of harmonic and biharmonic maps. The map $\varphi: (M, g) \rightarrow (N, h)$ between Riemannian manifolds is called interpolating sesqui-harmonic if it is a critical point of $E_{\delta_1, \delta_2}(\varphi)$

$$E_{\delta_1, \delta_2}(\varphi) = \delta_1 \int_{\Omega} \|d\varphi\|^2 dv_g + \delta_2 \int_{\Omega} \|\tau(\varphi)\|^2 dv_g \quad (1)$$

where Ω is a compact domain of M and $\delta_1, \delta_2 \in \mathbb{R}$. The functional (1) is commonly used in string theory of physics. In this study, we consider interpolating sesqui-harmonic submanifolds on generalized Sasakian space forms. We find the necessary and sufficient conditions for submanifolds on generalized Sasakian space forms to be interpolating sesqui-harmonic. Then, we analyze interpolating sesqui-harmonic submanifolds in this space. Finally, we consider interpolating sesqui-harmonic integral submanifolds on Sasakian space forms and give an example.

Keywords: Interpolating sesqui-harmonic; Biharmonic; Generalized Sasakian Space Form



GRAPH ATTENTION NETWORKS WITH TOPOLOGICAL INFORMATION FOR NODE CLASSIFICATION ON CORA

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ABSTRACT

Graphs consist of nodes (V) and edges (E) that represent the relationships between these nodes. Many real-world problems such as social networks, academic citation networks, and biological interaction networks can be modeled using graphs. Mathematically, a graph is defined as

$$G = (V, E) \quad (1)$$

A Graph Attention Network (GAT) is a graph neural network architecture that utilizes an attention mechanism. In classical GNN and GCN approaches, neighboring nodes are generally aggregated with equal weights, whereas this assumption is limited in heterogeneous graphs. In the GAT architecture, the importance between two nodes is computed using a content-based attention score e_{ij} . This score is typically defined as

$$e_{ij} = \text{LeakyReLU}(a^T [Wh_i \parallel Wh_j]) \quad (2)$$

The computed e_{ij} values are normalized across the neighbors of the target node using the softmax function to obtain the attention coefficients α_{ij} :

$$\alpha_{ij} = \frac{\exp(e_{ij})}{\sum_{k \in \mathcal{N}(i)} \exp(e_{ik})} \quad (3)$$

In this way, more informative neighbors receive higher weights for each node. The attention coefficients α_{ij} are used to aggregate weighted information from neighboring nodes and update node representations as shown in Equation (4):

$$\mathbf{h}_i^{(l+1)} = \sigma \left(\sum_{j \in \mathcal{N}(i)} \alpha_{ij} Wh_j \right) \quad (4)$$

In this study, the CORA citation network dataset was used for the node classification task. In CORA, nodes represent academic papers, while edges represent citation relationships between them. In the GAT model, the attention score unlike classical approaches captures graph topology beyond simple neighborhood aggregation. In this context, k-hop neighborhood information between nodes is incorporated into the attention mechanism. The model was evaluated on the CORA dataset using metrics such as Accuracy, Precision, Recall, and F1-score. The results demonstrate improvements in classification performance and enhanced discriminative power of node representations.

Keywords: Graph Attention Network (GAT); Graph Neural Networks (GNN); Attention Mechanism; Node Classification; CORA Citation Dataset; Graph Representation Learning



BRAIN TUMOR CLASSIFICATION FROM MRI IMAGES VIA DEEP FEATURE EXTRACTION AND INTUITIONISTIC FUZZY LOGIC INTEGRATION

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ABSTRACT

Precise classification of brain tumors are pivotal for effective treatment planning and improving patient survival rates. Although Magnetic Resonance Imaging (MRI) provides high-resolution soft tissue contrast, the delineation of tumor boundaries is often complicated by noise, artifacts, and the inherent ambiguity of transition zones between pathological and healthy tissues. Traditional clustering and classification methods often fall short in modeling this uncertainty. This study proposes a novel hybrid framework that integrates the feature extraction capabilities of Deep Learning with the uncertainty management principles of Intuitionistic Fuzzy Logic (IFL). In the proposed methodology, MRI images obtained from open-source repositories undergo preprocessing for noise reduction and normalization. Rather than relying on raw pixel intensities, a Convolutional Neural Network (CNN) is utilized to extract high-level deep features. Subsequently, an Intuitionistic Fuzzy C-Means (IFCM) algorithm is employed for segmentation. Unlike standard fuzzy sets, IFCM incorporates membership, non-membership, and hesitation degrees, thereby providing a more robust mechanism for handling boundary ambiguity. The classification of the segmented regions is performed using an Intuitionistic Fuzzy K-Nearest Neighbors (IFKNN) algorithm, which utilizes a hesitation-aware voting scheme. The study presents a comparative analysis of the proposed hybrid model against classical approaches. The framework is designed to evaluate performance metrics such as accuracy, precision, and F1-score. It is anticipated that the integration of deep features with intuitionistic fuzzy logic will mitigate false positives in boundary regions and offer a more reliable decision support tool for clinical diagnosis compared to conventional methods.

Keywords: Brain Tumor Classification; MRI; Intuitionistic Fuzzy C-Means (IFCM); IFKNN; Deep Learning; Uncertainty Modeling



APPROXIMATION SOLUTION OF GENERALIZED VARIATIONAL INCLUSION

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ABSTRACT

We introduce generalized B^1 -accretive mappings, a novel concept constructed as the sum of two symmetric accretive mappings. This expands upon the C_n -monotone mapping established by Nazemi [18]. We define the proximal point mapping for B^1 -accretive mappings and demonstrate its Lipschitz continuity. Applying this new proximal point mapping, we investigate a set-valued variational inclusion problem in q -uniformly smooth Banach spaces. Furthermore, we propose an iterative scheme incorporating B^1 -accretive mappings to solve this variational inclusion problem, detailing its convergence criteria with appropriate assumptions. Our work includes constructed examples and illustrative graphics to showcase the convergence of the generated iterative sequences.

Keywords: B^1 -accretive Mappings; Proximal-Point Mapping; Iterative Algorithm; Variational Inclusion



EXTENDED NONLINEAR VARIATIONAL INEQUALITIES

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ABSTRACT

This paper investigates a novel class of generalized systems that extend nonlinear variational inequalities, involving $3k$ -distinct nonlinear relaxed cocoercive operators. We analyze the corresponding fixed point problem associated with this generalized system and develop explicit k -step iterative methods based on projection operators. By reformulating the problem as an equivalent fixed point problem, we propose k -step Gauss–Seidel-type iterative algorithms to compute approximate solutions. Convergence of the proposed k -step explicit iterative methods is rigorously established. Furthermore, several special cases of the extended variational inequalities system are discussed to illustrate the scope of the results.

Keywords: k -step Gauss–Seidel-type Iterative Algorithm; Generalized System of Extended Nonlinear Variational Inequalities; Projection Method; Relaxed (α, β) -cocoercivity; Lipschitz Continuity



RETHINKING INTRAUTERINE DEVICE DESIGN FOR EFFECTIVE PREVENTION OF INTRAUTERINE ADHESIONS

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ABSTRACT

Intrauterine adhesions (IUAs), also known as synechiae or Asherman syndrome, are significant complications following operative hysteroscopy, particularly after procedures involving extensive endometrial damage. These adhesions may result in menstrual disturbances, infertility, and adverse reproductive outcomes. The objective of this study is to summarize current strategies for the prevention of intrauterine synechiae after operative hysteroscopy, with a particular emphasis on the role of intrauterine devices (IUDs) as mechanical barriers. **Materials and Methods:** A narrative review of the literature was conducted focusing on the prevention of postoperative synechiae following operative hysteroscopy. Preventive strategies evaluated included surgical technique optimization, mechanical barriers such as intrauterine devices and balloon catheters, anti-adhesive agents—particularly hyaluronic acid-based gels—and postoperative hormonal therapy. The indications, effectiveness, advantages, and limitations of IUD use were specifically analyzed. Currently, the variety of IUDs available is limited. Devices containing copper or inert plastic materials are considered suitable for adhesion prevention. However, commonly used T-shaped or Multiload IUDs may be insufficient, as they do not completely fill the uterine cavity. Previously used devices such as Lippes Loop and T-coil IUDs, which were more prevalent approximately 30 years ago, appeared to be more suitable for this purpose due to their cavity-filling design. **Results:** The development of intrauterine synechiae is closely associated with basal endometrial injury and prolonged contact between opposing uterine walls during the healing process. Mechanical barriers play a crucial role in preventing this contact. Copper-containing IUDs act as spacers that help maintain uterine cavity patency, particularly following extensive adhesiolysis. However, IUDs alone do not actively promote endometrial regeneration. Anti-adhesive hyaluronic acid gels have demonstrated superior efficacy in reducing adhesion formation, while postoperative estrogen therapy supports endometrial healing. Combined treatment approaches yield better outcomes, especially in moderate to severe cases. Therefore, IUDs with an appropriate design that adequately fills the uterine cavity should be preferred. **Discussion and Conclusion:** To improve the prevention of postoperative intrauterine adhesions, an IUD composed of inert, biocompatible materials and capable of completely filling the uterine cavity should be developed. The use of such a device as part of a combined treatment strategy following hysteroscopic intrauterine surgery may provide more effective protection against the development of intrauterine adhesions.

Keywords:

Hysteroscopy; Intrauterine Adhesions; Intrauterine Device; Adhesion Prevention



LEARNING-BASED SOLVERS FOR DISCRETE NONLINEAR ANISOTROPIC p -LAPLACIAN EQUATIONS

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ABSTRACT

We study a two-dimensional discrete Dirichlet boundary value problem driven by the anisotropic variable-exponent $p(\cdot)$ -Laplacian. Using a variational (energy minimization) framework and critical point theory, we establish existence of at least one weak solution under standard growth assumptions on the nonlinear term. We then approximate solutions numerically with a physics-informed neural network (PINN) implemented on the discrete grid and compare its behavior with a Jacobian-free Newton–Krylov solver. Our experiments indicate that PINNs provide stable and robust approximations across strongly nonlinear regimes where Krylov-type methods may suffer from convergence difficulties.

Keywords: Discrete Boundary Value Problem; Anisotropic $p(\cdot)$ -Laplacian; Weak Solution; Variational Minimization; Physics-informed Neural Networks (PINNs); Newton–Krylov Methods



NONLINEAR DYNAMICS AND CHAOS CONTROL IN A DISCRETE PREDATOR- PREY SYSTEM: STABILITY ANALYSIS, BIFURCATION STRUCTURE, AND NUMERICAL INVESTIGATIONS

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ABSTRACT

This work provides a detailed qualitative analysis of a discrete-time predator-prey model, focusing on the stability of biologically feasible equilibria and the emergence of complex dynamics. Local stability conditions are established using linearization, and the system's bifurcation structure is examined to identify critical transitions in behavior. Particular attention is given to codimension-one bifurcations that signal shifts from regular dynamics to chaotic regimes. The study further investigates the onset and progression of chaos through bifurcation diagrams and explores routes to chaotic behavior. To mitigate unpredictability, several chaos control strategies are implemented and evaluated for their effectiveness in restoring stable dynamics. Numerical simulations complement the theoretical analysis, illustrating bifurcation scenarios, chaotic attractors, and controlled states. The findings underscore the intricate nonlinear interactions governing predator-prey systems and offer practical approaches for managing chaotic dynamics in discrete ecological models. This research contributes to a deeper understanding of stability and control in complex population systems.

Keywords: Predator-prey Interaction; Stability analysis; Bifurcation Analysis; Chaos Control



GENERALIZATION OF ONE PARAMETER CONTINUOUS MODEL WITH APPLICATION IN ACCELERATED LIFE TESTING DATA

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ABSTRACT

In many fields, including computer science, hydrology, management, physics, health sciences, actuarial science, engineering, and biological sciences, lifetime data modelling and analyses are essential. Numerous classical probability distributions are crucial in dealing with both small and large data sets. Most of the classical or conventional probability models that are in use do not adequately account for the real data, which raises a number of serious concerns. In this regard, it is crucial to increase the adaptability of current probability models by combining two distributions or including new parameters. In this paper, we propose and investigate a novel two-parameter generalisation of the XLindley distribution, and we apply it to the modelling of time-to-event data set. We concentrate on researching practical survival and reliability properties, such as hazard rate, reversed hazard rate, stress-strength reliability, etc., in addition to the various structural and distributional characteristics of the proposed two-parameter XLindley distribution. We used maximum likelihood technique for estimating unknown parameters. For the proposed model, Renyi entropy and distributions of order statistics are examined. In order to track trends in the estimating process, a Monte-Carlo simulation study is carried out. The proposed model is compared with some other well-known lifetime models after a data set of time-to-event data from real life is analysed.

Keywords: Maximum Likelihood; Order Statistics; Renyi Entropy; Simulation; Stress-strength Reliability



NEW SUBFAMILIES OF MEROMORPHIC FUNCTIONS: ANALYTIC CONDITIONS AND COEFFICIENT ESTIMATES

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ABSTRACT

Let M is the family of meromorphic functions, which have the representation

$$f(z) = \frac{1}{z} + \sum_{n=0}^{\infty} a_n z^n$$

and be analytic in the punctured unit disk $D^* = \{z \in \mathbb{C} : 0 < |z| < 1\}$. In recent years, obtaining results related to meromorphic functions has been of significant importance for the development of geometric function theory. In this presentation, we introduce and investigate several new subfamilies of meromorphic functions defined under various analytic conditions. The primary objective of this study is to establish necessary and sufficient conditions for functions belonging to these subclasses. Furthermore, coefficient estimates for functions in the proposed classes are derived.

Keywords: Analytic functions, Meromorphic functions, Coefficient Estimates, Subordination.

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ASSESSMENT OF PSYCHOMETRIC PROPERTIES OF MATHEMATIC BASIC EDUCATION CERTIFICATE EXAMINATION ITEMS IN PLATEAU NORTH SENATORIAL ZONE NIGERIA

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ABSTRACT

This study examined the psychometric properties of Mathematics items in the Basic Education Certificate Examination (BECE) in Plateau North Senatorial Zone, Nigeria. The quality of the examination items was assessed in terms of item difficulty, item discrimination, and guessing parameters across different subgroups using Item Response Theory (IRT) approaches. A descriptive survey research design, specifically a cross-sectional survey design, was adopted. The population comprised 27,869 and 29,773 upper basic students' Mathematics BECE scripts for the years 2023 and 2024, respectively, drawn from 806 schools across six Local Government Areas in the zone. The sample consisted of three LGAs and 81 schools selected using multistage and proportional stratified sampling techniques, including public and private schools in urban and rural areas. All students' scripts from the selected schools were used, yielding 1,618 scripts in 2023 and 1,300 scripts in 2024. The sample size satisfied the minimum requirement ($N \geq 1000$) for stable parameter estimation under the three-parameter logistic model (3PLM). Data were obtained from the Mathematics BECE question papers and students' scripts for both years. Model fit and test information functions were also examined. The findings revealed that the item difficulty parameters for both 2023 and 2024 ranged from easy to moderately difficult. The study recommends the adoption of the IRT framework in BECE item analysis to enhance test quality and enable accurate placement of candidates based on their ability levels.

Keywords: Mathematics; Psychometric Properties; Basic Education Certificate Examination



INFLUENCE OF FORMATIVE ASSESSMENT ON STUDENTS' MATHEMATICS TEST ANXIETY AND PERFORMANCE IN JOS EAST, PLATEAU STATE, NIGERIA

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ABSTRACT

The study examined the effect of formative assessment on mathematics test anxiety and performance among Senior Secondary One students in Jos East Local Government Area of Plateau State, Nigeria. A cross-sectional survey research design was employed, and a sample of 200 students participated in the study. Data were collected using two instruments: a mathematics test anxiety questionnaire containing 15 items, and a 13-item checklist designed to determine the extent to which mathematics teachers implemented formative assessment strategies during instruction. Simple counts and percentages were used to answer the research questions, while mean, standard deviation, and independent-samples t-test were utilized to test the stated hypotheses. The results revealed that several mathematics teachers did not consistently use formative assessment practices during classroom instruction. This lack of formative assessment was associated with heightened test anxiety and poor performance among students. Based on these findings, the study recommended the need for capacity-building programmes for mathematics teachers, including training to enhance their knowledge and application of formative assessment techniques. Additionally, regular workshops, seminars, and in-service training should be organized to support teachers in adopting more effective instructional practices. The study further suggested that similar research be conducted in other Local Government Areas to better understand the influence of mathematics test anxiety on students' academic performance.

Keywords: Formative Assessment; Mathematics; Test Anxiety; Performance



ASSESSING THE EFFICACY OF DIFFERENTIATED MATH INSTRUCTION TRAINING USING SOLOMON FOUR-GROUP DESIGN

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ABSTRACT

Introduction and Objective: Differentiated instruction has become an essential pedagogical approach in addressing the diverse learning needs present in secondary mathematics classrooms. However, many teachers lack adequate training to effectively implement differentiated strategies such as tiered tasks, flexible grouping, and formative assessments. This study aims to evaluate the effectiveness of a structured training program on differentiated mathematics instruction for secondary school teachers using the Solomon Four-Group Experimental Design, thereby determining its impact on pedagogical competence and teacher confidence. **Materials and Methods:** A total of 100 secondary mathematics teachers from public and private schools were randomly assigned to four groups: two experimental (one with pretest, one without) and two control (one with pretest, one without). The intervention consisted of a **two-week training module** covering differentiated instruction principles and strategies tailored for mathematics teaching. Data were collected through pretests, post-tests, and a post-intervention perception survey. Statistical analyses included ANCOVA, t-tests, ANOVA, and correlation analysis to determine differences in pedagogical competence and instructional confidence across groups. **Results:** Teachers in the experimental groups demonstrated significantly higher post-test scores in pedagogical competence compared to those in the control groups ($p < .01$). No significant testing effect was found between pretested and non-pretested groups, supporting the internal validity of the Solomon design. Additionally, teachers who received the intervention reported higher confidence levels in applying differentiated instruction strategies ($M = 4.35$, $SD = 0.51$ on a 5-point scale), reflecting increased self-efficacy following the training. **Discussion and Conclusion:** The study confirms that structured training in differentiated instruction substantially enhances teachers' pedagogical competence and preparedness to address diverse learner needs in mathematics. The absence of significant testing effects strengthens the validity of the findings. Post-intervention confidence gains and increased reported use of differentiated strategies highlight the value of evidence-based professional development. To sustain these outcomes, teacher training institutions and policymakers are encouraged to implement and scale similar programs that foster inclusive, adaptive, and student-centered instructional practices.

Keywords: Differentiated Instruction; Mathematics Education; Teacher Training; Solomon Four-Group Design; Experimental Research; Pedagogical Competence



TRAINING OF MARINE ENGINEERS THROUGH MULTIMEDIA SIMULATOR PROGRAMS AND HUMAN CAPITAL DEVELOPMENT

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ABSTRACT

Introduction and Objective: The maritime industry requires highly qualified marine engineers capable of operating complex technical systems in compliance with international safety and environmental standards. In recent years, the increasing digitalization of maritime operations has emphasized the need for innovative training approaches. This study aims to examine the effectiveness of multimedia simulator programs in the professional training of engine room watch personnel and to evaluate their contribution to human capital development in the maritime sector of the Kazakhstan region of the Caspian Sea. **Materials and Methods:** The research is based on a qualitative and analytical review of modern multimedia simulator programs used in maritime education. The study analyzes their compliance with the requirements of the STCW-78/95/2010/2021 International Convention and evaluates their role in integrating theoretical knowledge with practical skills. Comparative analysis of traditional and simulator-based training methods was conducted, taking into account technical, educational, and socio-economic aspects. **Results:** The results of the study demonstrate that multimedia simulator-based training significantly improves the professional competence of marine engineers. The use of simulators enhances practical skills, increases occupational safety, and reduces the likelihood of errors caused by the human factor. Furthermore, simulator programs contribute to better preparedness of personnel for real operating conditions and complex emergency situations. **Discussion and Conclusion:** The findings confirm that multimedia simulator technologies are an effective tool for improving the quality of maritime education and training. From a socio-economic perspective, their implementation supports lifelong learning, strengthens professional qualifications, and enhances the quality of human capital in the maritime industry. The integration of scientifically grounded simulator-based training methodologies can contribute to sustainable development and increased efficiency of marine operations in the Kazakhstan sector of the Caspian Sea.

Keywords: Simulator Programs; Marine Engineers; Professional Training; Human Capital



AN EMPIRICAL STUDY OF PERSONALIZED COMPUTER SCIENCE INSTRUCTION IN KAZAKHSTANI SECONDARY SCHOOLS

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ABSTRACT

Background and Aim: Personalized learning is widely recognized as an effective pedagogical approach that accommodates learners' individual abilities, interests, and learning pace. However, empirical evidence on the implementation of personalized instruction in secondary school computer science education—particularly in the programming component—remains limited in the context of Kazakhstan. This study aims to examine the current state of personalized computer science teaching in Kazakhstani secondary schools, analyze students' learning difficulties in programming, and assess the extent to which personalized learning practices are adopted by teachers and schools. **Methods:** A quantitative survey was conducted among students, computer science teachers, and representatives of educational authorities in the Zhambyl region. The student sample comprised 158 learners from grades 7–10, including 55 students from general secondary schools and students from Nazarbayev Intellectual Schools in Taraz. Additionally, 166 computer science teachers and education sector representatives participated in the study. The survey addressed students' interest in programming, perceived learning difficulties, levels of teacher support, attitudes toward personalized learning, and the availability of educational resources and infrastructure. The data were analyzed using descriptive statistical methods. **Results:** The findings indicate that 95% of students demonstrate a strong interest in the programming component of computer science, while all respondents acknowledge its importance for future education and careers. The perceived difficulty of programming was rated as moderate (3.0–4.0 on a five-point scale), suggesting persistent challenges in specific topics. Teacher support was rated highly (mean score: 4.4); however, 80% of students reported not using supplementary learning resources. Among teachers, 40% indicated a lack of methodological materials for personalized instruction, and 80% emphasized the need for improved access to digital platforms and online resources. Educational authorities rated schools' technical infrastructure as inadequate (mean score: 2.3), identifying resource limitations as a major barrier to the implementation of personalized learning. **Conclusion:** Despite strong interest in personalized learning among students and teachers, its effective implementation is constrained by methodological, technical, and organizational challenges. Insufficient infrastructure, limited instructional support materials, restricted access to digital platforms, and increased teacher workload impede sustainable adoption. The study highlights the need for the development of targeted methodological resources, systematic investment in school infrastructure, and the integration of digital educational platforms to support personalized computer science education in secondary schools in Kazakhstan.

Keywords: Personalized Learning; Computer Science Education; Programming; Secondary Education; Educational Resources; Kazakhstan



SIMULATION-BASED EXAMINATION OF WINDOW THERMAL INSULATION PERFORMANCE IN A RESIDENTIAL BUILDING RENEWED THROUGH URBAN TRANSFORMATION

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ABSTRACT

In Türkiye, it is generally assumed that newly constructed residential buildings renewed through urban transformation projects are designed in compliance with the provisions of the TS 825 Thermal Insulation Regulation. However, in practice, the thermal insulation performance of double-glazed window systems is often evaluated primarily based on the definitions of “new building” and “double glazing,” while the extent to which this performance satisfies the regulatory limit values is not sufficiently examined through quantitative methods. Nevertheless, windows constitute one of the main components of the building envelope where heat losses are concentrated and therefore play a significant role in overall energy efficiency. The aim of this study is to assess the compliance of double-glazed window systems used in a newly renewed apartment building within the scope of urban transformation with the TS 825 Thermal Insulation Regulation by means of the DesignBuilder simulation software, and to indicate that window thermal insulation performance may contribute to sustainability through the reduction of heating energy demand. Within this framework, the thermal transmittance values of the existing double-glazed window system were defined in the DesignBuilder model, and a comparative evaluation was conducted using an alternative window scenario corresponding to the limit values specified in TS 825. The simulation results suggest that, despite being a newly constructed building renewed through urban transformation, the existing window system does not fully comply with the limit values prescribed by TS 825. This outcome indicates that, in new building production, window systems should be assessed not only in terms of their typological definitions but also with respect to their thermal insulation performance. The study underlines that enhancing window thermal insulation performance may represent an important component contributing to a sustainable building approach by reducing heating energy demand.

Keywords: TS 825, Double-Glazed Window; Thermal Insulation Performance; DesignBuilder; Urban Transformation



MATERIAL-MODEL RELATIONSHIP IN COMPLEX ARCHITECTURAL FORMS OF THE 21st CENTURY: AN EXAMINATION OF SMART MATERIALS AND EMERGING DESIGN APPROACHES

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ABSTRACT

This study aims to evaluate the relationship between complex architectural forms designed in the 21st century and the smart materials that have been developed and used, and to examine this relationship through selected case study buildings. Within this scope, it addresses how architectural structures are shaped by the materials used in line with cultural, social, economic, and especially technological factors, and how they are reinterpreted within the framework of new concepts and new design approaches. In the study, using a qualitative analysis method, modern building materials that began to be used in architecture in the 20th century along with new production techniques and technological developments, and the effects of these materials on architectural design, are first examined. During the review process, the physical, chemical, and aesthetic properties of materials are taken as a basis; how these properties evolved with technological developments after the Industrial Revolution and what new expressive possibilities they offered to architectural forms are supported by a literature review. In addition, how the structural properties of natural materials, reconsidered with the advancement of technology, affect architecture, and how smart materials shape architectural applications, are analyzed through selected example buildings. As a result of the examinations and analyses conducted, it is revealed that in the 21st century, material has become not only a building component in architecture but also a fundamental element that guides the design process. These relationships are evaluated in detail through example buildings such as Dominus Winery, the Watercube (Beijing), and the Guggenheim (Bilbao). The findings obtained in line with the examined examples show that smart materials provide flexibility and functionality to architectural form, increase the building's environmental compatibility, and enhance its durability performance. In addition, it is observed that they make possible the development of new design approaches such as ecological, organic, parametric, and genetic design. Moreover, it is emphasized that computer-aided design processes constitute a foundation for the architecture of the future. As a result, 21st-century architectural designs are largely shaped through smart materials and form an important infrastructure for future architectural productions. In this respect, architecture stands out as a dynamic field that strengthens interdisciplinary relationships and enables the development of innovative and alternative design approaches.

Keywords: Smart Materials; Complex Architectural Forms; Material–Model Relationship; Technological Transformation; Ecological Architecture; Organic Architecture; Computer-Aided Design



REPRESENTATION OF INDUSTRIAL MEMORY: HISTORIC RAILWAY WORKSHOPS IN TÜRKİYE

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ABSTRACT

This research aims to examine 'adaptive re-use' practices as an unignorable global approach within the scope of preserving industrial heritage structures, using Türkiye's Historic Railway Workshops as case studies, and to evaluate them in terms of urban, industrial, and spatial memory. Industrial heritage structures shed light on the socio-economic, urban and social development of countries. As is the case worldwide, in our country too, while some production facilities are lost during the industrial development process, others strive to adapt to technology through structural and spatial adaptations, and some continue to exist to be used for new functions. This study contains assessments aimed at revealing the current status of the Historic Railway Workshops, which possess significant knowledge about Türkiye's recent history, as urban and spatial memory spaces. The Railway Workshops, where locomotives and carriages were manufactured and technically maintained, emerged as a result of the Industrial Revolution's impact on Türkiye, which resonated throughout the world. These structures, which served the railway transport that began to develop in the Ottoman Empire, especially from the last quarter of the 19th century onwards, are fundamental building blocks of the industrialisation process in Türkiye. The Historic Railway Workshops located in Istanbul, Ankara, Eskişehir, and Sivas are important examples, forming key points in the railway network. Today, the Railway Workshops, which raise social awareness with their new functions open to public use, have become important socio-cultural components of the cities they are located in. The elements related to the industrial and spatial memory of these structures have great value to these spaces. The architectural formations, spatial organisations, and usage scenarios of Historic Railway Workshops over time constitute parts of the city's memory as a whole. Therefore, within a conservation approach, from the perspective of collective memory, Railway Workshops should be evaluated not only as physical structures but also as industrial memory spaces.

Keywords: Industrial Heritage; Adaptive Re-use; Historical Railway Workshops; Spatial Memory



**SUSTAINABLE PUBLIC SPACES;
AN ASSESSMENT BASED ON INTERNATIONAL EXAMPLES**

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ABSTRACT

Public spaces are places where individuals gather, socialize, form collective memory, and engage in democratic participation. From the agoras of ancient Greece to today's urban parks, the form and function of public space has evolved in parallel with the social structure of societies. The concept of sustainability, in general terms, refers to the capacity of a situation or process to be maintained over an indefinite period of time. This concept is fundamentally understood as the ability of ecology and ecological systems to continue their functions, processes, and productivity in the future. Public spaces are not merely physical voids; they are places that strengthen social interaction and improve quality of life. In this context, the sustainable design of public spaces aims to offer spatial solutions that support social equality and economic continuity, along with design approaches that consider ecological balance. This study aims to address the sustainable transformation of public spaces within the framework of social, environmental, and economic sustainability. In this context, international public space examples selected through a literature review were examined and evaluated in terms of ecological restoration, social inclusiveness, accessibility, and spatial quality. The examples examined include Superkilen Park (Copenhagen), Parc de la Villette (Paris), Cheonggyecheon Stream (Seoul), High Line Park (New York), Tempelhofer Feld (Berlin), and Millennium Park (Chicago). The findings reveal that sustainable public spaces are not limited to the creation of green areas, but are also places that support social integration, generate economic vitality, and recovery ecological systems. In particular, it has been observed that converting areas that previously served different functions into public spaces through sustainable design decisions contributes to both environmental and social improvement in cities. In this context, increasing user participation in design processes, making public spaces accessible to everyone, and addressing ecological restoration strategies at the planning scale provide a guiding framework for a sustainable urban future.

Keywords: Sustainability; Sustainable Public Space; Social Sustainability; Public Space Design



ROLE AND IMPORTANCE OF ARCHITECTS IN ENHANCING LANDSCAPE DESIGN IN CITIES

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ABSTRACT

Green spaces play a crucial role in urban environments, often referred to as the "lungs of the city." The architect is pivotal in enhancing the usability, accessibility, and ecological integrity of these green spaces, possessing the foresight to shape the future of urban landscapes. This paper examines the integral role architects play in the integration of landscape design within urban frameworks. It delves into the collaborative processes between architects and various stakeholders aimed at creating visually appealing and functional landscapes that elevate urban living standards. Furthermore, it underscores the architects' advocacy for public spaces and green infrastructure within urban development policy, alongside leveraging technological advancements to optimize interactions between the built environment and natural ecosystems. The discourse highlights the ways architects are fostering the rising trend of landscape design in urban settings through innovative design approaches, collaborative initiatives, and advocacy for green spaces. It stresses their vital contributions to developing landscape designs that are sustainable, resilient, and aesthetically harmonious, facilitating a symbiotic relationship between urban developments and the natural environment.

Keywords: Landscape Design; Outdoor Design; Garden Design; Plantation Design; Greening Design; Built Environment



INTEGRATION OF NATURAL LIGHTING IN THE DESIGN OF ONCOLOGY CENTRE IN MINNA, NIGER STATE, NIGERIA

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ABSTRACT

Introduction and Objective: Nigeria faces a rising cancer burden with approximately 124,000 new cases annually, yet Minna, Niger State, lacks dedicated oncology facilities, compelling patients to seek treatment in distant cities. Integrating daylighting in tropical healthcare settings presents unique challenges, requiring contextually adapted strategies to manage intense solar radiation while maintaining thermal comfort and functional illumination. This study aims to design an oncology centre in Minna that effectively integrates natural lighting to enhance patient well-being, staff efficiency, and environmental sustainability. **Materials and Method:** A mixed-method research design was employed, integrating qualitative data from case studies with quantitative data from structured questionnaires administered to 10 healthcare professionals, including nurses and administrators. The instrument achieved high reliability (Cronbach Alpha=0.874), and data analysis utilised descriptive statistics to identify key patterns. **Results:** Analysis revealed that 100% of respondents agreed that natural lighting improves staff efficiency in tasks like reading charts and diagnosis. Additionally, 60% supported natural lighting as a major design consideration. However, mixed perceptions emerged regarding psychological benefits, with 40% strongly agreeing that it reduces stress, while 40% expressed neutral or disagreeing views, highlighting a need for evidence-based design. **Discussion and Conclusion:** The proposed design integrates passive and active strategies tailored to Minna's tropical savanna climate. Key features include light shelves positioned 2.5 meters above floor level, high-performance glazing with 60–70% visible light transmittance, and automated external shading systems using vertical geometric perforated fins with selective horizontal overhangs. Interior finishes with ceiling reflectance above 80% and wall reflectance between 50–70% optimize distribution. Daylight-responsive controls are projected to reduce energy consumption by 50–60%. This research fills a critical gap regarding occupant perceptions in African oncology settings, offering a replicable framework for sustainable healthcare architecture that advances sustainable development goals in resource-limited environments.

Keywords: Natural Lighting; Oncology Centre; Tropical Savanna Climate; Daylighting; Strategies; Healthcare Architecture; Minna; Niger State



FUNCTIONAL ADAPTATION OF TEXTILE PRODUCTS IN UPCYCLING PROCESS: AN EXPERIMENTAL PRODUCTION APPLICATION

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ABSTRACT

The textile industry is among the sectors that cause high amounts of waste generation due to the consumption of natural and artificial raw materials and water. With evolving technological advancements, demands and expectations, and fashion trends, millions of tons of textile waste are generated worldwide every year. This waste is either sent to landfills or incinerated. In the long term, this leads to an increased environmental burden and the loss of natural resources. The upcycling approach, which aims to transform waste into higher value-added products while preserving its existing physical properties without subjecting it to any chemical recycling process, offers a significant alternative in terms of sustainable waste management. This study examines an application of upcycling textile products for reuse. In this application, end-of-life textile materials were selected and a functional product was obtained using mechanical processes (cutting, joining, and sewing) that do not require energy, water, or chemical consumption for ready-to-wear garment production. The aim of the study is to demonstrate the contribution of the upcycling approach to reducing textile waste. The findings show that textile products can be reused while preserving its physical properties, and that the upcycling method has a lower environmental impact compared to traditional recycling processes. Furthermore, the application process was found to be effective in developing sustainability awareness and raising awareness about the concept of waste. In conclusion, this study demonstrates that upcycling-based applications can be used as an environmentally friendly, low-cost, and feasible method for evaluating textile waste.

Keywords: Sustainability; Upcycling; Functional Textile Products



ARTIFICIAL INTELLIGENCE APPLICATIONS IN THE CIRCULAR ECONOMY: A LITERATURE REVIEW ON MATHEMATICAL APPROACHES

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ABSTRACT

The take-make-dispose model is linear, meaning it represents a wasted resource model of economy, causing damage to both natural resources and ecosystems. The line of circular economy is avoiding waste and damages through the extension of the life of products and materials via the principles of reuse, remanufacturing, and recycling. Both conceptual models and measurable indicators and performance assessment systems can be developed for circular economies, while the absence of quantifiable circular economy methods may result in process loss and inefficient management. Artificial intelligence is, in this scenario, the main resource for studying and managing the circular economy systems. The AI systems can be considered more than a supportive tool; with respect to a circular economy, they can also be a real supportive tool to ‘economy’ to support data-based decision making. AI and its components, machine learning, deep learning, natural language processing, computer vision, and robotics, and automation can be used in this context. This research investigates the use of artificial intelligence in waste management and recycling, as well as in the supply and energy systems of the circular economy, with a focus on construction, textiles, and materials. The objective is to articulate the effects of the use of artificial intelligence on the various modifications and advantages in processes documented in the literature. Additionally, it addresses the critical factors that may generate various types of gaps in the adoption processes, as well as the means of coping with such quadrants. The literature review provides a comprehensive analysis of the role of artificial intelligence in the efficient and sustainable utilisation of the circular economy. The originality of this study stems from the fact that it methodically differentiates various AI applications in the circular economy based on the different types of underlying mathematics and logic of the associated decision-making processes

Keywords: Artificial Intelligence; Sustainability; Circular Economy; Optimisation



CORRECTING THE TURKISH SPELLING ERRORS ON THE BROWSER

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ABSTRACT

In Turkish content generation informal writing styles like "gelicem" (I'll come), the separate/attached use of suffixes like "evde" (at home) instead of "ev de" (also at home), and person inconsistencies like "ben gidiyoruz" (we are going) are frequently observed on various platforms such as messaging, social media, and forums. Correcting these kinds of errors is difficult with classic spell-checking methods that only look up words in a dictionary. This is because the agglutinative structure of Turkish allows for many different words to be derived from a root, making the selection of the correct word more difficult. Another problem where ambiguity in Turkish is hard to resolve is the “de/da” suffix, which can function both as a locative suffix (-de/-da) and as a conjunction (as in "ben de"). In this study, a prototype Natural Language Processing application is being developed to correct certain common spelling errors in Turkish texts on a browser, or in other words, in a serverless environment. Three different types of errors are defined for consideration in the study: different colloquial future tense verb variants, different forms of “de/da” usage in words, and subject-verb agreement mismatches in person compatibility. The system to detect these errors is designed in two stages: rule-based candidate generation specific to the error type and ranking of the candidates using a character trigram language model (CharLM) combined with heuristic weights. In the study CharLM has been trained on a subset of the Cosmos Turkish Corpus v1.0 streamed from Hugging Face, and transferred to the client as a static file in the charlm.json format. This ensures the privacy and the portability as the text remains within the browser. For evaluation, a manually prepared test set consisting of 110 examples have been created, and metrics such as Top-k accuracy, false positive rate (FPR), and latency values have been measured. Experimental results show that the Top-1 accuracy is 0.582, span-based Top-3 recall (Top-5: 0.773) is 0.773, and FPR in negative samples is 0.300 (6/20). Latency measurements have been taken in a “model loaded” scenario under Node/Vitest, with an average of 0.05 ms and p95 latency of 0.11 ms. In the manual evaluation set, heuristic-only selection achieving a Top-3 span-hit score of 0.773 demonstrates the inclusivity of the candidate generation layer. However, the Top-1 success rate (especially in person matching) and the FPR in negatives show that there are areas open to improvement with the practical implementation of contextual selection. The Vite/React-based client deployment approach and training design using a subsample from a large-scale Turkish corpus like Cosmos are aligned with portability and privacy objectives.

Keywords: Natural Language Processing; Morphology; Text Correction; Character Language Model



EXPLAINABILITY IN ARTIFICIAL INTELLIGENCE APPLICATIONS

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ABSTRACT

The exploration of knowledge that, indicating what is specified, and knowledge why, explaining why it is necessary belongs to different fields of epistemology and has its roots in Aristotelian philosophy, is an ongoing process. These two phenomena hold primary importance in today's Artificial Intelligence (AI) studies. In its classical definition, knowledge is a phenomenon -based explanation subject to complete verification. Conversely, the concept of understanding is not always factual. Knowledge that makes a phenomenon understandable is not always fully verified; the system prioritizes conceptual analysis. Explainable Artificial Intelligence (XAI) fulfills an essential human intuition function to ensure the reliability of complex mathematical models. Today, understanding the inner workings of models has become an absolute necessity. Utilizing AI in high-risk domains like medicine, justice, or finance requires knowing the reasons behind decisions rather than binary yes/no answers. For instance, when a model declines to issue a loan or proposes a medical treatment, trust and accountability entail responsibility as the output is rarely straightforward. Thus, experts take control. Having liability and responsibility placed on humans ensures the traceability of model-induced errors. Frameworks like the European Union AI Act and GDPR address regulatory compliance and safety by granting the right to explanations for those affected by automated decisions. Another enhancement example shows Ensuring Equity, maintaining the consistency of model logic, and foreseeing a fairer digital future. Through solutions like Feature Engineering and Edge Case Detection, the challenging and time-consuming nature of black-box models is simplified into logical outcomes. Unnecessary data is removed, speeding up models by focusing only on data points that guide results, and erroneous correlations are identified. In medicine, importance maps used to highlight specific pixels in medical images serve as replacements for the significant disadvantage of black-box models. In the finance sector, FICO, a global credit scoring system, utilizes XAI for generating Reason Codes; when a credit model produces a score, the system lists all factors influencing that score. Consequently, the system offers transparent Saliency Maps to improve the user's financial situation. Autonomous vehicles provide another comprehensive application of XAI. In these applications, explainability constitutes a safety feature. The reasons behind a car's sudden braking or maneuvering must be meticulously planned. To demonstrate what the vehicle's brain perceives in real-time, companies like Waymo and Tesla employ visual explanation layers. In the retail sector, Recommendation Systems are crucial for interaction with users. For instance, Netflix and Amazon are pioneers in Natural Language Explanations, becoming the first companies.

Keywords: Explainability; Knowledge; Feature Engineering; Recommendation Systems



ARTIFICIAL INTELLIGENCE-BASED APPROACHES FOR SUSTAINABLE WASTEWATER TREATMENT

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ABSTRACT

Wastewater treatment systems face increasing challenges due to complex influent variability, stricter environmental regulations, high energy consumption, and the need for optimized operational performance. In this context, artificial intelligence (AI) technologies offer innovative and powerful tools to enhance the efficiency, reliability, and sustainability of wastewater treatment processes. This study explores the application and potential of artificial intelligence techniques, including machine learning algorithms, artificial neural networks (ANN), deep learning, fuzzy logic, and hybrid AI models, in wastewater treatment plant (WWTP) monitoring, control, and optimization. These approaches are evaluated for their ability to predict key process parameters, optimize operational conditions, detect faults, and improve treatment performance. AI-based models demonstrate high accuracy in predicting critical indicators such as chemical oxygen demand (COD), biochemical oxygen demand (BOD), nutrient removal efficiency, sludge production, and energy consumption. The integration of AI with conventional and advanced treatment technologies, such as activated sludge systems, membrane bioreactors (MBR), and anaerobic digestion, enables real-time decision-making, adaptive process control, and improved system resilience under dynamic operating conditions.

Furthermore, AI-driven optimization contributes to reduced operational costs, enhanced energy efficiency, minimized environmental impact, and improved effluent quality. The study highlights that the combination of artificial intelligence with digital sensors and automation systems represents a transformative approach for the development of smart and sustainable wastewater treatment plants. Artificial intelligence thus emerges as a key enabler for the next generation of wastewater treatment systems, supporting efficient resource management, regulatory compliance, and environmental protection.

Keywords: Artificial Intelligence; Wastewater Treatment; Machine Learning; Process Optimization; Predictive Modeling; Smart Treatment Plants



ARTIFICIAL INTELLIGENCE ADOPTION IN INFORMATION SYSTEMS IN TIMES OF TURBULENCE

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ABSTRACT

Technology increasingly shapes contemporary business realities across digital, virtual, and intelligent domains, while fiscal, political, and geopolitical instability amplifies uncertainty. enterprise systems, traditionally perceived as stable infrastructures, are now dynamic, adaptive, and exposed to significant risks in volatile markets. Their effectiveness depends on continuous reform, adaptability, and organizational resilience. The integration of Artificial Intelligence (AI) into enterprise systems has emerged as a strategic imperative within the accelerating wave of digital transformation. Adoption in contexts characterized by VUCA (volatility, uncertainty, complexity, ambiguity) and BANI (brittleness, anxiety, non-linearity, incomprehensibility) requires a multidimensional approach that integrates both individual and organizational perspectives, providing a more comprehensive understanding of technology adoption under turbulent conditions. This paper introduces a research model that combines organizational and individual perspectives to advance understanding of AI adoption in enterprise systems. By explicitly incorporating the effects of turbulent and uncertain environments, the model extends existing theoretical frameworks and offers a robust lens for examining technology adoption in dynamic, high-risk contexts.

Keywords: Artificial Intelligence; Enterprise Systems; Technology Adoption; VUCA; BANI



DETECTION OF THE PRE-METASTATIC STATE AND IDENTIFICATION OF THE CRITICAL TRANSITION THRESHOLD IN BREAST CANCER BY INTEGRATING DYNAMIC NETWORK BIOMARKERS AND cfDNA FRAGMENTOMICS

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ABSTRACT

One of the most significant clinical challenges in breast cancer is the inability to detect the period during which the tumour progresses from a localised state to systemic metastasis using conventional diagnostic methods. Identifying this critical window requires the simultaneous monitoring of systemic instability signals and tumour-induced structural changes. At the molecular level, dynamic network biomarker (DNB) analysis can characterize critical slowing-down signals emerging in gene regulatory networks prior to the transition of breast cancer cells to a metastatic phenotype as mathematical early-warning indicators, typically reflected by marked and coordinated increases in expression variance and inter-gene correlations. However, biological validation is required to distinguish DNB scores from non-specific cellular stress responses. In this context, cell-free DNA (cfDNA) fragmentomics can support these findings by providing complementary evidence that the dynamic network instability detected by DNB may be tumor-derived through tissue-specific molecular signals inferred from fragment size distributions, fragment end motifs, and nucleosome positioning-related patterns. This study aims to integrate current evidence and methodological strategies for capturing the hidden biological window preceding macroscopic metastasis, by jointly considering, within a holistic framework, the temporal predictive capacity offered by DNB and the source-specific molecular information provided by fragmentomics. Ultimately, the proposed multidisciplinary perspective views breast cancer progression through the lens of phase transition dynamics and outlines a roadmap for proactive molecular monitoring in clinical oncology, supported by mathematical modelling.

Keywords: Dynamic Network Biomarker; cfDNA Fragmentomics; Breast Cancer; Critical Transition; Pre-Metastatic State; Tipping Point



AI IN CANCER DIAGNOSIS: MACHINE LEARNING APPROACHES

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ABSTRACT

Cancer diagnosis has long been a complex and nuanced challenge in healthcare. Recent advancements in machine learning (ML) have opened new avenues for improving diagnostic accuracy and speed. This study explores the application of ML algorithms in cancer diagnosis, leveraging medical imaging, genomic data, and clinical records. We review current ML approaches, including deep learning and transfer learning, and their potential to enhance cancer detection, classification, and prognosis. Our analysis highlights the benefits of ML in reducing false positives, improving patient outcomes, and streamlining clinical workflows. Furthermore, we discuss the challenges and limitations of implementing ML in cancer diagnosis, including data quality, interpretability, and regulatory frameworks. By harnessing the power of ML, we can revolutionize cancer diagnosis and pave the way for precision medicine.

Keywords: Supervised Learning for Classification; Deep Learning for Image Analysis; Feature Extraction from Patient Data; Ensemble Methods for Accuracy Boost; Transfer Learning for Improved Performance



OPTIMAL TRANSPORT-BASED BALANCING IN HYBRID QUANTUM-CLASSICAL NEURAL NETWORKS FOR MEDICAL DATA CLASSIFICATION

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ABSTRACT

Introduction and Objective: Medical image classification presents significant challenges due to inherent class imbalance, where pathological conditions often represent minority classes compared to healthy samples. This imbalance leads to biased predictions and poor generalization in clinical decision support systems. Quantum neural networks (QNNs) have emerged as a promising paradigm leveraging quantum superposition and entanglement for enhanced pattern recognition; however, they face fundamental limitations in multi-class classification scenarios where increasing class numbers risk overlapping quantum states that blur decision boundaries. This study aims to develop a hybrid quantum-classical convolutional neural network (QCCNN) that addresses class imbalance through optimal transport-based balancing using the Sinkhorn algorithm, with application to medical image classification on the MedMNIST benchmark dataset comprising standardized biomedical images across multiple modalities including X-Ray, OCT, ultrasound, and CT scans. **Materials and Methods:** The proposed QCCNN architecture integrates classical convolutional layers for feature extraction with parameterized quantum circuits (PQCs) for high-level pattern recognition. A one-vs-all decomposition strategy transforms the multi-class problem into binary classification tasks, where each quantum classifier specializes in detecting a specific medical condition. To address the severe class imbalance inherent in this decomposition and in medical datasets, we incorporate the Sinkhorn algorithm based on optimal transport theory with entropic regularization. The algorithm solves the Kantorovich formulation by iteratively computing transport plans that redistribute probability mass between unbalanced and target distributions. Classical data is encoded into quantum states via amplitude encoding, requiring only $n = \log_2(k)$ qubits for k -dimensional features. The variational quantum circuit applies parameterized rotation gates (R_z , R_y) and controlled rotations (C R_y) for entanglement across 10 quantum layers, optimized using Adam optimizer with learning rate 10^{-3} over 60 epochs. Experiments were conducted on the MedMNIST v2 benchmark, a large-scale collection of 12 standardized 2D biomedical datasets with 708,069 images at 28x28 resolution, resized to 8x8 and 16x16 for quantum processing. **Results:** The proposed QCCNN with Sinkhorn balancing demonstrated superior performance compared to existing hybrid quantum-classical approaches. On standard benchmarks, the model achieved classification accuracies of 87.85% and 70.09% on MNIST and Fashion-MNIST respectively, outperforming state-of-the-art



methods including Bai et al. (87.56%, 69.32%) and Chalumuri et al. (77.64%, 71.15%). At higher resolutions, accuracy reached 98.12% (8x8) and 98.56% (16x16) on MNIST. The Sinkhorn balancing mechanism proved particularly effective under severe class imbalance: accuracy gains of 2.12 percentage points at 50% minority representation, expanding to 4.6 percentage points at 10% minority representation compared to models without balancing. Sinkhorn outperformed classical balancing techniques including SMOTE by 0.61-1.20% accuracy and improved minority class recall by 2.7-3.4%. Hyperparameter analysis identified optimal entropic regularization at $\epsilon = 0.1$, achieving balance between transport accuracy (87.85%) and computational efficiency (67 iterations, 19.5 seconds). The 10-layer quantum circuit configuration provided optimal tradeoff between expressibility and training cost.

Discussion and Conclusion: The findings demonstrate that integrating optimal transport theory through the Sinkhorn algorithm effectively addresses class imbalance challenges in quantum neural networks for medical data classification. The mathematical framework based on the Kantorovich formulation provides a principled approach to redistribute probability mass across classes, ensuring fair representation of underrepresented pathological conditions during training. The hybrid architecture successfully combines the feature extraction capabilities of classical CNNs with the enhanced pattern recognition of quantum circuits exploiting superposition and entanglement. The one-vs-all decomposition strategy enables scalable multi-class classification while maintaining quantum circuit simplicity. Results indicate that the approach is particularly valuable for medical imaging applications where minority classes often carry critical diagnostic importance, as evidenced by substantial improvements in minority class recall. The computational overhead of quantum circuit simulation remains a current limitation; however, training efficiency analysis shows only 6% additional cost compared to recent quantum methods while delivering superior accuracy. Future research directions include extending the framework to 3D medical imaging modalities available in MedMNIST, exploring hardware-efficient ansatz designs for near-term quantum devices, and integrating quantum error mitigation techniques for enhanced robustness in clinical deployment scenarios.

Keywords: Quantum Neural Networks; Optimal Transport; Sinkhorn Algorithm; Hybrid Quantum-Classical Model; Medical Data Classification; Class Imbalance



A COMPARATIVE ANALYSIS OF FEATURE SELECTION TECHNIQUES FOR EARLY BREAST CANCER PREDICTION USING MACHINE LEARNING CLASSIFICATION MODELS

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ABSTRACT

Breast cancer is a complex and prevalent disease that primarily affects women, although men may also be diagnosed. It arises from the uncontrolled growth of cells within breast tissue, leading to the formation of malignant tumors. Early detection through screening methods such as mammography and self-examinations significantly improve treatment outcomes. Major risk factors include age, genetic predisposition, hormonal influences, and lifestyle factors. Despite extensive research, achieving higher prediction accuracy for early diagnosis remains a challenge. To enhance breast cancer prediction performance, this study focuses on improving classification accuracy through feature selection techniques and machine learning models. Two feature selection methods, Recursive Feature Elimination (RFE) and Least Absolute Shrinkage and Selection Operator (LASSO) were applied to identify the most relevant features. Subsequently, three classification models, Logistic Regression (LR), Support Vector Machine (SVM), and Gradient Boosting (GB) were trained and evaluated. Model performance was assessed using accuracy, precision, recall, and F1-score. The experiments were conducted on the Wisconsin Diagnostic Breast Cancer (WDBC) dataset obtained from the UCI Machine Learning Repository, which contains 569 instances with 30 diagnostic features extracted from fine-needle aspirate images of breast masses. The results demonstrate that RFE combined with the Support Vector Machine achieved the highest performance, improving classification accuracy by 1.93%. In comparison, LASSO improved accuracy by 0.60% when used with the Gradient Boosting model. Additionally, RFE improved precision, recall, and F1-score by 2.94%, 0.08%, and 1.50%, respectively, whereas LASSO showed improvements of 1.01%, 0.50%, and 0.00% for the same metrics. Overall, the findings indicate that the Recursive Feature Elimination technique, particularly when combined with the Support Vector Machine classifier, provides superior performance for breast cancer prediction and can contribute to more accurate early diagnosis.

Keywords: Machine Learning; Predication Models; Breast Cancer Disease; Recursive Feature; Elimination (RFE); Least Absolute Shrinkage and Selection Operator (LASSO); Wisconsin Diagnostic Breast Cancer (WDBC) Dataset



CHEMICAL SCIENCES AT THE INTERSECTION OF ETHICS, POLICY, AND CULTURE

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ABSTRACT

The chemical sciences occupy a critical position in contemporary society, influencing healthcare, agriculture, industry, environmental management, and technological innovation. As chemical research and applications expand, ethical considerations, policy frameworks, and cultural contexts increasingly shape how chemical knowledge is produced, regulated, and accepted by society. This paper explores the intersection of chemical sciences with ethics, public policy, and culture, emphasizing the need for socially responsible and culturally sensitive scientific practice. Ethical issues such as environmental pollution, chemical safety, unequal exposure to toxic substances, and responsible innovation raise important questions about accountability and justice. Policy instruments including regulatory standards, international chemical conventions, and national safety guidelines play a vital role in governing chemical activities and mitigating societal risks. However, the effectiveness of these policies often depends on cultural perceptions, public trust, and local knowledge systems. The paper also examines how cultural beliefs and traditional practices influence attitudes toward chemicals, particularly in areas such as medicine, agriculture, and environmental protection. In developing regions, weak regulatory systems and limited public awareness further complicate the ethical governance of chemicals. By integrating ethical reflection, robust policy design, and cultural understanding, the paper argues that chemical sciences can better serve societal needs while minimizing harm. Strengthening dialogue among chemists, policymakers, and communities is essential for achieving responsible chemical innovation and sustainable development.

Keywords: Chemical Sciences; Ethics in Chemistry; Science Policy; Chemical Regulation; Cultural Perspectives



CHEMISTRY, SOCIETY, AND SUSTAINABLE FUTURES

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ABSTRACT

Chemistry plays a central role in shaping modern society, influencing health, industry, agriculture, energy, and the environment. As the world faces escalating challenges such as climate change, resource depletion, pollution, and public health crises, the relationship between chemistry and society has become increasingly significant. This paper examines the role of chemistry in advancing sustainable futures through an interdisciplinary lens that integrates scientific innovation with social responsibility, ethics, and policy frameworks. It highlights how chemical research contributes to sustainability through green chemistry, renewable materials, cleaner energy technologies, and environmentally friendly industrial processes. At the same time, the paper emphasizes that technological solutions alone are insufficient without public trust, effective governance, and inclusive decision making. Social perceptions of chemical risks, unequal exposure to pollutants, and disparities in access to chemical technologies raise important ethical and justice related concerns. The paper further explores the role of education and science communication in bridging the gap between chemists and society, enabling informed public participation in sustainability initiatives. Special attention is given to developing countries, where chemistry driven innovations offer opportunities for economic development while also posing regulatory and environmental challenges. By situating chemistry within its broader social, cultural, and political contexts, this paper argues that sustainable futures depend on collaborative approaches that align chemical innovation with societal values, environmental stewardship, and long term human well-being.

Keywords: Chemistry and Society; Sustainable Development; Green Chemistry; Environmental Sustainability; Science Policy



DETERMINATION OF THE ANTIOXIDANT POTENTIAL OF AVOCADO SEED (PERSEA AMERICANA) SEED EXTRACTS OBTAINED BY SOXHLET EXTRACTION

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ABSTRACT

This study aims to evaluate the antioxidant capacity of avocado seeds, a significant agricultural by-product, through conventional Soxhlet extraction using 70% methanol. The radical scavenging activity of the extracts was determined using the DPPH (1,1-diphenyl-2-picrylhydrazyl) assay within a concentration range of 1–200 µg/mL. Antioxidant efficiency was quantified by calculating the IC₅₀ value, representing the concentration required to neutralize 50% of DPPH radicals. According to the results, the avocado seed extract exhibited a potent antioxidant effect with an IC₅₀ value of 1.83 µg/mL, which was remarkably close to the commercial antioxidant Butylated Hydroxytoluene (BHT), which showed an IC₅₀ of 1.38 µg/mL. These findings suggest that avocado seeds, typically discarded as waste, possess high-value bioactive compounds and can be utilized as a potent natural antioxidant source in food and pharmaceutical industries.

Keywords: Avocado Seed; Soxhlet Extraction; DPPH; Antioxidant Activity; IC₅₀



DETERMINATION OF THE CONCENTRATIONS OF HARMFUL HEAVY METALS, PAHs, AND VOCs IN THE VAPORS OF DIFFERENT TYPES OF ASPHALT AT DIFFERENT TEMPERATURES IN THE AIR

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ABSTRACT

Asphalt concrete is the primary material used in the road construction sector, which is classified as highly hazardous in the scope of occupational health and safety. During the application of asphalt concrete to highways, workers on site are primarily affected by the polluting gases, dust, and especially asphalt fumes that are released when the high-temperature material is poured onto the ground using a paver. Research conducted in literature shows that the respiratory tracts of asphalt workers are affected by: Volatile Organic Compounds (VOCs), Carbon Monoxide (CO), Sulfur Dioxide (SO₂), Phenol, and Polycyclic Aromatic Hydrocarbons (PAH), among other hazardous compounds. It has been observed that such exposure poses a serious risk of occupational disease. Therefore, in our research study, we experimentally determined the concentrations of heavy metals, polycyclic aromatic hydrocarbons, and volatile organic compounds emitted from the vapors of different hot mix asphalt types at different temperatures, as well as the concentrations of toxic gases and vapors. Binder asphalt, Wear Type-1 asphalt, and Stone mastic asphalt were used as samples at our experiments. Tests were conducted at temperatures between 125 °C and 150 °C for binder asphalt and Type-1 asphalt, and at temperatures between 150 °C and 175 °C for stone mastic asphalt, which has a higher bitumen percentage. Based on the results obtained, it has been determined that the use of alternative materials and Asphalt 4.0 technologies is essential to reduce greenhouse gas emissions affecting asphalt workers and environmental health in the asphalt industry. In this way, reducing carbon emissions on highways will contribute to mitigating the destructive effects of global climate change. In line with the objectives of our study, it is recommended that awareness be raised in the asphalt sector; that regulations resulting from international policies be adapted to our country; and that OHS 4.0 and Asphalt 4.0 technologies be disseminated and implemented nationwide by all stakeholders in the private and public sectors. Furthermore, this study was supported under the Istanbul Gedik University Scientific Research Projects Project Support framework, within the scope of the project titled “An ecological approach to developing wearable products in the design of OHS 4.0 technology initiatives for the asphalt sector,” numbered GDK202411-24.

Keywords: Asphalt; Asphalt Fumes; PAHs; VOCs; OHS; Greenhouse Gas Emissions



GREEN PRODUCTION OF COBALT OXIDE NANOPARTICLES VIA PLANT-EXTRACT-ASSISTED SYNTHESIS

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ABSTRACT

Cobalt-based nanomaterials have gained significant interest for their myriad applications in catalysis, energy storage, magnetics, and biomedicines. This paper discusses the environmentally friendly nanomaterials production method, in which cobalt-based nanoparticle synthesis is carried out in soybean extract as a natural reducing and stabilizing agent. With regard to the synthesis, the cobalt salt solution (an aqueous solution of cobalt salt) was used, and the precursor, Co, was synthesized after the concentration of the metal ion was determined by complexometric EDTA titration. Soybean extract, which is a renewable biological source, was mixed with distilled water and the ratio of the mix was optimized to



achieve the best yield. The extract was allowed to react with the cobalt precursor at room temperature, where synthesis was carried out without the addition of toxic chemicals, low temperatures, or external reducing agents. The combination of physicochemical techniques was used to characterize and separate the products. In the ultraviolet-visible spectrophotometry reduction and the formation of nanoparticles were monitored. Colloidal stability and dispersion were assessed through zeta potential and size analysis. Results verified that nanostructures based on cobalt were formed successfully. The scanning electron micrography of the synthesized nanoparticles showed that relatively uniform shapes with sizes on a nanoscale were obtained. The FTIR (Fourier-transform infrared) spectroscopy showed that the functions that were naturally present in the soybean extract stabilized the nanoparticles. The phenolic and carboxylate grouping surface fixation were identified as the main contributors in preventing rapid aggregation of the nanoparticles and in enhancing the stability of the nanoparticles. The use of plant extracts to mediate the synthesis of cobalt-based nanomaterials demonstrates to be a positive and sustainable approach to nanomaterials synthesis. This method is complex in its chemical reactions but simple in its practical use. It reduces the positive impact on the environment while also providing a low-cost innovative method to create nanomaterials that are functional and complex in their structures for use in the technological fields.

Keywords: Cobalt Nanoparticles; Green Synthesis; Soybean Extract; Sustainable Nanomaterials



COMPARATIVE ANALYSIS OF ULTRASOUND-ASSISTED AND CONVENTIONAL BREWING OF MELON (*CUCUMIS MELO L.*) SEED TEAS: PHENOLIC CONTENT AND ANTIOXIDANT ACTIVITY

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ABSTRACT

This study examined the effectiveness of ultrasound-assisted brewing as an alternative extraction technique for enhancing the phenolic composition and antioxidant capacity of melon seed tea. Tea infusions were prepared using 2 g of dried melon seed powder and 100 mL of distilled water. Ultrasound-assisted brewing was conducted at room temperature for 10, 15, and 30 min, while conventional hot-water brewing at elevated temperature served as the control under identical extraction times. Total phenolic content (TPC), total flavonoid content (TFC), and antioxidant activities (DPPH, FRAP, and CUPRAC) were evaluated. Ultrasound-assisted brewing significantly enhanced the extraction of bioactive compounds compared to conventional hot-water infusion. The highest TPC (2.24 g GAE/kg dm) and TFC (1888.58 mg CE/kg dm) values were obtained after 30 min of ultrasound treatment, representing a marked increase relative to control samples. Antioxidant capacities determined by CUPRAC, FRAP, and DPPH assays were also substantially higher in ultrasound-treated infusions, with maximum values observed at longer ultrasonication times. Pearson correlation analysis revealed strong positive correlations between TPC and TFC ($r = 0.954$, $P < 0.01$) and significant associations between phenolic content and antioxidant capacity across all assays, indicating that phenolic compounds were the major contributors to the antioxidant activity of melon seed tea. Ultrasound-assisted brewing proved to be a highly effective non-thermal extraction approach, promoting greater release of phenolic and flavonoid compounds and enhancing antioxidant potential. These findings highlight the potential of ultrasound technology for developing value-added, functional tea beverages from melon seed by-products.

Keywords: Functional Beverages; Green Extraction; Melon Seed Tea; Phenolic Compounds; Ultrasound-assisted Extraction



EFFICIENT REMOVAL OF CATIONIC DYE METHYLENE BLUE FROM AQUEOUS MEDIA USING A BENTONITE-ACTIVATED CARBON-Fe₃O₄ MAGNETIC COMPOSITE

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ABSTRACT

Increased industrial activity, particularly from the textile and dye industries, has resulted in cationic dyestuffs causes significant environmental problems to water resources. One of these dyestuffs, methylene blue (MB), is among the pollutants that must be effectively removed from wastewater due to its toxic effects and resistance in aqueous environments [1-5]. In this study, a magnetic composite adsorbent consisting of bentonite/activated carbon/Fe₃O₄ components was synthesised for the removal of methylene blue from aqueous solutions, and its adsorption performance was evaluated. The magnetic composite adsorbent was synthesised using the precipitation method, and adsorption studies were carried out in a batch system. The parameters affecting the adsorption process was systematically investigated. Accordingly, based on experimental results, the optimum adsorption time was determined to be 150 minutes and the



optimum adsorbent amount was determined to be 1 mg. In order to explain the mechanism of the methylene blue adsorption system with bentonite/activated carbon/ Fe_3O_4 adsorbent, equilibrium isotherm equations were derived by using the results of adsorption experiments at three different temperatures. The Langmuir, Freundlich and Temkin isotherm models were evaluated for their suitability. Furthermore, the kinetic mechanisms of the adsorption system were investigated, and it was determined that the experimental kinetic data showed high compliance with the pseudo-second-order kinetic model. When all the experimental results obtained were evaluated, it was shown that the bentonite/activated carbon/ Fe_3O_4 magnetic composite adsorbent is an effective adsorbent that can be used for the removal of MB from aqueous solutions.

Keywords: Adsorption; Activated Carbon; Bentonite; Magnetic Composite; Methylene Blue; Wastewater Treatment.



MOLECULAR MARKER DETECTION OF DROUGHT-RELATED GENE REGIONS IN TOMATOES

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ABSTRACT

Tomatoes are among the most prominent crops in global breeding programs and genetic studies. With the world population projected to increase by 50% by 2050, an increase in tomato production, as with other crops, is also expected. Furthermore, newly developed tomato varieties need to be resistant or tolerant to biotic and abiotic stress conditions. In Turkey, which is among the leading countries in global tomato production, adverse effects such as drought can reduce these production levels. Identifying gene regions associated with drought in tomato plants is regarded as both a significant step and a turning point for research in this field. These identifications, made using molecular markers, aim to establish a solid foundation for determining drought-resistant tomato varieties. In conclusion, by expanding the scope and depth of research, the development of tomato varieties that maintain productivity even under drought conditions is encouraged. This, in turn, will enable more sustainable and efficient agricultural practices, helping farmers become more resilient in challenging situations. This review aims to systematically evaluate the current body of knowledge by compiling recent studies on molecular markers and genomic regions associated with drought stress in tomato, in order to provide a scientific basis for breeding programs.

Keywords: Tomato; Biotic and Abiotic Stress; Drought; Molecular Marker



FABRICATION OF ZnO-M-CoFe₂O₄ (M = TiO₂, SiO₂, CuO) HETEROJUNCTION PHOTOCATALYSTS FOR DEGRADATION OF ORGANIC POLLUTANTS

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ABSTRACT

With rapid industrialization and urbanization in most economies, water sources have become contaminated with toxic pollutants such as dyes, heavy metals, and microplastics, which negatively impact the availability and quality of freshwater resources. Traditional wastewater treatment systems often struggle to effectively eliminate these contaminants, especially when pollution levels are high. In this research work, ZnO-M-CoFe₂O₄ (M = TiO₂, SiO₂, CuO) heterojunction photocatalysts were prepared by the co-precipitation method in an attempt to overcome this challenge. XRD, SEM, FTIR, Zeta sizer, and UV-Visible spectroscopy were used to measure the structural, morphological, and optical characteristics of the prepared nanocomposites. XRD results showed that crystalline spinel and wurtzite structures were successfully formed, and FTIR results indicated the formation of metal-oxygen bonds. SEM images revealed that the semi-spherical particles had porous surfaces, and the Zeta sizer analysis demonstrated that the particle sizes ranged from 160 nm to 240 nm. The absorption in the visible region was significant, as UV-Vis spectroscopy showed the band gaps of 2.48 eV, 2.72 eV, and 3.10 eV for ZnO-TiO₂-CoFe₂O₄, ZnO-CuO-CoFe₂O₄, and ZnO-SiO₂-CoFe₂O₄, respectively, indicating increased photocatalytic potential. The photocatalytic degradation of methylene blue dye was carried out under visible light to assess the performance. After 120 minutes of exposure, the efficiencies of the composites were recorded as 89.6%, 81.3%, and 76.4% degradation for ZnO-TiO₂-CoFe₂O₄, ZnO-CuO-CoFe₂O₄, and ZnO-SiO₂-CoFe₂O₄, respectively. These findings demonstrate that the synthesized photocatalysts have improved charge separation, a reduced band gap, and enhanced surface activity. The research indicates that these nanocomposites are highly effective and reusable for visible-light-driven water purification, offering a sustainable solution for wastewater treatment.

Keywords: Heterojunction Photocatalysts; Wastewater; Organic Pollutants; Synthetic Dyes



REACTIVITY AND THERAPEUTIC POTENTIAL OF 1H-PYRROLE-2,3-DIONE CYCLOADDITION DERIVATIVES: ADMET PREDICTIONS AND MOLECULAR DOCKING

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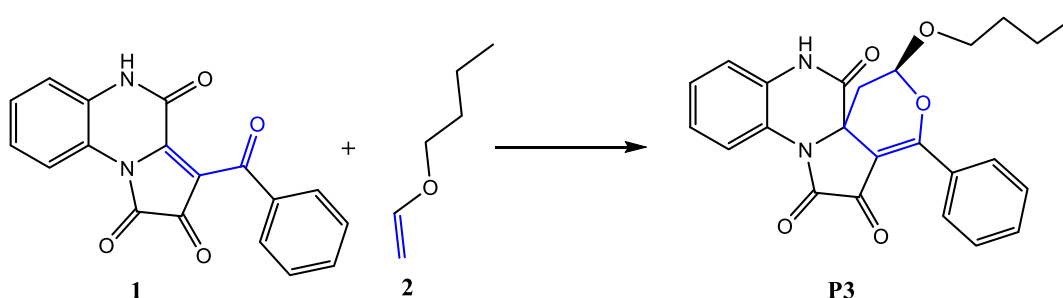
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ABSTRACT

A comprehensive MEDT-based investigation was performed on the [4+2] cycloaddition between butyl vinyl ether and 1H-pyrrole-2,3-dione derivatives. Conceptual DFT analyses reveal the nucleophilic nature of butyl vinyl ether and the electrophilic character of the pyrrole-2,3-dione framework. Theoretical activation and reaction energies are in good agreement with experimental results, confirming the chemo-, regio-, and stereoselectivity of the cycloaddition process. Electron density analyses indicate that the reaction may proceed via either a fully concerted or an asynchronous pathway. Furthermore, molecular docking studies combined with ADMET evaluation of the predominant product toward VEGFR-2 show strong and stable binding primarily driven by hydrophobic interactions, highlighting potential photonic effects and the compound's suitability for further photochemical investigations.



Keywords: Reactivity; MEDT; Docking; ADMET; VEGFR-2; Photonic Effects; ELF



THEORETICAL ELUCIDATION OF ACID CORROSION INHIBITION BY 8-HYDROXYQUINOLINE DERIVATIVES: A DFT/MC/MD STUDY

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ABSTRACT

DFT calculations combined with Monte Carlo and molecular dynamics simulations were performed to elucidate, at the atomic scale, the corrosion-inhibition mechanism of newly synthesized 8-hydroxyquinoline derivatives in 1.0 M HCl. Electronic-structure descriptors derived from DFT (electron-density distribution, frontier-orbital characteristics, and reactivity indices) were used to assess the inhibitors' donor-acceptor capability and their tendency to adsorb on the metal surface. The results emphasize the crucial role of heteroatoms and the π -conjugated 8-hydroxyquinoline framework in promoting charge-transfer interactions with iron. Consistently, MC/MD simulations predict stable adsorbed configurations and the formation of a compact protective layer at the interface, with adsorption-strength trends in agreement with the DFT-based reactivity ranking. Overall, the combined DFT/MC/MD approach provides a coherent theoretical rationale linking functional-group effects to interfacial stability and adsorption affinity, supporting the experimentally observed inhibition performance.

Keywords: 8-hydroxyquinoline; Corrosion Inhibition; MC/MD Simulation



SILVER OXIDE DOPED WITH SULFUR FOR CATALYTIC APPLICATION

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ABSTRACT

Photocatalysts are materials, when exposed to light, can accelerate chemical reactions while remaining unchanged. They play an essential role in many fields, such as air and water depollution. A semiconductor functions as a heterogeneous photocatalyst when the absorbed light energy (photons) excites valence electrons, moving them to the conduction band and leaving holes in the valence band. The electron–hole pairs generated by this photo-illumination migrate to the photocatalytic surface, where oxidation–reduction reactions are accelerated at the active sites of surfaces that absorb water. The energy positions of the conduction band (CB) and valence band (VB) of a semiconductor photocatalyst are strongly influenced by the photocatalytic decomposition process of organic matter. In most favorable cases, the following occurs: the higher the VBM (valence band maximum) potential, the stronger oxidizing holes are generated; and the more negative the CBM (conduction band minimum) potential, the stronger the reducing power of the electrons. In this work, we show that silver oxide doped with sulfur $\text{Ag}_2\text{O}_{1-x}\text{S}_x$ (with $x = 0, 0.25, 0.5, 0.75$, and 1) is an effective pollutant remover, due to various electron transfers that drive the chemical transformations of compounds absorbed or deposited on the semiconductor.

Keywords: Photocatalysis; Sulfur-Doped Silver Oxide; Semi-conductor; Depollution



ENHANCED HIGH-TEMPERATURE POWER CONVERSION EFFICIENCY OF THALLIUM SULFIDE MONO- AND HOMO-BILAYERS: A FIRST-PRINCIPLES STUDY

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ABSTRACT

A first-principles investigation of the thermoelectric properties of two-dimensional TlS in monolayer and homo-bilayer configurations was carried out within density functional theory using the FP-LAPW method implemented in the WIEN2k code. Van der Waals (vdW) interactions were included via the DFT-D3 correction, and the GGA-mBJ potential was employed to improve the description of electronic and transport properties. The TlS homo-bilayer was found to be energetically favorable, with an interlayer spacing of 3.25 Å and a binding energy of -99.25 meV/atom, while the cohesive energy increased from 3.66 to 3.79 eV/atom upon stacking. The monolayer exhibited a direct band gap of 1.68 eV, whereas the homo-bilayer showed an indirect band gap of 0.62 eV, highlighting strong interlayer coupling. The overall thermal conductivity decreased markedly, from 1.35 to 0.30 W/K.m at 300 K and from 2.50 to 0.59 W/K.m at 900 K, according to thermoelectric calculations. The TlS homo-bilayer outperformed the monolayer ($ZT = 1.66$), reaching a maximum figure of merit (ZT) of 1.75 at 900 K, and the energy conversion efficiency increased from 16.25% to 18%, indicating a successful strategy for enhancing the thermoelectric performance of two-dimensional TlS. These results suggest that TlS mono- and homo-bilayers are promising candidates for high-temperature thermoelectric applications. Overall, the study demonstrates that layer stacking is an effective approach for improving the optical and thermoelectric properties of two-dimensional TlS.

Keywords: vdW Homostructure; TlS Bilayer; Thermoelectric; Power Conversion Efficiency; DFT



ARYLATED CARBAZOLE DERIVATIVES: SYNTHETIC STRATEGIES AND POTENTIAL APPLICATIONS

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ABSTRACT

Introduction and Objective: Carbazole is a heterocyclic aromatic organic compound formed by the fusion of two benzene rings with a five-membered nitrogen-containing ring. In recent years, arylated azaheterocycles have gained considerable attention in synthetic chemistry due to their wide applications in biology, pharmaceuticals, and materials science. Among these, *N*-arylcarbazole derivatives have emerged as important scaffolds because of their excellent photoconductivity, hole-transporting ability, and high thermal stability, making them valuable materials for organic solar cells, organic light-emitting diodes (OLEDs), and luminescent devices. The objective of this review is to summarize recent advances in the synthesis methods and applications of *N*-arylcarbazole derivatives. **Materials and Methods:** This study is based on a comprehensive review of published literature collected from scientific databases including Web of Science, PubMed, Google Scholar, ScienceDirect, and SpringerLink. Relevant peer-reviewed articles focusing on the synthesis, catalytic strategies, and applications of *N*-arylcarbazole derivatives were thoroughly analyzed. **Results:** The literature reveals a wide variety of synthetic approaches to the *N*-arylation of carbazoles. These include copper-catalyzed Ullmann coupling reactions, palladium-catalyzed cross-coupling reactions, nickel- and iron-catalyzed methodologies, and transition-metal-free approaches. These methods provide access to structurally diverse *N*-arylcarbazole derivatives with promising physicochemical and functional properties. **Discussion and Conclusion:** Comparative analysis of reported protocols shows that while transition-metal-catalyzed reactions offer high efficiency, metal-free approaches are widely adopted on account of their environmental and economical benefits. Overall, *N*-arylcarbazole derivatives represent versatile and valuable compounds for advanced material applications. Further research focusing on sustainable synthesis and functional optimization may enhance their potential in optoelectronic and pharmaceutical fields.

Keywords: Carbazole; *N*-arylation; Catalyst; Applications



ADVANCES IN THE SYNTHESIS OF DIVERSELY SUBSTITUTED THIAZOLIDIN-4-ONE DERIVATIVES

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ABSTRACT

A significant group of heterocycles that contain sulfur and nitrogen is thiazolidin-4-one derivatives that have significant applicability in medicinal chemistry. Recent developments in their synthesis have continued to centre on multicomponent reaction (MCR) strategies owing to their efficiency, simplicity, and structural variety. MCR methods allow the synthesis of diversely substituted thiazolidin-4-one derivatives with a one-pot reaction, reduced reaction steps, reduced solvent consumption, and reduced purification efforts. These routes permit quick substitution in strategically important sites of the thiazolidin-4-one mainframe in mild circumstances and, in most situations, have good yields and atom economy. MCR protocols are flexible to enable the creation of expanded compound libraries, and this aspect is especially useful in structure -activity relationship research. Altogether, MCR-based synthesis is an effective and sustainable method for the efficient synthesis of substituted thiazolidin-4-one derivatives that have a pharmaceutical potential.

Keywords: Thiazolidin-4-one Derivatives; MCR; Synthesis



SYNTHESIS OF FURAN DERIVATIVES BY MULTICOMPONENT REACTION

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ABSTRACT

Multicomponent reactions have proved to be practical tools for efficiently synthesizing a variety of molecular frameworks, especially oxygen-containing heterocycles. Because of furan's biological and therapeutic properties, the synthesis of these bioactive heterocycles has garnered significant interest among medicinal and organic chemists. The synthesis of furan *via* the multicomponent reactions approach using environmentally friendly, recyclable heterogeneous catalysts is important because it provides new pathways for incorporating oxygen into organic molecules. The MCR route concisely summarizes recent developments and advances for synthesizing oxygen-containing heterocycles. It is systematically organized, focusing on the MCR approach to oxygen-containing heterocycles such as furan. The MCR-based synthesis is an effective and sustainable method for the efficient synthesis of furan derivatives that have a pharmaceutical potential for researchers interested in designing and applying oxygen-containing heterocycles like furan.

Keywords: Furan Derivatives; MCR; Synthesis



METALS-DOPED ACTIVATED BIOCHAR FROM AGRO-WASTE RESIDUES FOR ENERGY-STORAGE APPLICATIONS

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ABSTRACT

This work reports the valorization of mixed agro-waste biomass into modified activated biochars for electrochemical energy-storage applications. The biomass was chemically activated to produce activated biochar (BA), then impregnated with transition metals to obtain two materials with high potential and high electrical conductivity. The materials were characterized using XRD, RAMAN, FT-IR, BET, TGA, TOC, and SEM–EDX to evaluate structural and textural changes induced by activation and doping. The resulting materials had to be pressed into pellets before being measured by EIS. During pellet preparation, only one



sample was successfully compacted into a mechanically stable and cohesive pellet. Therefore, under these conditions, EIS measurements can reasonably be performed just on this one sample. Comparative results show that Fe/Ni-BA exhibits superior structural stability, improved conductivity, and enhanced electrochemical behavior relative to BA and Fe/Mn-BA. These features highlight Fe/Ni-doped biochar as a promising, low-cost electrode material for supercapacitors and microbial fuel cells. This study demonstrates a scalable pathway for converting abundant biomass residues into functional carbon materials.

Keywords: Activated Biochar; Bimetallic Impregnation; Energy Storage; Supercapacitors; Microbial Fuel Cells



OPTIMIZATION OF EXTRACTION OF PECTIN FROM AFRICAN STAR APPLE (*CHRYSOPHYLLUM ALBIDUM*) RESIDUE USING MICROWAVE-ASSISTED METHOD

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ABSTRACT

Pectin is a high-molecular-weight carbohydrate polymer present virtually in all plants, it functions as a gelling, thickening and stabilizing agent in foods. The main commercial sources of pectin are citrus fruit peels and apple pomace. The increasing demands of pectin necessitate for search for other sources of commercial pectin (Cp). African star apple was purchased from Oje market, Ibadan, Nigeria. The fruit residues were processed by cleaning, juicing, treating with ethanol, oven drying (50°C) and pulverizing. This research investigates the optimization studies using Response Surface Methodology for the extraction of pectin from African star apple residue to obtain the best extraction conditions suitable for extraction. Three independent variables; pH (1-3), time (3-8 min) and power (300-600 W) were used for the microwave assisted method of extraction. The yield obtained ranged from 3.2-10.8% with an optimized extraction condition of pH 3.0, power 482.9 W, extraction time 7.0 min, yield 6.3%. It was observed that increase in power and extraction time at lower pH leads to increase in the yield of pectin. The model is significant while the lack of fit was insignificant which shows that this model was suitable for the optimization studies of extraction of pectin from African star apple with an excellent desirability of 1.0. Therefore, African star apple pectin can be used as an alternative source of commercial pectin, turning waste into value added product and also it is a means of preventing the fruit from going into extinction.

Keywords: African Star Apple; Commercial Pectin; Extraction; Pectin



APPLICATIONS OF MAGNETIC AND ELECTROMAGNETIC FIELDS IN WATER TREATMENT AND DESALINATION PROCESSES

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ABSTRACT

The application of magnetic and electromagnetic fields has emerged as a promising approach for enhancing water treatment and desalination processes. These fields are reported to influence water physicochemical properties, ion transport, scaling behavior, and membrane performance, potentially leading to improved efficiency and reduced energy consumption. This communication examines the current research landscape on magnetic and electromagnetic field-assisted water treatment and desalination, based on publications collected from major scientific databases. Key application domains, research trends, and emerging technological directions are identified, with particular attention to desalination of seawater and brackish water. The analysis highlights both the growing scientific interest in this field and the existing knowledge gaps related to fundamental mechanisms and practical implementation, providing insights into future research opportunities for sustainable water desalination technologies.

Keywords: Magnetic Field; Electromagnetic Field; Water Desalination; Water Treatment



GREEN SYNTHESIS OF *MELIA DUBIA* MEDIATED SILVER NANOPARTICLES AND EXPLORING ITS ANTIBACTERIAL PROPERTY IN MASTITIS PATHOGENS

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ABSTRACT

Antibiotic resistance among bovine mastitis pathogens has become a serious concern, adversely affecting animal health, milk quality, and the sustainability of the dairy industry. The increasing failure of conventional antibiotics highlights the urgent need for alternative and eco-friendly antimicrobial strategies. In the present study, silver nanoparticles (AgNPs) were biosynthesized using the leaf extract of *Melia dubia* through a green, cost-effective, and sustainable approach, in which plant phytochemicals acted as natural reducing and stabilizing agents. The formation and physicochemical properties of the synthesized AgNPs were confirmed using UV–Visible spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), Zeta Potential analysis, and Field Emission Scanning Electron Microscopy (FESEM), revealing their crystalline nature, nanoscale morphology, surface functionalization, and colloidal stability. The antibacterial activity of the biosynthesized AgNPs was evaluated against major multidrug-resistant bovine mastitis pathogens, including *Klebsiella pneumoniae*, *Escherichia coli*, and *Acinetobacter baumannii*. The AgNPs demonstrated strong antibacterial efficacy, as evidenced by significant inhibition of bacterial growth, disruption of cell membrane integrity, and impairment of essential cellular functions. The antimicrobial action is primarily attributed to the generation of reactive oxygen species, enhanced membrane permeability, and interaction with intracellular biomolecules such as proteins and DNA. Overall, this study highlights the potential of *Melia dubia*-mediated AgNPs as a promising alternative antimicrobial agent for the effective management of bovine mastitis. The application of such biogenic nanoparticles may contribute to reducing antibiotic dependence, limiting the development of antimicrobial resistance, and promoting sustainable livestock healthcare practices.

Keywords: Silver Nanoparticles; Green Synthesis; *Melia Dubia*; Bovine Mastitis; Antimicrobial Activity; Multidrug-Resistant Pathogens



COMPARISON OF HYDROTHERMAL AND GREEN SOL–GEL SYNTHESSES OF TiO₂ NANOPARTICLES FOR KAOLINITE-BASED CERAMIC MEMBRANES IN WASTEWATER TREATMENT

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ABSTRACT

Titanium dioxide (TiO₂) nanoparticles were synthesized using two different routes: a conventional hydrothermal method and a green sol–gel approach employing titanium tetraisopropoxide (TTIP) as precursor and a plant-based extract as a natural stabilizing agent. The green synthesis was performed under mild and environmentally friendly conditions, avoiding hazardous chemicals. The obtained TiO₂ nanoparticles from both methods were deposited onto kaolinite-based ceramic membranes to fabricate TiO₂–kaolinite composite membranes. The prepared membranes were evaluated for wastewater treatment applications. A comparative analysis showed that the synthesis route influences TiO₂ particle characteristics and membrane surface properties, affecting interactions with organic pollutants and filtration performance. The results highlight the advantages of green-synthesized TiO₂ as a sustainable alternative for membrane-based wastewater treatment.

Keywords: Titanium Dioxide (TiO₂); Green Sol–Gel Synthesis; Hydrothermal Synthesis; Kaolinite Ceramic Membranes; Wastewater Treatment



DEVELOPMENT OF POLYCARBAZOLE-BASED FUNCTIONAL CERAMIC MEMBRANES FOR WATER TREATMENT

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ABSTRACT

This work reports a simple strategy for the functional modification of ceramic membranes using a conducting polymer layer formed in situ. Polycarbazole was deposited directly onto porous ceramic supports via oxidative polymerization, leading to the formation of a stable surface-functionalized membrane without complex fabrication steps. The modified membranes were evaluated under pressure-driven filtration conditions, showing stable permeation behavior and effective removal of organic contaminants from aqueous solutions. The separation performance is attributed to surface functionalization effects, combining physicochemical interactions and modification of the membrane interface. These results highlight the potential of polycarbazole as a versatile functional material for ceramic membrane applications in water treatment, offering a low-cost and easily implementable alternative for membrane surface engineering.

Keywords: Polycarbazole; In Situ Oxidative Polymerization; Surface Functionalization, Interfacial Modification



PREPARATION AND PERFORMANCE EVALUATION OF PERLITE– PHOSPHATE CERAMIC MICROFILTRATION MEMBRANES

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ABSTRACT

This work focuses on developing and the optimizing low-cost ceramic microfiltration membranes based on Moroccan geomaterials, specifically perlite and micronized phosphate. The primary objective is to prepare membranes with appropriate porosity, high permeability, and sufficient mechanical strength for wastewater treatment applications. A series of membranes was prepared by varying the micronized phosphate content and the sintering temperature. The resulting membranes were systematically characterized using structural and morphological analyses, as well as porosity, linear shrinkage, permeability, and mechanical strength measurements. The optimized microfiltration membrane was subsequently applied to clarify industrial wastewater, demonstrating its potential for practical use. Overall, this work contributes to sustainable development by valorizing locally available natural resources and promoting environmentally friendly membrane fabrication technologies [1, 2].

Keywords: Ceramic Membranes; Microfiltration; Perlite; Micronized Phosphate; Wastewater Treatment



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MEMBRANE TECHNOLOGIES FOR WASTEWATER TREATMENT: APPLICATION OF MXENE-BASED MEMBRANES

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ABSTRACT

Water and wastewater treatment are major global challenges as the consequence of population increase, industrial activity, and the continuous discharge of organic, inorganic, and biological contaminants into water resources [1]. Membrane-based technologies are typically recognized as practical and sustainable alternatives to water purification due to their high separation efficiency and low energy requirements. However, obstacles including fouling, limited permeability, and poor selectivity frequently plague traditional membranes. MXenes are a class of two-dimensional transition metal carbides, nitrides, and carbonitrides that have gained popularity as membrane materials for the treatment of water and wastewater. Improved water permeability and separation performance are facilitated by their high hydrophilicity, large specific surface area, adjustable surface chemistry, and changeable interlayer spacing [2]. MXene-based membranes have shown great promise in eliminating dyes, heavy metals, salts, and other impurities from wastewater, demonstrating its appropriateness for advanced membrane technology in environmental applications.

Keywords: Water Treatment; Wastewater Treatment; Membrane Separation; MXene; Environmental Applications

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PRODUCTION AND CHARACTERIZATION OF BIODEGRADABLE POLYESTER FROM PLANTAIN STEM WASTE

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ABSTRACT

The persistent environmental problems associated with petroleum-based plastics have intensified the search for biodegradable alternatives derived from renewable resources, particularly within the framework of sustainable development and social responsibility. This study reports the synthesis and characterization of biodegradable polyester produced from cellulose extracted from plantain stem waste, an underutilized agricultural residue in many developing countries. Plantain stems were subjected to alkaline treatment to extract cellulose, which was subsequently converted into polyester through a polycondensation process. The produced polyester was characterized using Fourier Transform Infrared (FTIR) spectroscopy, tensile and flexural mechanical tests, and solubility analysis. FTIR results confirmed the formation of ester linkages, while mechanical testing revealed moderate strength and flexibility suitable for biodegradable applications. Beyond technical performance, the study highlights the socio-economic and environmental relevance of converting agricultural waste into value added materials. The findings demonstrate that plantain stem waste is a viable, low-cost, and sustainable raw material for biodegradable polyester production, supporting waste to wealth initiatives, environmental protection, and circular economy goals relevant to social science discourse.

Keywords: Biodegradable Polyester; Plantain Stem; Cellulose; Agricultural Waste; Sustainability; Circular Economy



FROM NANO-HYDROXYAPATITE TO HIGH-PERFORMANCE CERAMIC MEMBRANES: APPLICATIONS IN DOMESTIC AND INDUSTRIAL WASTEWATER TREATMENT

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ABSTRACT

The design of high-performance membrane materials for wastewater treatment requires the development of selective layers with tailored physicochemical properties. In this context, nano-hydroxyapatite (nano-HAp), a calcium phosphate-based bioceramic, offers compelling advantages due to its large surface area, high ion-exchange capacity, and strong affinity for various pollutants, including heavy metals, dyes, and organic compounds. This study presents a systematic investigation into the synthesis of nano-HAp via different routes primarily hydrothermal and wet chemical methods aiming to control key parameters such as particle size, morphology, crystallinity and surface functionality. The synthesized nano-HAp is subsequently applied as a selective coating on ceramic membrane supports to fabricate advanced composite membranes. Structural and surface characterizations (XRD, SEM, FTIR and BET) confirm the successful formation of nanoscale apatite with desired textural properties. The incorporation of nano-HAp significantly enhances the membrane's hydrophilicity, adsorption capacity, and antifouling behavior, enabling efficient removal of contaminants from complex domestic and industrial wastewater matrices. Preliminary filtration tests demonstrate high rejection rates of toxic ions and persistent organic pollutants, combined with stable permeate flux and mechanical durability under harsh operational conditions. Finally, this work underlines the critical role of synthesis route optimization in tuning the properties of nano-HAp for membrane engineering. The proposed approach offers a sustainable and scalable platform for the development of next-generation ceramic membranes tailored to real-world water treatment challenges.

Keywords: Nano-hydroxyapatite; Synthesis; Ceramic Membranes; Wastewater Treatment



**STRUCTURAL AND OPTICAL PROPERTIES OF NON-STOICHIOMETRIC
 $\text{Bi}_4\text{Si}_x/2\text{Sn}_{x/2}\text{V}_{2-x}\text{O}_{11-3x/4}$ ($0.1 \leq X \leq 0.5$)**

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ABSTRACT

The non-stoichiometric solid solution $\text{Bi}_4\text{Si}_{x/2}\text{Sn}_{x/2}\text{V}_{2-x}\text{O}_{11-3x/4}$ (where $0.1 \leq x \leq 0.5$), referred to as BiSiSnVO_x , was synthesized via the conventional solid-state reaction method. The resulting materials were subjected to comprehensive structural and microstructural characterization using X-ray diffraction, Raman spectroscopy, Fourier transform infrared spectroscopy, and scanning electron microscopy combined with energy-dispersive X-ray spectroscopy. X-ray diffraction analyses performed at room temperature and as a function of temperature confirmed the presence of three crystalline phases: α , β , and γ . These results were confirmed by Raman and infrared spectroscopic data. Scanning electron microscopy images revealed a dense microstructure with well-defined grains. Furthermore, the optical band gap of BiSiSnVO_x was found to decrease from 2.08 electron volts (for $x = 0.1$) to 1.91 electron volts (for $x = 0.4$), indicating enhanced absorption in the visible range and promising potential in photocatalytic applications.

Keywords: BiSiSnVO_x ; XRD and Raman as a Function of Temperature; FTIR; DRS



PREPARATION AND CHARACTERIZATION OF FIBER GLASS FOR ADVANCE APPLICATION

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ABSTRACT

Samples of glass fiber having variable composition were synthesized by hand lay-up method. The composition varies in the range of 65-35 to 95-05 weight% of resin-hardener. Samples were examined by using XRD, UTM and Dielectric measurements. XRD result shows amorphous behavior for all samples. UTM and dielectric results were showing maximum tensile strength, Young's modulus and dielectric constant for sample 95-05 wt%. Nanofillers (0.5 wt%) were added in sample 95-05. By comparing result with neat sample, sample having nanofillers also shows amorphous behavior. Tensile strength and Young's modulus decreased as compared to neat sample. Dielectric constant enhanced as compared to neat sample. VSM result shows magnetic behavior for sample having nanofillers while neat sample possess diamagnetic behavior.

Keywords: Glass Fiber Composites; Hand Lay-up Method; X-ray Diffraction (XRD); Tensile Strength; Dielectric Properties; Nanofillers; Magnetic Behavior



NANO ENGINEERING-BASED DEVELOPMENT OF FOOD PACKING MATERIAL TO INCREASE SHELF LIFE AND PROTECT FROM PATHOGENS

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ABSTRACT

Foodborne pathogen and extension of shelf life are the uprising global challenges. The involvement of chemicals in conventional presentation methods elevates the environmental risk and health hazards. This study focuses on this critical issue by developing a novel and sustainable Nano-engineered approach for active packaging of food. The core innovation is the green synthesis of silver nanoparticles (AgNPs) using plant extract. The richness of bioactive compounds (like flavonoids and terpenoids) in plant extract provides safe, eco-friendly and a better alternative to toxic chemical methods. The efficiency of the nanoparticles is enhanced by encapsulating into Nano emulsion which offers stability, nanoparticle interaction and bioavailability. The finally developed Nano-engineered integrated packaging material is effective in inhibiting the growth of foodborne pathogens, extends shelf life, and improving quality and safety. This research authenticates a powerful, cost effective and eco-friendly strategy for sustainable future in food preservation and a revolutionizing advancement in food safety standards.

Keywords: Green Synthesis; Silver Nanoparticle; Nano Emulsion; Food Preservation; Foodborne Pathogen; Active Packaging



ADDRESSING IRON DEFICIENCY THROUGH FOOD FORTIFICATION: DEVELOPMENT OF AN IRON-ENRICHED NUTRITIONAL BAR

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ABSTRACT

Iron deficiency anemia remains one of the most widespread public health and humanitarian challenges, disproportionately affecting adolescent girls, menstruating women experiencing regular blood loss, pregnant and lactating mothers, and young children in developing countries. Addressing this nutritional burden through affordable, culturally acceptable, and food-based interventions is therefore a priority for public health and social development. The present study aims to develop an iron-enriched fortified bar using locally available, plant-based ingredients including roasted chickpea, spinach, munakka (dried grapes), black sesame seeds, and jaggery. These ingredients were selected for their high iron content, presence of natural enhancers of iron bioavailability, and additional micronutrients beneficial for women's and children's health. The developed product is analysis for chemical composition and physicochemical properties. The study shows that consumption of the recommended quantity of the fortified bar could contribute significantly toward meeting the daily iron requirement. Texture profile analysis (TPA) evaluate the textural characteristics of the product. Compared to the control chickpea bar, the fortified bar showed a higher iron content and improved nutritional value. An increase in spinach concentration resulted in a softer texture of the product, enhancing its acceptability. Jaggery and dates are used as natural sweetening agents, providing a healthier alternative to refined sugars while contributing additional minerals and energy. The findings emphasize the importance of affordable functional foods as a social intervention to strengthen women's and children's health and promote inclusive nutritional security.

Keywords: Anemia, Social Issue; Iron fortification; Chickpeas; Texture; Physicochemical Analysis



RESPONSIVENESS OF 5HT-1A RECEPTORS IN ADULT RATS FOLLOWING PRENATAL STRESS INDUCED SUSCEPTIBILITY TO APOMORPHINE ADDICTION

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ABSTRACT

Prenatal stress is an essential factor influencing the development of neuropsychiatric disorders and substance abuse vulnerability. This study examines the results of prenatal stress at the susceptibility to apomorphine dependency and the responsiveness of 5HT-1A receptors in adult rats formerly subjected to prenatal stress. Pregnant rats were subjected to unpredictable chronic mild stress on day 14 of pregnancy until birth, and their offspring were assessed in adulthood. Behavioural evaluation revealed that prenatally stressed rats exhibited a notably higher preference for apomorphine paired compartment in conditioned place preference paradigm, indicating potentiated susceptibility to addiction. Data on 5-HT syndrome and neurochemical analysis suggested altered 5HT-1A receptor responsiveness in these rats, suggesting that prenatal stress induces long-term modifications in serotonergic signalling pathways. These findings provide novel insights into how prenatal environmental factors contribute to the substance addiction and spotlight the role of 5HT-1A receptor modulation in mediating these outcomes. Understanding these mechanisms is essential for developing preventive and treatment strategies for addiction rooted in early life stress.

Keywords: Prenatal Stress; Apomorphine Dependency; 5HT-1A Receptors; 5-HT Syndrome; Conditioned Place Preference



NOVEL APPROACHES TO CONVERTING PLASTIC WASTE INTO ECO-FRIENDLY CONSTRUCTION MATERIALS

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ABSTRACT

The urban environment landscape is greatly polluted with a plastic waste crisis where over 400 million tonnes are produced annually with minimal recycling. Inadequate plastic waste management and construction's reliance on carbon-intensive materials exacerbate environmental degradation. This research develops scalable strategies converting mixed plastic waste into high-performance building materials (interlocks) meeting conventional standards through novel composite formulations, cost-effective processing, quality frameworks, and implementation roadmaps. Existing literature focuses on single-polymer applications and laboratory demonstrations, neglecting multi-polymer integration, long-term structural performance, fire resistance optimization, and socio-economic implementation. A multi-phase approach combines materials experimentation, computational modelling, and industry analysis. Phases include plastic feedstock characterization, prototype development varying compositions (10-70% plastic), mechanical and durability testing per ISO/ASTM standards, lifecycle assessment, and stakeholder engagement through structured interviews. Optimised composites achieve 25-45 MPa compressive strength suitable for non-load-bearing applications, with 30-40% improved thermal insulation and 30-50% carbon footprint reduction. Surface treatments increase bonding by 45-60%. Economic viability exists where feedstock costs remain below \$0.15/kg. Fire performance requires additional treatments. Pilot projects demonstrate successful applications in pavements, walls, and roofing. Prioritise fire-retardant research, develop regional processing hubs, conduct longitudinal performance studies, and launch awareness campaigns demonstrating safety and environmental benefits.

Keywords: Plastic Waste Valorisation; Sustainable Construction Materials; Circular Economy; Green Building; Recycled Plastic Aggregates



**LEVERAGING ARTIFICIAL INTELLIGENCE FOR SUSTAINABLE OCEANS:
DEEP LEARNING APPLICATIONS IN MARINE PLASTIC DETECTION AND
THEIR IMPLICATIONS FOR ENVIRONMENTAL POLICY**

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ABSTRACT

Introduction and Objective: Marine plastic pollution represents one of the most pressing environmental challenges of our time, with an estimated 100 to 150 million tons of plastic in the world's oceans and approximately 6.4 million tons deposited annually. This pollution poses significant threats to marine ecosystems, biodiversity, and human health through bioaccumulation in the food chain. Traditional monitoring methods, including manual beach surveys and satellite-based remote sensing, suffer from significant limitations in terms of spatial coverage, temporal resolution, and cost-effectiveness. This study aims to demonstrate how advanced artificial intelligence and deep learning technologies can be leveraged for automated marine plastic detection and monitoring, while examining the broader implications for environmental policy and sustainable development goals, particularly UN SDG-14 "Life Below Water" and SDG-6 "Clean Water and Sanitation". **Materials and Methods:** A comprehensive evaluation of state-of-the-art deep learning models was conducted using



multiple datasets including TrashCAN (7212 annotated underwater images), DeepTrash, and aerial datasets comprising 6589 drone-captured images with 51840 annotations. The study employed several detection architectures including improved YOLO-based models enhanced with Coordinate Attention mechanisms and Sinkhorn Distance regularization based on optimal transport theory. Data was collected using unmanned aerial vehicles (UAVs) and remotely operated vehicles (ROVs) across diverse marine environments including coastal beaches in Morocco at the mouth of the Moulouya River. Performance evaluation utilized precision, recall, mean Average Precision (mAP), and counting accuracy metrics across varying environmental conditions. **Results:** The improved deep learning detection system achieved a precision of 92% and recall of 94% in aerial scenes, and a precision of 90% and recall of 92% in subaqueous scenes. Comparative analysis of YOLO model variants (v8, v9, v10, v11) for plastic litter quantification demonstrated counting accuracies exceeding 98% across all versions, with YOLOv11 achieving the highest performance (99.07% counting accuracy, 93.53% mAP@50-95). The integration of attention mechanisms with optimal transport-based regularization significantly reduced false positives caused by surface reflections and improved detection of small, partially occluded debris. Real-time processing capabilities were demonstrated with inference times as low as 0.0017 seconds per image. **Discussion and Conclusion:** The findings demonstrate that AI-driven monitoring systems can significantly enhance the efficiency and accuracy of environmental surveillance efforts, providing valuable data for policymakers and environmental organizations. These technologies offer scalable and cost-effective solutions that complement traditional monitoring methods while enabling evidence-based environmental policy decisions. The integration of deep learning with drone platforms creates opportunities for adaptive monitoring strategies where survey patterns can be dynamically adjusted based on detected pollution hotspots. From a policy perspective, such automated systems can verify plastic collection metrics for plastic credit markets, support the Marine Strategy Framework Directive, and contribute to achieving Good Environmental Status indicators. The study argues that bridging the gap between technological innovation and environmental policy represents a paradigm shift in how societies can address plastic pollution, highlighting the critical role of interdisciplinary approaches in tackling global environmental challenges and supporting coastal community conservation efforts.

Keywords: Artificial Intelligence; Deep Learning; Marine Plastic Pollution; Sustainable Development; Environmental Policy; Ocean Conservation; Computer Vision

EVALUATION OF METEOROLOGICAL DROUGHT USING THE SPI INDEX AT DIFFERENT TIME SCALES



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ABSTRACT

Drought is a major issue in semi-arid regions, particularly in Morocco, where water resources and vegetation cover are heavily dependent on rainfall. This study aims to assess the spatial and temporal variability of rainfall over a long period in the Tensift basin. To do this, monthly precipitation data was used to calculate the SPI-3, 6, and 12-month indices. Analysis of the results showed alternating wet and dry periods in the basin, with each dry period followed by a short wet period. Furthermore, drought has always been present in the history of the basin, but the risk has worsened significantly over the last decade, especially since 2015. In addition, the different SPI time scales detected the same periods of drought with different sensitivities, but the SPI-12 remains the most suitable for characterizing drought in the basin.

Keywords: Drought; SPI; Precipitation; Tensift Basin



SUSTAINABLE RESOURCE CYCLE FROM MINING WASTE

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ABSTRACT

Mining activities have a multifaceted impact on various sectors, including but not limited to energy, construction, healthcare, and transportation. These contributions address fundamental human needs and exert a substantial economic impact. However, mining operations also generate a substantial volume of waste, amounting to billions of tons on an annual basis. Given the impracticality of on-site disposal of this waste, the necessity of storage areas is paramount. In instances where a solution medium is employed during mining operations, the resultant waste is typically stored in designated waste pools. The detrimental impacts of solid or solution-type waste have been demonstrated to cause significant problems in soil, water, and air receiving environments. Two significant issues have been identified with waste disposal sites. The primary concern pertains to the size of these sites, while the secondary concern is the elevated risk of harm to living beings from accidents caused by natural disasters or human error. Moreover, the mounting demand for mining activities in rapidly expanding sectors, such as technology, has resulted in heightened demand. Nevertheless, escalating expenditures in mining operations and investigative endeavors into the management of waste disposal facilities have redirected attention toward these mining byproducts. A portion of mining waste is utilized in sectors such as transportation and construction. However, a significant amount is subjected to re-enrichment processes, a process which aims to recover metals that are economically worthless. However, the process of creating a sustainable resource cycle from mining waste is not without its challenges. For mining waste to contribute to the circular economy, it is essential that various stakeholders (i.e., industrialists, academics, policymakers, etc.) collaborate to develop suitable solutions. The present study focuses on the evaluation of mining wastes in terms of circular economy principles, with the objective of creating a sustainable resource cycle.

Keywords: Mining Waste; Sustainable; Resource Cycle; Circular Economy



SUSTAINABLE APPROACH TO WATER SCARCITY IN ARID AREAS BY USING RENEWABLE ENERGY FOR DESALINATION

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ABSTRACT

Arid and semi-arid areas, which cover approximately 46% of the Earth's surface, are particularly vulnerable to the combined effects of climate change, desertification, and water scarcity. These constraints lead to the gradual deterioration of ecosystems, a reduction in ecosystem services, and increasing water insecurity affecting approximately three billion people. In this context, water desalination appears to be a strategic solution for enhancing water security in arid areas. This study focuses on examining the major desalination technologies, namely reverse osmosis, thermal distillation, and emerging processes. It highlights their integration with renewable energy sources such as solar, wind, and geothermal energy. The analysis highlights that coupling desalination with renewable energy reduces carbon footprint, dependence on fossil fuels, and long-term operating costs. Despite the challenges inherent in energy intermittency, initial investment, and brine management, these technologies offer promising prospects for sustainable water management. Desalination powered by renewable energy plays a crucial role in combating climate change and promoting sustainable development in arid and semi-arid regions. It is an essential lever for adapting to climate change, while helping to secure water supplies and promote energy independence.

Keywords: Renewable Energy; Water Desalination; Water Security; Climate Change; Renewable Energy; Reverse Osmosis; Energy Efficiency



MODERNIZING WATER AND SANITATION INFRASTRUCTURE IN GURJAANI, GEORGIA

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ABSTRACT

Effective water and wastewater management is fundamental to public health, economic stability, and environmental sustainability. Gurjaani, a municipality in Georgia's eastern Kakheti region, has historically faced deficiencies in water distribution and sewage treatment infrastructure. However, a series of recent governmental and internationally supported initiatives signal a transformative period for the region. This article provides a comprehensive analysis of Gurjaani's evolving water infrastructure, highlighting the social, technical, and environmental dimensions of its modernization efforts.

Keywords: Water; Sustainable; Wastewater



BIOPLASTICS: A GREEN APPROACH IN MATERIALS FOR GREEN ENVIRONMENT

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ABSTRACT

The diverse and ubiquitous consumption of polymers urges the necessity to make these materials easily available. However, the excessively used petrochemicalbased polymers such as Polyvinyl Chloride (PVC) are non-biodegradable, which is a motivation to modify it with “green” alternatives. In the present study, PVC ($MW = 48\,000\text{ gmol}^{-1}$) has been incorporated with cornstarch (CS) to synthesize a series of 25 samples of bioplastics in addition to blank polymer samples. The films of five various thicknesses (0.1, 0.2, 0.3, 0.5, and 1.0 mm) have been synthesized using in situ polymerization. Each sample of pure PVC film and bioplastic has been induced with different concentrations of CS in the range of 1– 5 wt %. The synthesized samples were subjected to the structural characterization by using Fourier transform infrared. Thermogravimetric analysis (TGA) has demonstrated the three-step degradation with the improved stability of 250 °C. The 3% concentration of CS has shown the optimum storage modulus (E') of 1.660 MPa from dynamic mechanical analysis (DMA) and the value of $\tan \delta$ as 0.50. The swelling test performed using water has shown an induction of hydrophilicity in PVC up to 4%. CS-induced bioplastics can be a potential ecofriendly alternative of conventional polymers.

Keywords: Green Environment; Bioplastics; Poly Vinyl Chloride; Biowastes; TGA; DMA Behavior



ASSOCIATION BETWEEN PRIOR-NIGHT SLEEP DURATION AND ACUTE 2-BACK WORKING-MEMORY CHANGE DURING HIIT IN ADOLESCENTS: A SCHOOL-BASED RANDOMIZED CONTROLLED TRIAL IN A PHYSICAL EDUCATION SETTING

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ABSTRACT

Background: Sleep duration may influence cognitive performance and could contribute to inter-individual variability in acute cognitive responses to high-intensity interval training (HIIT). **Objective:** To examine whether prior-night sleep duration is associated with acute change in working memory (2-back score) during an acute HIIT testing session in adolescents. **Methods:** A school-based HIIT program was implemented over 6 weeks (two sessions/week) in healthy high-school students. The present analysis focused on the second acute testing session (Intervention 2) conducted in the experimental group ($n = 23$; 11 boys, 12 girls; mean age 17.91 years). HIIT intensity was prescribed relative to individual maximal aerobic speed (MAS) with 100% MAS work bouts, structured in Sets A–C (20"/40", 30"/30", 40"/20"), with a 3-min walking recovery between sets (total work time: 10 min). Prior-night sleep duration (hours) was recorded using a smartphone sleep-tracking application. Working memory change was computed as $\Delta 2\text{-back} = \text{post} - \text{pre}$ (score). The association between sleep duration and $\Delta 2\text{-back}$ was tested using Pearson correlation. **Results:** Mean sleep duration was 7.39 ± 0.99 h, and mean $\Delta 2\text{-back}$ was 1.43 ± 1.34 ($n = 23$). Sleep duration was not associated with $\Delta 2\text{-back}$ ($r = -0.10$, $p = 0.65$). **Conclusion:** In this adolescent sample, prior-night sleep duration was not associated with acute working memory change during the HIIT session. Future studies should incorporate more detailed sleep indicators (e.g., quality, fragmentation, sleep debt) to better characterize sleep–cognition interactions in response to acute exercise.

Keywords: High-Intensity Interval Training; Sleep Duration; Working Memory; 2-Back; Adolescents; Acute Exercise



REVOLUTIONIZING CANCER DIAGNOSIS: THE POTENTIAL OF 3D PRINTED NANOSENSORS

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ABSTRACT

Cancer is a complicated illness with a worldwide impact, requiring ongoing breakthroughs in diagnosis and treatment. The application of 3D printing technology is increasingly recognized as an innovative tool in cancer diagnosis, offering enormous possibilities in detection and surveillance. The study aims to improve early diagnosis and prognosis for patients. 3D printing has become more popular for producing precise, customizable nanosensors with high sensitivity and specificity. The study covers the latest advances in 3D-printed cancer nanosensors. It discusses how inkjet printing, stereolithography, and fused deposition modeling can create intricate nanostructures with increased performance. Design and functionalization strategies for targeting nucleic acids, proteins, and circulating tumor cells are also covered. Nanomaterial-based sensors can detect tumor biomarkers, circulating cells, and extracellular vesicles, improving cancer diagnosis and survival. Integrating 3D-printed nanosensors with fluorescence, electrochemical, and surface-enhanced Raman spectroscopy allows rapid and accurate cancer diagnosis in clinical settings. The publication critically reviews and synthesizes previous research to show how 3D-printed nanosensors could improve cancer diagnosis as well as personalized therapy. The study explores the capacity of 3D-printed nanosensors to bring about significant changes in the field of cancer diagnostics. Using 3D-printed technology and additive manufacturing, these sensors provide exceptional sensitivity and specificity for the early identification of cancer biomarkers. Their ability to be customized allows for specific therapies for various types of cancer, offering substantial progress in precision medicine. The paper analyzes the most recent advancements, obstacles, and potential future opportunities of 3D-printed nanosensors, with a specific focus on their significant impact on transforming cancer diagnosis.

Keywords: 3D Printing; Nanosensor; Stereolithography; Cancer Diagnosis; Personalized Therapy



PERCEPTIONS AND BARRIERS TO PHYSICAL ACTIVITY IN DEMENTIA CARE AMONG HEALTHCARE PROFESSIONALS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: Dementia is a major public health challenge with substantial functional, cognitive, and social consequences. Physical activity is increasingly recognized as a promising non-pharmacological strategy to preserve autonomy and quality of life in people living with dementia. However, effective implementation in clinical practice largely depends on healthcare professionals' perceptions, knowledge, and organizational constraints. **Objective:** To explore healthcare professionals perceptions, perceived barriers, and needs regarding physical activity for patients with dementia, including training and institutional structuring needs. **Methods:** A



descriptive cross-sectional study was conducted using a self-administered questionnaire distributed to healthcare professionals across multiple clinical settings in Morocco. The questionnaire assessed clinical exposure to dementia, perceived benefits of physical activity, the availability of institutional practices/protocols, perceived barriers to implementation, and interest in physical activity related training and support tools. Responses were summarized using descriptive statistics. **Results:** Among respondents ($n = 81$), 75.3% were women ($n = 61$). Professional categories were dominated by general nurses (54.3%, $n = 44$) and nurse anesthetists (18.5%, $n = 15$), followed by physicians (11.1%, $n = 9$). Main practice areas included the Emergency Department (24.7%, $n = 20$), Cardiology (12.3%, $n = 10$), and Intensive Care (11.1%, $n = 9$), with additional respondents from primary care/health centers (11.1%, $n = 9$). Workplace settings included university hospitals (37.0%, $n = 30$), regional hospitals (14.8%, $n = 12$), and health centers (22.2%, $n = 18$). Professional experience was distributed as <5 years (37.0%), 5–10 years (39.5%), and >10 years (23.5%). Regarding exposure, 51.9% reported regular contact with patients with dementia and 45.7% reported occasional contact. Perceptions were broadly favorable: 76.5% considered physical activity beneficial, 85.2% believed it helps maintain functional autonomy, and 80.2% reported potential positive cognitive and/or behavioral effects. However, physical activity integration was perceived as not realistic in the current system (agreement ≥ 4 : 19.8%, mean 2.57/5). Institutional protocols were rarely reported (agreement ≥ 4 : 4.9%, mean 1.95/5), whereas the need to develop protocols was strongly endorsed (agreement ≥ 4 : 70.4%, mean 4.06/5). Major perceived barriers (agreement ≥ 4) were lack of training (81.5%), limited time/resources (74.1%), lack of protocols/coordination (76.5%), and fear of risk (72.8%). Overall, 97.5% supported implementing physical activity -related training, protocols, and tools. **Conclusion:** Healthcare professionals across diverse roles and settings strongly endorse the benefits of physical activity in dementia care, yet report substantial structural and organizational barriers. Implementing targeted training, institutional protocols, and interprofessional coordination appears essential to improve real-world physical activity integration for patients with dementia.

Keywords: Dementia; Physical Activity; Perceptions; Healthcare Professionals; Barriers; Protocols; Training



INTEGRATING METAGENOMIC FUNCTIONAL PROFILING TO EVALUATE PUBLIC HEALTH RISKS DERIVED FROM PTE-CONTAMINATED RIVER SEDIMENTS

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ABSTRACT

Potentially toxic element (PTE) contamination in river sediments represents a persistent environmental issue with significant implications for water security and public health. River sediments act as long-term sinks for toxic elements originating from both natural processes and anthropogenic activities, and they may function as secondary sources of contamination through remobilization processes and food web transfer. Assessing sediment-associated risks therefore requires approaches that extend beyond conventional physicochemical measurements. This study is presented as a conceptual and narrative review that integrates current knowledge on PTE-contaminated river sediments, microbial functional responses, and public health risk pathways. The research focuses significantly on the functional profiling of the metagenome as a tool for detecting microbial adaptations to metal-induced stress, including genes related to metal resistance, detoxification, oxidative stress response, and redox transformations. Evidence from the literature suggests that such functional indicators provide biologically meaningful signals of environmental stress that may not be fully captured by concentration-based sediment assessments alone. By synthesizing findings from environmental chemistry, microbial ecology, and public health-oriented studies, this review highlights the potential of metagenomic functional information to support a more holistic interpretation of sediment quality and contamination dynamics. Although metagenomic data cannot directly quantify human health outcomes, integrating microbial functional profiles into sediment-focused evaluations offers valuable contextual insight into conditions that may influence exposure pathways and long-term health risks. Overall, this review underscores the relevance of metagenomic functional profiling as a complementary approach for understanding the environmental and public health implications of PTE-contaminated river sediments and for strengthening integrative frameworks in sediment-based risk assessment.

Keywords: Metagenomic; Potential Toxic Element; Environmental Issues



USE OF MULTIVARIATE STATISTICAL METHODS IN ENVIRONMENTAL MONITORING RESEARCH: A BIBLIOMETRIC ANALYSIS

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ABSTRACT

Environmental monitoring has become increasingly data-intensive due to the growing complexity of environmental systems, expanding monitoring networks, and intensified anthropogenic pressures on air, water, soil, and sediment environments. In this context, multivariate statistical methods have been widely applied to interpret high-dimensional datasets, identify pollution patterns, and support environmental assessment and management. Despite the rapid growth of scientific output in this field, a comprehensive and systematic understanding of its global research structure, thematic evolution, and methodological trends remains limited. This study presents a bibliometric analysis of research on multivariate statistical methods in environmental monitoring based on 1,239 publications retrieved from the Web of Science Core Collection covering the period 1987–2025. A structured search strategy and exclusion criteria were applied to ensure a focused dataset encompassing key multivariate techniques, including principal component analysis, factor analysis, cluster analysis, canonical correlation analysis, and multivariate adaptive regression splines. Bibliometric analyses were conducted using the bibliometrix package and its Biblioshiny interface, incorporating performance indicators, international collaboration networks, bibliographic coupling, co-citation analysis, and keyword-based thematic mapping. In addition, growth dynamics and a logistic life-cycle model were employed to assess the developmental stage of the research field. The results indicate a strong and accelerating growth in scientific production since the early 2010s, with China, the United States, and several European countries leading global research output. The intellectual structure of the field is characterized by a stable methodological core centered on principal component analysis and cluster analysis, closely linked to application domains such as pollution assessment, water quality, sediments, and heavy metal contamination. Emerging trends indicate an increasing integration of machine learning, remote sensing, and sensor-based approaches with classical multivariate statistical techniques.

Keywords: Multivariate Statistical Methods; Environmental Monitoring; Bibliometric Analysis; Science Mapping; Research Trends



THE NANO-ASSAULT: ENGINEERING NEW DELIVERY FRONTIERS FOR OVARIAN CARE

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ABSTRACT

Poor bioavailability and high systemic toxicity often compromise the therapeutic efficacy of conventional chemotherapy in ovarian cancer, despite improvements in surgical intervention. "The Nano-Assault" examines the transition from systemic medication delivery to the precision-engineered field of nanomedicine. The creation of multifunctional nanocarriers, such as liposomes, polymeric micelles, and gold nanoparticles, to take advantage of the distinct "leaky" vasculature of ovarian cancers is examined in this article. We talk about how these "nanoshells" can deliver high-concentration payloads straight to the cancerous location by avoiding healthy tissue through the engineering of ligand-mediated targeting (such as folate and hyaluronic acid receptors). This paper demonstrates how creating new delivery frontiers is not only a required attack on the mechanisms of drug resistance but also an incremental improvement by examining existing clinical trials and the obstacles of the tumor microenvironment. This microscopic accuracy, which turns a "silent killer" into a treatable, targetable illness, is the key to the future of ovarian care.

Keywords: Ovarian Cancer; Nanomedicine; Targeted Drug Delivery; Nanocarriers; Ligand-Mediated Targeting; Tumor Microenvironment; Bioavailability; EPR Effect



QUORUM SENSING INHIBITION BY ALGAL COMPOUNDS AGAINST MARINE BIOFILMS

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ABSTRACT

We examined that whether patulin and penicillic acid, two well-known quorum sensing inhibitors (QSI) for human pathogen *Pseudomonas aeruginosa* PAO1, can prevent biofilm formation. The study aims for amplification of a putative luxS gene homologue in the marine microorganism *H. pacifica* ATCC 27122, as well as monitoring AI-2 QS in marine organisms. Degenerated primers were designed based on the luxS protein sequence of ten gram-negative, α -, β - and γ - proteobacteria, and used for luxS gene amplification in *H. pacifica*. AI-2 assays were carried out using the well-established *Vibrio harveyi* BB170 AI-2 bioluminescence assay. Effect of penicillic acid on AI-2 induction of *H. pacifica* showed strong inhibitory effect at non-growth inhibitory concentrations compared to patulin having adverse effect at the highest concentration (25 μ M) tested in our study. QSI's effect on biofilm forming capability of marine isolates was isolate specific. Detection of bioluminescence in the autoinducer bioassay and the presence of a putative luxS gene orthologue are biochemical and genetic evidence for the production of a signalling molecule(s) and provide a first step in characterizing *H. pacifica* quorum sensing. Our study emphasizes that QSI compounds must be selected in the specific system in which they are to function and they cannot easily be transferred from one QS system to another.

Keywords: Biofilm Formation; *H. pacifica*; AI-2 Assay; LuxS Gene; Patulin; Penicillic Acid



OPTIMIZATION OF HEAT EXCHANGER PERFORMANCE USING BAFFLE CONFIGURATION AND NANOFLUID ENHANCEMENT

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ABSTRACT

Introduction and Objective: This study aims to enhance the thermal performance of a shell-and-tube heat exchanger by optimizing baffle configurations and applying nanofluid enhancement, while maintaining a maximum allowable pressure drop of 1000 Pa. **Materials and Methods:** A reference heat exchanger operating at the pressure-drop limit was established. Geometric optimization was conducted by varying the number of baffles ($N_b = 4, 6, \text{ and } 8$) and baffle cut ratios to evaluate their effects on flow behavior and heat transfer. Nanofluid enhancement was applied by adding nanoparticles to the hot-side working fluid, and different volume fractions were analyzed. **Results:** Increasing the baffle number improved turbulence and heat transfer, with diminishing gains beyond $N_b = 6$. The $N_b = 8$ configuration yielded the best overall thermal performance within the pressure-drop constraint. Nanofluid application further enhanced heat transfer, with improvements of up to 36%, and the optimal performance was achieved at a 2% nanoparticle volume fraction. **Discussion and Conclusion:** The results demonstrate that combining baffle optimization with nanofluid enhancement significantly improves heat exchanger performance while satisfying hydraulic constraints, providing an effective approach for thermal system optimization.

Keywords: Shell-and-Tube Heat Exchanger; Baffle Optimization; Nanofluid; Heat Transfer Enhancement; Pressure Drop



SECOND-ORDER SLIP-CONTROLLED MHD MICROPOLAR NANOFLUID FLOW OVER A STRETCHING PLATE WITH SUCTION AND NONLINEAR CONVECTION

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ABSTRACT

In various advanced thermal management and materials processing systems, (e. g. microelectromechanical devices, polymer extrusion, etc.) where micro-scale effects, magnetic fields, and surface mass transfer are critical, understanding of slip effects are critical. Therefore, the current study investigates the second-order slip-controlled MHD flow of a micropolar nanofluid over a stretching plate in the presence of suction and nonlinear convection. The governing boundary-layer equations for the flow of micropolar nanofluid in the presence of microrotation, Lorentz force, nanoparticle transport, and nonlinear buoyancy effects are derived and transmuted into a coupled system of nonlinear ordinary differential equations using appropriate similarity transformations. The solutions are obtained via a numerical technique while the analysis of the impacts of second-order slip, magnetic parameter, suction strength, micropolar material parameter, and nonlinear convection on the velocity, microrotation, temperature, and concentration fields are graphically displayed. The results reveal that enhanced second-order slip significantly reduces wall shear stress while modifying microrotation dynamics, whereas suction effectively suppresses boundary-layer thickness and improves thermal stability. Nonlinear convection is found to intensify buoyancy-driven transport, leading to notable variations in heat and mass transfer rates. These findings provide useful physical insight for optimizing microscale MHD flow control and thermal performance in advanced engineering applications.

Keywords: Micropolar Nanofluid; Nonlinear Convection; Slip Controlled flow; Second order slip; Suction effects



SIMULATION OF THE GAS-LIQUID PROCESS MIXTURES TAKING INTO ACCOUNT PHASE TRANSITIONS

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ABSTRACT

In these works, the filtration process is studied on the basis of the filtration equations of each phase with the corresponding initial and boundary conditions. This complicates the analytical solution of the problem and the derivation of expressions for their practical applications. Therefore, the solution of the problem of filtration of a gas-liquid mixture in a porous medium of a more simplified model suitable for practical applications is of both scientific and practical interest.

Keywords: Filtration, Gas-Liquid, Pressure, Simulation



A NOVEL COOPERATIVE ALGORITHM FOR UNMANNED AERIAL VEHICLE SWARMS TO SEARCH UNKNOWN ENVIRONMENTS WITH CONSIDERING THE ENERGY CONSUMPTION

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ABSTRACT

This study deals with the energy consumption minimization of swarm unmanned aerial vehicles (UAVs) in unknown environments. The main objective of drones is to search for a dynamic target in an unknown environment. A novel target probability map (TPM) modeling is proposed to better cope with the uncertainties induced by the dynamic target. Moreover, a novel Particle Swarm Optimizer (PSO) algorithm is introduced that considers the velocity of each UAV in the swarm and tries to minimize the energy consumption of the drones while exploring the area and trying to find the target. The optimizer assumes only the velocities in the x and y directions while the altitudes of the drones remain the same. The Artificial Potential Field method is utilized to prevent the collusion of the UAVs during their mission. Crazyflie 2.1 drones are employed in the swarm in this study. The energy consumption of the UAVs is determined by the motor voltage and current consumption of each rotor concerning the revolutions per minute (RPM). The simulation studies are performed in Python environment with gym-pybullet-drones library. Two simulation studies are accomplished to test the energy consumption minimization performance of the swarm. The energy consumption and target search are considered in the first simulation. Only the target search is taken into account in the second simulation. The results revealed that the energy consumption of the UAV swarm is reduced when the energy consumption is taken into account.

Keywords: Energy Consumption Optimization; Swarm UAVs; Target Probability Maps



MICROSTRUCTURE AND HARDNESS CHANGES OF Al-40Zn-3Cu BEARING ALLOYS WITH Sn ADDITION

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ABSTRACT

Al-40Zn-3Cu bearing alloys, which are preferred in automotive and machinery applications due to their high wear resistance and favorable mechanical properties, were investigated in this study. Both the base Al-40Zn-3Cu alloy and novel Al-40Zn-3Cu-(x)Sn alloys (x = 2.5, 5, 7.5, and 10 wt%) were examined for changes in microstructure and hardness after casting and heat treatment. Commercially pure metals (Al, Zn, Cu, and Sn) were used for alloy production. The metals were added to a graphite crucible and melted at 740 °C using an electric resistance furnace. The molten alloys were held at 740 °C for 1 hour prior to casting, with mechanical stirring every 10 minutes using a graphite rod. To achieve a more homogeneous structure, the ingots produced in the first casting were re-melted at 640 °C and cast a second time. The alloys were subjected to T6 heat treatment. The ingots were solution-treated at 450 °C for 1 hour, quenched in ice water, and then artificially aged at 100 °C for 1 hour, followed by furnace cooling to room temperature. The hardness of both as-cast and heat-treated specimens was measured using a Leeb hardness tester. Five measurements were taken at different points on each ingot, and the average value was calculated. For easier comparison with literature data, Leeb hardness values were converted to Brinell hardness. For microstructural analysis, specimens were prepared from the ingots using standard metallographic procedures and etched in Keller's solution for 10 seconds. It was determined that Sn addition up to 5 wt% reduced the hardness of the Al-40Zn-3Cu alloy, while further increase of Sn content from 5% to 10% did not cause significant changes. After T6 heat treatment, all alloys exhibited a notable increase in hardness, which was associated with precipitation hardening in the Al-Zn-Cu system. The Sn-free Al-40Zn-3Cu alloy exhibited the highest hardness after T6 treatment. The results provide preliminary insights into the effects of Sn addition and T6 heat treatment on the mechanical properties of Al-40Zn-3Cu bearing alloys.

Keywords: Al-Zn-Cu Alloys; Sn Addition; T6 Heat Treatment; Hardness; Bearing Alloys

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EFFECT OF INFILL PATTERN ON TENSILE AND IMPACT PERFORMANCE OF FDM-PRINTED PLA+

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ABSTRACT

Fused Deposition Modeling (FDM) is widely used in additive manufacturing for producing polymer components with complex geometries; nevertheless, the mechanical performance of printed parts is highly dependent on their internal structural configuration. In this work, the influence of five different infill patterns on the tensile properties and impact energy absorption of FDM-fabricated PLA+ specimens are investigated. PLA+ was chosen because of its improved toughness and interlayer adhesion compared with conventional PLA, which enhances its suitability for functional applications. To ensure a fair comparison, all samples were printed using identical processing parameters, allowing the isolated assessment of infill geometry effects. Tensile tests were conducted to determine ultimate tensile strength, elastic modulus, and elongation at break, while impact testing was employed to evaluate energy absorption capability. The results indicate that infill pattern has a substantial influence on both tensile and impact behavior. Certain infill geometries exhibit notably improved strength-to-weight performance and higher impact resistance while maintaining similar material consumption. These outcomes emphasize the importance of infill pattern selection in the mechanical optimization of FDM-printed PLA+ parts and offer practical insights for the design of lightweight, load-bearing, and energy-absorbing components.

Keywords: Additive Manufacturing; PLA+; Infill Pattern; Tensile Properties; Impact Energy



BATTERY THERMAL MANAGEMENT SYSTEM USING PHASE CHANGE MATERIALS UNDER VARIOUS THICKNESS AND DISCHARGE RATES

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ABSTRACT

The importance and use of electric vehicles have increased with technological developments, as fossil fuels have limited reserves and significant environmental impacts. However, temperature control is one of the biggest challenges because of the high temperatures reached by battery cells. Therefore, Battery Thermal Management System (BTMS) plays a crucial role in battery health, safety, and life. Several cooling methods in the scope of BTMS studies are applied to battery surface temperature control in electric vehicles. Phase change material (PCM) is frequently preferred as one of the cooling applications due to the high latent heat storage. In this context, BTMS models were investigated using PCMs with three different thickness values for the current study. Battery surface temperatures decreased with a further increase of the PCM thickness. Surface temperatures decreased by 11.4%, 12.5%, and 13.4% at 4 mm, 6 mm, and 8 mm PCM thicknesses, respectively, under a discharge rate of 1C. Then, analyses were performed under 3C discharge rate to observe the effect of PCM thickness at different heat generation rates. Results indicated that temperature decreases to approximately 56% by increasing PCM thickness. In other words, the influence of PCM is more clearly understood compared to a single cell as the heat generation rate increases. All in all, PCM usage in BTMS enabled the batteries to reach their optimum operating temperature range by decreasing the surface temperature. It is anticipated that these results will provide important fundamental data for our future passive, active, and hybrid battery cooling research, which will be further developed by adding different parameters.

Keywords: PCM thickness, Battery thermal management system, Discharge rate



METHODOLOGICAL APPROACHES TO MEASURING ENERGY EFFICIENCY: A FOCUS ON DATA ENVELOPMENT ANALYSIS

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ABSTRACT

Accurately measuring energy efficiency is a precondition for designing effective policies in the fields of energy, environment, and economic development. Traditional indicators such as energy intensity (energy use per unit of GDP) are widely used in empirical and policy analyses, yet they conflate structural, technological, and behavioral effects and do not provide a clear notion of an efficiency frontier. This paper offers a methodological review of approaches to measuring energy efficiency, with particular emphasis on frontier-based techniques and Data Envelopment Analysis (DEA). First, the paper clarifies the conceptual distinction between energy intensity and energy efficiency, and reviews common indicator families, including thermodynamic, physical–thermodynamic, and economic–thermodynamic measures. Second, it introduces frontier methods, contrasting parametric approaches such as Stochastic Frontier Analysis with non-parametric DEA. The core of the paper presents DEA as a flexible multi-input–multi-output framework for assessing energy–economic performance across countries, sectors, or firms. Within this framework, the paper discusses, in a general way, both single-input models that treat energy as the only input and broader multi-input specifications in which energy is combined with other relevant production factors (e.g. labour, capital, or technological variables), depending on the empirical context. The paper concludes with a methodological discussion of the advantages, limitations, and recent extensions of DEA in energy efficiency studies, and outlines directions for future empirical research, including applications to emerging economies and the integration of environmental performance indicators.

Keywords: Energy Efficiency; Energy Intensity; Data Envelopment Analysis (DEA); Methodological Review



ENERGY-EFFICIENT PRODUCTION OF HYDROGEN AND SULFUR FROM HYDROGEN SULFIDE IN DIELECTRIC BARRIER DISCHARGE PLASMA

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ABSTRACT

Hydrogen is called the cleanest source of energy. Huge reserves of hydrogen are concentrated in water - research is being carried out in the direction of developing a technology for extracting hydrogen from water, as this is an environmentally friendly and waste-free production. However, hydrogen can also be obtained from hydrogen sulfide. In this case, two process products are obtained at once in one stage: hydrogen and sulfur. The extremely low thermal effect of the process is noteworthy, allowing, in principle, to produce hydrogen by this method with exceptionally low energy consumption, which is especially interesting in the context of atomic-hydrogen energy. This paper presents studies on the decomposition of hydrogen sulfide in a barrier discharge on a pilot plant mounted on the experimental base of the institute. It was found that under certain process conditions, the hydrogen sulfide-containing gas completely decomposes into hydrogen and sulfur. When decomposing hydrogen sulfide in the plasma of a barrier discharge, the factor determining the course of the reaction is the specific energy consumption. The reaction rate is determined by the rate of energy supply, i.e., the discharge power.



Keywords: Hydrogen; Barrier Discharge; Low Energy Consumption; Charged Particles
APPLICATION OF NANOTECHNOLOGY TO HIGH-VOLTAGE INSULATION MATERIALS

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ABSTRACT

High-voltage insulation materials are critically important for the reliability and stability of power systems. This paper briefly outlines the impact of nanotechnology on the electrical, mechanical, and thermal properties of high-voltage insulation materials. Methods for the synthesis and application of nanofillers and nanocomposites for high-voltage insulation materials are discussed. It is shown that the application of nanotechnology enhances dielectric strength, reduces electrical conductivity, and ensures the long-term durability of high-voltage insulation materials.

Keywords: Nanotechnology; High-Voltage Insulation; Nanocomposite; Dielectric Strength; Electrical Engineering Materials



INTEGRATION OF ENERGY EFFICIENT PRINCIPLES IN THE DESIGN OF FIVE STAR HOTEL IN ABUJA, NIGERIA

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ABSTRACT

The hospitality sector is one of the most energy-intensive components of the built environment, with five-star hotels consuming large amounts of energy due to their scale, continuous operation, and high comfort requirements. In Nigeria, unreliable public power supply and dependence on fossil-fuel generators further intensify this challenge. This study investigates the application of energy-efficient architectural design principles in the proposed design of a five-star hotel in Abuja, with the aim of reducing energy consumption and environmental impact while maintaining international standards of luxury. A mixed-method research approach was adopted, combining energy performance simulations using STROMA FSAP 2012 and Elmhurst SAP10 with case study analysis of selected luxury hotels in Abuja. The study examined climate-responsive design principles suitable for the tropical savannah climate, including building orientation, shading systems, natural ventilation, façade treatment, daylighting, and landscape integration. Energy Efficiency Ratings and Environmental Impact Ratings were used to evaluate building performance. Results indicate that many existing luxury hotels in Abuja perform below recommended energy benchmarks due to poor orientation, extensive unshaded glazing, and heavy reliance on mechanical cooling. Simulation outcomes demonstrate that incorporating passive design strategies can significantly reduce cooling demand, energy use, and carbon emissions without compromising guest comfort. The study concludes that energy-efficient architectural design is technically feasible, environmentally beneficial, and economically viable for luxury hotel development in Abuja.

Keywords: Energy Efficiency; Five-star Hotel; Sustainable Architecture; Passive Design; Abuja



CHARGED PARTICLE DYNAMICS AS A MECHANISM FOR HF-QPOs IN MICROQUASARS AND ACTIVE GALACTIC NUCLEI

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ABSTRACT

High-Frequency Quasi-Periodic Oscillations (HF QPOs) are among the most intriguing phenomena observed in Low-Mass X-ray Binaries (LMXBs) containing black holes or neutron stars. In this paper, we investigate the dynamics of charged particles in the vicinity of a Schwarzschild-like black hole immersed in a uniform magnetic field (MF) and surrounded by Cold Dark Matter (CDM). Our goal is to gain deeper insight into how magnetic and dark matter distributions influence observable phenomena near compact objects. We begin by presenting a modified metric that incorporates the effects of CDM, and we explore how both dark matter and magnetic fields affect the effective potential, stable circular orbits, and escape conditions of ionized particles. Using a Hamiltonian formalism, we analyze the energy boundaries and the innermost stable circular orbit (ISCO), demonstrating the combined effects of CDM and a Uniform MF. Furthermore, we compute the fundamental oscillation frequencies to examine how their variations depend on the joint influence of CDM and magnetic field strength. The resulting frequency structure enables us to identify resonance radii associated with HF QPOs, particularly those exhibiting the 3:2 ratios observed in microquasars. We also evaluate several theoretical models for QPO generation. Our results emphasize the importance of including both magnetic and dark matter effects in strong-field astrophysics and support the interpretation of HF QPOs as sensitive probes of black hole environments. This study opens new perspectives for exploring particle dynamics, accretion disk structures, and potential observational signatures of dark matter in the vicinity of compact objects.

Keywords: Microquasar; Particle Dynamics; Astrophysics; High-Frequency Quasi-Periodic Oscillations



EVALUATION OF CRITERIA ENABLING DIGITAL TRANSFORMATION SUCCESS FACTORS FOR SUSTAINABLE PERFORMANCE IN LOGISTICS SECTOR

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ABSTRACT

Digital transformation has become a strategic driver for improving competitiveness and ensuring sustainable performance in the logistics sector; however, the multidimensional and highly interconnected nature of digital technologies makes it difficult to draw clear boundaries among transformation criteria. This complexity requires these criteria to be considered not as independent constructs, but within a framework of interaction and complementarity. Accordingly, this study proposes a holistic and structured decision-support framework for evaluating digital transformation in the logistics sector. In the first stage, digital transformation criteria were identified through a comprehensive literature review. Preliminary analyses showed that clear distinctions among these criteria were limited. Therefore, the criteria were grouped using the Fuzzy C-Means clustering method, which captures different degrees of similarity among them. The uncertainty observed during clustering further reflects the inherently complementary nature of digital transformation components. Subsequently, the relative importance of the clustered criteria was evaluated using the Fuzzy Analytic Hierarchy Process (F-AHP) based on expert judgments obtained from professionals with substantial experience in the logistics domain. The analysis results indicate that automation-oriented systems represent the most important criterion for digital transformation success in logistics, while integration-oriented systems rank second with a very close level of importance. This result suggests that automation functions as the primary driving force of digital transformation, whereas integration plays a critical complementary role by enabling the effective and sustainable implementation of automated solutions. Moreover, infrastructure and security, together with analytical capabilities, are identified as key supporting elements that enhance system effectiveness and facilitate the conversion of technological investments into operational value. Overall, the findings emphasize that digital transformation should be approached not as isolated technologies, but as interrelated and mutually reinforcing technology groups with defined priorities.



Keywords: Digital Transformation; Logistics Sector; Fuzzy C-Means; Fuzzy AHP
**PERFORMANCE ANALYSIS FOR INDUSTRIAL PRODUCTION USING DATA
ENVELOPMENT ANALYSIS AND MALMQUIST INDEX METHODS: A CASE
STUDY IN THE CEMENT SECTOR**

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ABSTRACT

This study analyzes the productivity of a large-scale cement factory in Turkey using production data from 2018 to 2022. Technical efficiency levels, environmental impacts, structural similarities among production periods, and potential contributions of policy scenarios were all examined. The Slacks-Based Measure (SBM) model was chosen over classical Data Envelopment Analysis (DEA) approaches because it addresses input excesses and output shortfalls separately, providing more detailed results. Productivity changes over the five-year period were measured with the Malmquist Total Factor Productivity Index, which breaks down changes into efficiency change and technological change components. The reliability of efficiency scores was tested using Bootstrap resampling with 1000 iterations. For further analysis, Principal Component Analysis (PCA) was applied to reduce dimensionality and K-means clustering helped identify patterns across production periods. Three policy scenarios were also tested: 50% energy reduction, 30% CO₂ emission cuts, and 25% increased R&D investment. Environmental costs including CO₂, NO_x, and SO_x emissions were calculated in USD terms to give a clearer picture of the factory's environmental footprint. Results show notable differences in efficiency levels across years, pointing to specific areas where improvements could bring gains in both cost and environmental performance. The study offers a practical framework for decision-makers in the cement industry and adds to the literature on measuring sustainable production performance.

Keywords: Data Envelopment Analysis; Slacks-Based Measure; Malmquist Total Factor Productivity Index; Eco-Efficiency; Cement Industry; Bootstrap Analysis

Note: This study is derived from the Master's thesis titled "Performance Analysis for Industrial Production Using Data Envelopment Analysis and Malmquist Index Methods" by Gökhan Doğru, supervised by Asst. Prof. Dr. Furkan Diskaya, Istanbul Beykent University, Graduate School of Education, Department of Industrial Engineering, 2025.



ERGONOMIC EVALUATION OF HEAVY LOAD HANDLING SYSTEMS FROM AN INDUSTRY 4.0 PERSPECTIVE

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ABSTRACT

Manual handling systems lead to increased ergonomic risks and productivity losses in industrial manufacturing facilities. In particular, the physical strain associated with the manual handling of heavy loads further intensifies the negative effects on employee health and process performance. With the advent of Industry 4.0, a significant transformation has been observed in production processes. This transformation necessitates a reconsideration of manual handling systems. Accordingly, existing material handling processes in industrial manufacturing facilities were examined through on-site observations, and time study analyses were conducted. To evaluate the current state from an ergonomic perspective, the physical workloads imposed on employees were analyzed using the Ergonomic Assessment Worksheet (EAWS), Methods-Time Measurement (MTM), and Rapid Entire Body Assessment (REBA) methods. Based on the findings, automated guided vehicles, air-cushion-based handling systems, and automated wheeled transport systems were considered as alternatives to manual handling systems. The ergonomic and operational impacts of the proposed handling systems were comparatively assessed using the Best Worst Method (BWM) and the Multi-Objective Optimization on the basis of Ratio Analysis (MULTIMOORA), which are among Multi-Criteria Decision Making (MCDM) methods. The results indicate that automation-based handling systems are ergonomically more favorable than conventional handling systems. The study provides significant contributions toward reducing ergonomic risks, enhancing operational efficiency, improving occupational health and safety levels, and establishing a sustainable internal logistics structure.

Keywords: Industry 4.0; Industrial Material Handling Equipment; Ergonomic Risk Analysis; BWM; MULTIMOORA



AN APPLICATION OF MIXED-INTEGER LINEAR PROGRAMMING TO MINIMIZE THE COST OF UNIVERSITY STUDENTS REQUIRED BASIC NUTRITIONAL REQUIREMENTS

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ABSTRACT

This study analyzes the effectiveness of linear programming (LP) methods in minimizing costs within budgets for student nutrition planning and small-scale agribusiness food formulation. In both cases, decision-making within limited resources while maintaining nutritional value is a challenge, where conventional empirical methods are not optimized. In the education-related field, a mathematical model is proposed for residential students, which helps meet nutritional needs at the lowest cost through daily food selection. According to the results, it is possible to implement a balanced diet plan for only 80 taka per day. In the agriculture-based field, since 70% of the production cost of small-scale farm food formulation is related to food, an optimization model is developed using local ingredients. It incorporates information on nutritional value, market prices, and industry practices. The model significantly reduces costs compared to conventional methods and provides insights into realistic decision-making through sensitivity analysis. The two models presented together show that LP-based optimization methods can play a significant role in cost-efficiency and effective use of resources.

Keywords: Nutrition Planning; Linear Programming (LP) Methods; The Agriculture-Based Field; Small-Scale Farm Food Formulation; LP-Based Optimization



ENHANCING TRANSPORTATION EFFICIENCY AND COST REDUCTION THROUGH AI-ASSISTED DIGITAL MAINTENANCE SYSTEMS

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ABSTRACT

Transportation systems play a vital role in economic stability, workforce mobility, and service delivery within modern societies. However, inefficient maintenance practices in transport fleets often result in increased operational costs, unexpected breakdowns, service disruptions, and reduced organizational productivity. From a managerial and socio-economic perspective, there is a growing demand for maintenance systems that support informed decision-making while remaining cost-effective and adaptable to organizational constraints. This study proposes an AI-assisted digital maintenance framework aimed at enhancing transportation efficiency and reducing operational costs in transport fleet management. Instead of relying on complex and resource-intensive engineering models, the proposed system focuses on decision support for managers through vehicle health profiling, analysis of maintenance history, and digital alert mechanisms. Basic artificial intelligence techniques are utilized to identify maintenance priorities and assist in planning decisions without increasing system complexity or implementation costs. The framework enables organizations to optimize maintenance scheduling, minimize unplanned downtime, and improve fleet availability, thereby contributing to enhanced service reliability and economic performance. By centralizing maintenance data and translating technical information into actionable managerial insights, the system improves transparency and supports effective operational decision-making. The findings indicate that AI-assisted digital maintenance systems can bridge the gap between traditional preventive maintenance practices and advanced predictive approaches while remaining accessible to resource-constrained organizations. From a social sciences perspective, the proposed framework contributes to improved organizational efficiency, reduced operational waste, and sustainable transportation management, supporting broader economic and societal development goals.

Keywords: Transport Fleet Management; Digital Maintenance Systems; Decision Support; Operational Efficiency; Cost Reduction; AI-Assisted Management



SIMULATION-BASED ANALYSIS OF THE TRADE PERFORMANCE OF DIFFERENT RSI DERIVATIVES ON THE BTCUSDT FINANCIAL TIME SERIES

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ABSTRACT

Introduction and Objective: Technical analysis indicators are widely used in financial markets, particularly in the development of algorithmic trading strategies aimed at generating buy–sell signals from high-frequency price data. The objective of this study is to comparatively analyze the trade performance of various RSI derivatives developed based on the Relative Strength Index (RSI) using a simulation-based approach on the BTCUSDT financial time series, a highly liquid cryptocurrency asset. By conducting the analysis within a market structure characterized by relatively low volatility and high liquidity, the study aims to obtain more reliable mathematical and statistical results. **Materials and Methods:** In addition to the classical RSI approach, sliding window, weighted, and multi-time-resolution RSI variants were evaluated. The dataset was constructed from high-frequency BTCUSDT price data covering the last five years, selecting periods with the highest weekly trading volumes. This volume-based sampling strategy was employed to mitigate price anomalies caused by low liquidity. Buy–sell signals were generated through a dedicated trade simulation framework, and portfolio performance was modeled using a dynamic cash and asset management approach, where a fixed proportion of the portfolio was allocated to each transaction. **Results:** The findings indicate that different RSI derivatives exhibit statistically significant performance differences even when applied to the same financial time series. In particular, weighted RSI methods and those computed over shorter time windows demonstrated faster and more responsive signal generation during high-volume periods, leading to relatively positive improvements in overall portfolio performance. **Discussion and Conclusion:** The results highlight that the choice of financial instrument and data sampling strategy is as critical as the parametric structure of technical indicators in performance evaluation. Volume-based analyses conducted on BTCUSDT, which offers high liquidity and relatively low volatility, enable a more reliable comparison of the mathematical behavior of RSI derivatives. In this context, the proposed methodology provides an effective framework for the design and evaluation of algorithmic trading strategies.

Keywords: Financial Mathematics; RSI; BTCUSDT; Time Series; Volatility; Algorithmic Trading; Simulation



LEARNING WHEN NOT TO ADAPT: DECISION-AWARE AUTONOMOUS MORPHING VIA RANDOM FOREST REGRESSION

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ABSTRACT

Birds' ability to vary their wing shape in response to variations in airflow and flight requirements enables them to maintain efficient flight. Bio-inspired morphing wing technologies have been developed for next generation aircraft and UAS's. Recent computational studies demonstrate that bio-inspired morphing wings, coupled with machine-learning based aerodynamic modeling, enable autonomous adaptation without requiring expensive and time-consuming CFD solvers or mechanically complex actuators. This study considers a bio-inspired morphing wing framework where geometric parameters defining airfoils used in avian flight characteristics are parameterized and evaluated over various aerodynamic conditions. Candidate morphologies are generated from the parameterized airfoil geometries by selecting $J = C_L/C_D$ for a candidate wing morphology under given flow conditions and comparing $J_{candidate}$ and $J_{current}$ for autonomous selection. Aerodynamic performance data, including lift (C_L), drag (C_D), and lift-to-drag ratio (C_L/C_D), are generated using XFLR5/XFoil simulations within a representative low-Reynolds-number regime ($Re \approx 2 \times 10^5 - 6 \times 10^5$), corresponding to typical UAV and small-scale flight conditions. Nonlinear relationships between geometric parameters and aerodynamic performance are determined through regression-based machine-learning models including Random Forest. Continuous morphing provides an alignment with aerodynamic optimization objectives but implies that all adaptations are beneficial. However, predicted gains can be small, and sensor noise and model uncertainty can cause unwanted or detrimental changes to morphological configurations; high frequency of adaptation increases stress, adds complexity to control systems and causes system instability. A more appropriate strategy is suggested by biological flight: birds selectively suppress adaptation when environmental conditions do not warrant the need for adaptation. To address this limitation, the morphing problem is reformulated as a decision-aware adaptation task under uncertainty. Rather than executing morphing whenever a performance improvement is predicted, an additional decision layer evaluates whether adaptation should be executed or suppressed. Let $J = C_L/C_D$ and $\Delta J = J_{candidate} - J_{current}$. Morphological adaptation is executed only if $\Delta J > \varepsilon$ and $\sigma_J < \delta$, where ε is the minimum aerodynamic benefit threshold and σ_J is the uncertainty associated with the prediction estimate from the Random Forest model and represents ensemble variance. If either condition is violated, adaptation is deliberately suppressed and the current wing configuration is maintained. The proposed methodology gives



a decision-aware mechanism that selectively suppresses morphological adaptations under uncertain conditions while maintaining performance of C_L/C_D . By integrating decision-aware, uncertainty-based suppression into a bio-inspired, machine-learning-driven morphing wing framework, in this study we extend autonomous aerodynamic learning toward a more realistic and biologically consistent paradigm. The proposed approach increases robustness, reduces unnecessary morphological changes, supports safe autonomous operation under uncertain conditions so that the framework remains computationally lightweight and suitable for UAVs, adaptive drones and future intelligent flight systems.

Keywords: Machine Learning; Morphing Wings; Bio-Inspired Engineering; Uncertainty Quantification; Random Forest



MACHINE LEARNING-BASED NUTRITIONAL BALANCE PREDICTION FOR MULTI-CRITERIA DECISION SUPPORT: A DATA MINING APPROACH USING THE OPEN FOOD FACTS DATABASE

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ABSTRACT

This study proposes a scalable machine learning infrastructure for estimating dietary quality through a composite *Nutrition Balance Score* (NBS) designed for digital decision support systems. The NBS is conceptualized as a dual-component metric integrating (i) macro- and micronutrient balance (X component) and (ii) food processing level and sustainability-related impact derived from the NOVA classification (Y component). Leveraging the *Open Food Facts* database, we curated a dataset of 1.26 million food items. A key pre-processing step distinguished implausible records from rare but plausible extremes, retaining the latter to reflect real-world nutritional variability. To manage high variance and heavy-tailed distributions, percentile-based normalization was used for feature scaling. We evaluated Linear Regression, Random Forest, and LightGBM for NBS prediction. Initial experiments produced near-perfect performance ($R^2 \approx 0.999$), which triggered an audit that revealed data leakage due to overlap between the composite NBS construction and raw nutritional inputs. The pipeline was then re-engineered using leakage-aware feature selection and strict train-test separation. Under the revised evaluation protocol, ensemble models (Random Forest and LightGBM) achieved robust performance with R^2 values between 0.78 and 0.85. These findings show that while NBS is highly predictable from nutritional profiles, valid inference requires leakage-resilient design and transparent evaluation. The resulting modular architecture provides a reproducible backend for integrating sustainability-aware metrics into large-scale health analytics.

Keywords: Machine Learning, Nutritional Informatics, Multi-Criteria Decision Support, Nutrition Balance Score, Random Forest, LightGBM, NOVA Classification, Percentile-Based Normalization.



AI-DRIVEN MODELLING AND OPTIMIZATION OF PROCESS PLANS IN SUSTAINABLE RECONFIGURABLE MANUFACTURING SYSTEMS

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ABSTRACT

Artificial intelligence has increasingly been applied to solve complex, multi-objective optimization problems in Sustainable Reconfigurable Manufacturing Systems (SRMS), particularly in environmentally conscious process planning. While many evolutionary algorithms have demonstrated strong performance in this domain, they often emphasize efficiency at the expense of system flexibility. To overcome this limitation, this paper proposes an AI-driven methodology that integrates Evolutionary Token-Based Process Model (ETPM)—a Token-Based Process Model-based modeling framework enhanced through evolutionary principles—with an advanced genetic algorithm, NSGA-III, to support adaptive and intelligent process plan generation. By leveraging the structural advantages of Token-Based Process Model, the approach enables accurate modeling, verification, and dynamic optimization of process plans in reconfigurable environments, including the identification of deadlocks and resource conflicts. The optimization simultaneously targets four key sustainability objectives: minimizing total production cost, reducing production time, lowering greenhouse gas emissions from energy consumption, and limiting hazardous liquid waste. Numerical experiments validate the proposed AI-based framework, demonstrating its effectiveness in producing feasible and environmentally optimal process plans within SRMS contexts.

Keywords: Sustainable Reconfigurable Manufacturing Systems (SRMS); Evolutionary Token-Based Process Model (ETPM); Artificial Intelligence; Genetic Algorithms (NSGA-III); Multi-objective Optimization; Process Planning; Deadlock Detection; Green Manufacturing; Intelligent Systems



COMPARISON OF THE EFFECT OF DIFFERENT PARAMETERS ON ACCURACY RATE

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ABSTRACT

This study was conducted to examine the importance of different parameters in increasing the accuracy rates obtained in sentiment analysis of Turkish texts. A dataset consisting of 21,000 post-order food reviews and ratings from the food industry was used. This dataset was organized into two separate datasets: one containing only text data and another containing text data and numerical score. In this study, accuracy rates were obtained using different datasets and machine learning algorithms with the Weka software. The accuracy rates obtained using seven different machine learning algorithms; K-Nearest Neighbor (KN), Naive Bayes (NB), Naive Bayes Multinomial (NBM), Random Forest (RF), Decision Tree (J48), Logistics, and Sequential Minimum Optimization (SMO)—were compared. A k-layer cross-validation technique was used to determine the accuracy rates with machine learning studies. However, it was desired to investigate whether there was a relationship between the numerical value of the chosen k parameter and the obtained accuracy rate. Therefore, the accuracy rates obtained with k values of 10 and 20 were compared when applying the k-layer cross-validation method. The accuracy rates obtained using k-layer validation (k=10 and k=20) with 7 different algorithms on 2 different datasets were compared. The study showed that the highest accuracy rate of 66% was obtained with the NBM and SMO algorithms when using a dataset containing only text data (k=10 and k=20). Using a dataset containing both text and numerical values, the highest accuracy rate of 80% was obtained with the RO and SMO algorithms (k=10 and k=20). This indicates that the numerical features in the dataset used have a significant impact on the obtained accuracy rate.

Keywords: Artificial Intelligence; Machine Learning; K-Layer Cross-validation;



CLUSTERING THE MARKET MIND: A K-MEANS MACHINE LEARNING APPROACH TO INVESTOR TYPOLOGIES

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ABSTRACT

This research introduces a novel, data-driven framework that leverages the k-means clustering algorithm as its core analytical engine to uncover distinct investor typologies from dynamic emotional and behavioral data. We first model high-frequency individual emotional trajectories (valence and arousal) using stochastic differential equations (SDEs) within the DynAffect modeling framework, with parameters estimated via Bayesian Markov Chain Monte Carlo (MCMC) methods. The resulting personalized emotional regulation parameters—such as attractor points, reactivity, and return-to-equilibrium speed—are then used as feature vectors for k-means clustering. This unsupervised machine learning technique successfully segments investors into interpretable, homogeneous groups (e.g., "Emotionally-Resilient Investors," "Stress-Sensitive Traders," and "High-Arousal Speculators") based purely on their psychodynamic profiles, demonstrating how a classic algorithm can extract novel behavioral finance insights from advanced psychological time-series models.

Keywords: K-Means Clustering; Unsupervised Machine Learning; Stochastic Differential Equations (SDEs); Bayesian MCMC Estimation; DynAffect Model; Psychodynamic Modeling

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PREDICTING USER CONSENT-BASED CONTEXT SHARING IN MOBILE APPLICATIONS USING MACHINE LEARNING

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ABSTRACT

Data mining and machine learning techniques are making decision-making processes more efficient and predictable across a wide range of industries today. They make significant contributions, particularly in data-intensive fields such as banking and finance, where they are used to analyse customer behaviour. This study aims to analyse whether bank customers' tendency to grant location permission through banking applications is related to their personal and financial characteristics. The dataset used in the study consists of real and anonymised customer information from a bank operating in Türkiye via Softtech Company, including information on customers who grant and do not grant location permission. The data covers various personal and financial characteristics such as address, age, occupation, education status, customer segment, term and demand deposit status, and financial holdings. Histogram-Based Gradient Boosting (HGB), Multi-Layer Perceptron (MLP) and Random Forest (RF) algorithm-based models were applied for prediction purposes. The dataset was split 80-20 for model training and testing, and the results were evaluated. The HGB model achieved an accuracy rate of 85.27%, while the RF model performed with an accuracy rate of 85.11% and MLP model performed with an accuracy rate of 82.87%. In the feature importance analysis, it was determined that regular relationships established with the bank, such as salary, other permissions granted within the application, age, and financial ownership were the features that most affected the classification performance. The study is unique in that it focuses on predicting the customer's propensity to share their location context with the application, unlike topics commonly encountered in the literature on banking, such as credit risk analysis, customer churn analysis, and customer segmentation. It thus offers a perspective for improving the performance of personalisation and targeting strategies in mobile banking applications. The findings obtained can contribute to the development of personalised services in applications and can also serve as a basis for obtaining user consent in banking.

Keywords: Data Mining; Machine Learning; Mobile Application



MRF-BASED MAP BINARY LABELING AND STRUCTURAL RELIABILITY SCORING FOR OBJECT-TEXTURE DISCRIMINATION IN INDUSTRIAL VISUAL INSPECTION

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ABSTRACT

Industrial anomaly detection pipelines often rely on a fixed inspection strategy, despite the fact that object-centric and texture-centric scenarios exhibit fundamentally different structural characteristics. In this work, we propose a pre-decision framework that explicitly addresses this distinction by performing an initial structural assessment of the input image before downstream processing. Figure ground separation is formulated as a binary labeling problem and solved through Maximum a Posteriori inference within a Markov Random Field formulation. Foreground and back ground regions are modeled using a Gaussian Mixture Model, while spatial consistency is encouraged through neighborhood-based regularization. The resulting energy is minimized in an iterative manner using a Graph Cut optimization scheme based on min-cut and max-flow, producing a structurally coherent binary mask. Rather than treating this segmentation as an end result, we use it as a cue for decision-making. To quantify the structural reliability of the obtained mask, a Structural Reliability Score is introduced. The score is derived from a combination of fill ratio, dominance of the largest connected component, the number of connected components, and a compactness measure. Basic morphological operations are applied to reduce the influence of spurious small regions prior to scoring. Experiments conducted on 15 categories from the MVTec AD dataset show that a single reliability threshold consistently separates object-based inspection tasks, such as those involving rigid manufactured items, from texture-based inspection tasks associated with homogeneous surface materials. The results suggest that the proposed approach offers an effective and lightweight pre-routing mechanism that can be integrated into industrial anomaly detection pipelines with minimal overhead.

Keywords: Industrial Visual Inspection; MAP Estimation; Markov Random Field (MRF); Graph Cut (Min-Cut/Max-Flow); Binary Labeling



COMPARING LINEAR AND ENSEMBLE-BASED ARTIFICIAL INTELLIGENCE MODELS FOR PREDICTING ACADEMIC PERFORMANCE IN NOISY AND MULTILEVEL DATA

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ABSTRACT

Educational data present significant challenges for academic performance prediction due to high noise levels, missing observations, and inherently multilevel structures. Traditional statistical approaches often prove insufficient for such complex data, necessitating the use of artificial intelligence (AI) and machine learning (ML) methods. This study analyzes open-source data from web-based intelligent tutoring system ASSISTments, covering the 2020–2021 academic year and providing interactive feedback in mathematics. Multisource data at student, assignment, and grade levels were integrated. The analytical model included 18 independent variables, with *mean_class_score*—a continuous outcome ranging from 0 to 1—defined as the target variable. Observations lacking the target ($n = 22,599$) were excluded, yielding final sample of 252,378 records. The study aims to comparatively evaluate predictive performance of ML algorithms in estimating students' mathematics achievement. Missing data were addressed using Multivariate Imputation by Chained Equations to preserve inter-variable structure and avoid bias associated with simple imputation. Outliers were treated to prevent distortion of data distributions. Before modeling, two behavioral features were engineered: *completion_rate* (the ratio of completed to started assignments) and *tenure_days* (time since system enrollment). The dataset was split into training (80%, $n = 201,902$) and test (20%, $n = 50,476$) sets. Elastic Net, Random Forest, and XGBoost models were compared. Model performance was evaluated using R^2 , RMSE, and MAE. Results indicate that Elastic Net performs poorly in capturing complex, nonlinear relationships (RMSE = 0.354, MAE = 0.302, $R^2 \approx 0.02$). In contrast, ensemble-based models achieved substantially higher accuracy. Random Forest attained RMSE = 0.156, MAE = 0.096, and $R^2 \approx 0.810$, while XGBoost yielded the best performance (RMSE = 0.154, MAE = 0.097, $R^2 \approx 0.815$), explaining approximately 81.5% of the variance in student achievement. These findings demonstrate that ensemble-based AI methods offer robust and reliable solution for predicting academic performance in noisy, multilevel educational data.

Keywords: Artificial Intelligence; Machine Learning; Educational Data Mining



THE IMPACT OF SMART OHS TOOLS AND ARTIFICIAL INTELLIGENCE-SUPPORTED MONITORING SYSTEMS ON OCCUPATIONAL HEALTH AND SAFETY

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ABSTRACT

Occupational safety and health (OSH) risk monitoring and management practices are experiencing a significant shift driven by digital transformation. Emerging technologies such as artificial intelligence (AI), the Internet of Things (IoT), and wearable systems enable workplaces to identify hazards in real time and support proactive, preventive safety measures. In line with the International Labour Organization's perspective on "How Digitalisation Is Transforming Safety and Health at Work," this study explores the use of smart OSH tools and AI-assisted monitoring systems across various sectors. The scope of the study includes the Seoul Smart Safety Management System implemented at small and medium-sized construction sites, an AI-based accident prevention solution designed for temporary workers in France, AI-supported video analytics for occupational safety applications in Türkiye, as well as AI-enabled fleet and driver safety technologies combined with wearable sensor systems. These digital solutions allow for continuous monitoring of worker behavior, workplace conditions, and physiological indicators, facilitating early detection of risks such as structural hazards, improper use of personal protective equipment, falls from height, and prolonged exposure to high noise levels. The results demonstrate that intelligent monitoring systems play a substantial role in reducing occupational accidents, improving risk anticipation, and enhancing data-driven OSH management practices. Nevertheless, the sustainable and effective deployment of these technologies requires careful consideration of user acceptance, protection of personal data, and the potential psychosocial impacts associated with continuous workplace surveillance.

Keywords: Occupational Health and Safety; Digitalisation; Artificial Intelligence; Smart Monitoring Systems, Wearable Technologies



A SYSTEMATIC REVIEW OF STUDIES ON THE EFFECT OF PERCEIVED OHS PRACTICES ON ORGANIZATIONAL COMMITMENT

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ABSTRACT

Occupational Health and Safety (OHS) practices have evolved into a strategic component of contemporary working life, influencing organizational behavior outcomes significantly beyond merely safeguarding the physical and mental well-being of employees. Among these critical outcomes, organizational commitment stands out as a decisive factor in determining employees' intention to remain with the organization and their overall performance. The primary objective of this study is to systematically evaluate the existing national and international literature that examines the impact of perceived OHS practices on the levels of organizational commitment among employees. Within the scope of this research, comprehensive scans were conducted across various academic databases, including Web of Science, Scopus, and TR Dizin, utilizing specific keywords. The articles, selected based on predetermined inclusion and exclusion criteria, were classified and analyzed regarding their publication year, sample characteristics, measurement scales employed, and research findings. The results of the systematic review indicate that in the vast majority of the studies examined, employees' positive perceptions regarding OHS practices have a positive and statistically significant effect, particularly on the "affective commitment" dimension of organizational commitment. It was consistently observed that a sense of belonging to the institution intensifies in environments where employees feel secure and perceive a genuine commitment to safety from management. Conversely, the impact of OHS perception on "continuance commitment" was found to vary across different studies. In conclusion, this study demonstrates that organizations should regard OHS investments not merely as a legal necessity, but as a vital instrument for retaining a qualified and committed workforce.

Keywords: Occupational Health and Safety; Organizational Commitment; OHS Perception; Systematic Review; Employee Behavior



THE EVOLUTION OF OCCUPATIONAL HEALTH AND SAFETY CULTURE IN THE EUROPEAN UNION: A COMPARATIVE ANALYSIS WITH TÜRKİYE

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ABSTRACT

In this thesis, the current situation regarding occupational accidents and diseases in the European Union (EU) countries and Türkiye is examined comparatively; the effectiveness of occupational health and safety (OHS) policies is analyzed within the framework of the social and economic impacts of these incidents. According to 2024 data, the fatal occupational accident rate per 100,000 workers is 2.11 in EU countries, whereas this rate is recorded as 3.20 in Turkey. This difference indicates that Türkiye lags behind the EU in terms of OHS performance. The high rate of occupational accidents in Türkiye is rooted in structural weaknesses. In particular, lack of inspections, widespread subcontracting, insufficient OHS measures in small and medium-sized enterprises, and the lack of employee training emerge as the main determining factors. In contrast, in EU countries, OHS policies are not limited to legislation; they are supported by multi-actor structures such as workplace culture, employer responsibilities, worker representation, and trade union participation. This structure has played a significant role in reducing fatality rates in the EU. In gender-based analyses, the vast majority of fatal occupational accidents in both regions occur among male workers. According to Eurostat 2024 data, 95.3% of fatal occupational accidents in the EU occurred among men, and a similar situation is observed in Türkiye. The lower representation of women in these statistics can be explained by their employment in lower-risk sectors. In terms of age groups, while fatal accidents in the EU are concentrated in the 55–64 age range, in Türkiye, such accidents are more frequent among younger and middle-aged groups. The inexperience of young workers in Türkiye, along with their employment in high-risk sectors, increases their exposure to accidents. In conclusion, this study finds that the differences between Türkiye and the EU are not limited to the frequency of occupational accidents, but also extend to risk management and prevention strategies. In order to reduce fatality rates resulting from occupational accidents, Türkiye needs to adopt preventive approaches, reform its education and inspection systems, and promote a widespread culture of occupational safety.

Keywords: Occupational Health and Safety (OHS); Fatal Occupational Accidents; European Union Policies; OHS Practices in Türkiye; Gender- and Age-Based Risks



A DESIGN-ORIENTED OCCUPATIONAL HEALTH AND SAFETY APPROACH TO STREET-LEVEL RISKS: THE CASE OF VARNALI STREET

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ABSTRACT

In mixed-use urban areas, street-level work environments are exposed to interconnected hazards that are often addressed separately by urban planning, architectural design, and occupational health and safety (OHS) management. This study proposes an interdisciplinary and empirical approach to identify and mitigate OHS risks on Varnalı Street in Silivri district of Istanbul, a corridor with high commercial activity. A mixed-methods design will be employed in the study. In the first phase, observable and measurable risk factors on the street will be mapped through systematic field observations using a structured street audit. This audit will cover pedestrian infrastructure continuity, ground/surface conditions, lighting, visibility/perceptibility, curbside activities, unregistered loading/unloading areas, and accident-risk interactions such as pedestrian-vehicle and micro-mobility. In the second phase of the study, risk perceptions, near misses and exposure patterns will be collected through surveys from local business owners and employees, service sector workers and frequent street users. In the third stage, observation and survey findings will be combined into a risk registry, prioritized using a qualitative risk matrix (severity-probability, and a feasible intervention set will be proposed. The proposed controls will be developed with solutions based on a control hierarchy: (i) at the planning and architecture scale (including pavement widening, barrier-free continuity, improved transitions, lighting strategy, and curb management for delivery) and (ii) at the industrial design scale (including modular protective barriers, guidance/warning systems, ergonomic delivery aids, and durable street furniture supporting safe movement). The main contribution of the study is that it offers an integrated and replicable workflow for small businesses and public space management that transforms street monitoring and survey data into design-oriented OHS improvements.

Keywords: Design-Oriented Occupational Health and Safety (OHS); Street-level Risk Mitigation; Urban Design for Safety; Design-led Interventions



INTEGRATING LANDSCAPE ELEMENTS IN THE DESIGN OF REHABILITATION CENTRE IN MINNA, NIGER STATE, NIGERIA

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ABSTRACT

Introduction and Objective: Substance use disorders constitute a severe public health crisis in Nigeria, with a prevalence rate of 14.4%, nearly triple the global average. Despite this, rehabilitation infrastructure in Niger State adheres to a custodial model, prioritising containment over restoration. This study challenges the efficacy of such environments, positing that strategically integrating landscape elements serves as a critical therapeutic modality. The research aims to develop a context-sensitive design model for a rehabilitation centre in Minna to enhance emotional regulation and recovery. **Materials and Methods:** Adopting a mixed-methods design, the qualitative phase analysed four case studies, contrasting local facilities with international benchmarks in the Netherlands and Austria. The quantitative phase utilised purposive sampling to survey 15 key stakeholders, including patients and healthcare professionals, utilising descriptive statistics to determine design priorities. **Results:** Results indicate a definitive hierarchy where safety constitutes the foundational prerequisite for therapeutic engagement. Respondents unanimously ranked Safety as the most critical design principle (100%), with Security Lighting (86.7%) and Therapeutic Gardens (73.3%) identified as vital interventions. Contrary to purely aesthetic approaches, the findings reveal that the Nigerian context prioritises secure, visually controlled environments. **Discussion and Conclusion:** Consequently, the study proposes a design framework based on “Visual Connectivity,” employing extensive glazing and strategic zoning to provide psychological access to nature while maintaining physical security. This research concludes that landscape integration is not merely ornamental but a fundamental component of the therapeutic infrastructure required for effective addiction recovery in Nigeria.

Keywords: Therapeutic Landscapes; Rehabilitation Design; Visual Connectivity; Substance Use Disorders; Nigeria



A SPATIAL AND SOCIO-ECONOMIC ANALYSIS OF REGIONAL COMPETITIVENESS IN NORTHERN BANGLADESH

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ABSTRACT

The northern region of Bangladesh contains 16 districts in total. Whereas the region is facing some challenges in terms of development. This study shows the comprehensive study of spatial and socio-economic analysis within the northern region of Bangladesh. Different metrics have been used in this study to identify the central district, core districts, peripheral districts and hinterlands. Regional Competitiveness index has been employed to identify the overall competitiveness of the region and functional urban region with the use of gravitational model that uses population and distance from one-to-many districts to identify the intra-regional interaction level and quantity. The dimensions of the study have been added through regional competitiveness for sustainable development and ensuring the growth of a district moves forward in right direction. In this study, district level data have been used for example accessibility, demographic characteristics. This study puts some variable such as income, education, health into comparison. The result directs the development potential of any district and potential sector to be developed in terms of the analysis of current condition. Bogura emerges as the most influential district as per its spatial relation, connectivity and all other socio-economic metrics. But in most of the cases the district with connectivity to India such as India, Panchagarh is found to be the least progressive relative to their contribution to national economy. This study allows policymakers to understand the current scenario and make them integrate the result with the planning policies. A prime focus on equitable development has been emphasized by this study which identifies the higher competitiveness and lagging districts.

Keywords: Interaction; Equitable; Integrate; RCI; Gravity; Accessibility



EVALUATION OF OUTDOOR LEARNING SPACES AS A STRATEGY FOR ENHANCING STUDENT ENGAGEMENT IN THE DESIGN PROPOSAL OF A MODEL SECONDARY SCHOOL IN ABUJA, NIGERIA

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ABSTRACT

Secondary school education in Abuja, Nigeria, typically relies on rigid, indoor-centric infrastructures that fail to leverage the pedagogical benefits of the physical environment. This study evaluates outdoor learning spaces as a critical design strategy to enhance student engagement, specifically addressing the Nigerian "low maintenance culture" where infrastructural decay is accelerated by budgetary deficits. Grounded in literature where regression analyses establish that physical environment quality accounts for approximately 53.6% ($R^2 = 0.536$) of the variance in learning outcomes, this research posits that widely accessible, durable outdoor spaces can sustain high engagement levels (β coefficients linking environment to motivation) without the high operational costs associated with enclosed facilities. The research adopts a mixed-methods design, utilizing a sample size of 206 respondents ($N=206$) across four secondary schools in Abuja. The quantitative instrument achieved internal consistency with a Cronbach's Alpha coefficient of $\alpha > 0.784$. Data were analyzed using SPSS, employing descriptive statistics and inferential tests, including Chi-square (X^2) and Analysis of Variance (ANOVA), to evaluate the significance ($p < 0.054$) of relationships between outdoor space usage and student behavioral engagement. Qualitative findings from local case studies (Springhall British and Dikrisa International) reveal that while outdoor spaces exist, their utility is severely compromised by "maintenance and safety concerns" and a lack of climatic responsiveness. To mitigate the correlation (r) between poor maintenance and facility disuse, the study proposes a model secondary school in Lugbe East District Abuja. The design integrates "low maintenance" architectural strategies by utilizing locally sourced materials like treated bamboo and laterite, offering thermal comfort in the tropical savannah climate. The study concludes that a design framework prioritizing environmental durability offers a statistically significant, cost-effective solution to Nigeria's educational infrastructure challenges.

Keywords: Technology; Architecture; Structure



EXPLORING CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN (C.P.T.E.D) PRINCIPLES IN THE DESIGN PROPOSAL OF A BUS TERMINAL, NASARAWA STATE, NIGERIA

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ABSTRACT

Escalating insecurity in Nigeria's transport hubs, ranging from theft to insurgency, necessitates architectural interventions surpassing traditional fortification. This study evaluates the efficacy of Crime Prevention through Environmental Design (CPTED) in the North-Central zone using a pragmatic mixed-methods approach. Data was triangulated from a quantitative survey of 248 users and ISO 22341 observational audits of representative terminals. The empirical results expose a critical "Resilience Gap," with an aggregate audit compliance of only 59%. This score highlights a failure in operational maintenance rather than structural integrity. Crucially, this "Operational Decay" creates a gendered safety disparity, confirmed by a significant T-Test gap ($p=0.001$) where female users reported drastically lower safety perceptions. Furthermore, regression analysis ($R^2=0.645$) established Natural Surveillance ($\beta=0.620$) as the primary driver of safety, statistically outweighing Access Control ($\beta=0.110$). This finding challenges the local reliance on physical barriers, proving that "Visual Permeability" is significantly more effective at reducing fear than fencing alone. Synthesizing these findings, the study proposes a context-adaptive design for the Keffi Bus Terminal. The proposal operationalizes "Passive Surveillance" through high-durability glazing and a panoptic Watch Tower. Additionally, it introduces gender-responsive measures, such as 300-Lux lighting in vulnerable zones, and utilizes spatial segregation to buffer passengers from informal "Agbero" activities. The study concludes that resilient transport architecture in Nigeria requires a paradigm shift from "Fortress Design" to "Visually Permeable" environments.

Keywords: Environment; Architecture; Synthesis; Design



SYNTHESIS IN NANOSCALE AND ITS PROBLEMS

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ABSTRACT

The synthesis of nanostructured materials represents one of the most dynamic and rapidly developing fields in modern materials science. At the nanoscale, the physical and chemical properties of matter differ significantly from those of bulk materials, enabling new functionalities and applications in electronics, medicine, catalysis, and energy storage. However, achieving controlled synthesis at this scale remains a major scientific and technological challenge. Key problems include the reproducibility of nanoparticle size and shape, control over surface chemistry, and scalability of synthesis methods. Traditional bottom-up approaches, such as sol-gel processes, chemical vapor deposition, and self-assembly, often face difficulties in maintaining structural uniformity and preventing aggregation. Moreover, environmental and safety concerns related to the use of toxic precursors and solvents further complicate industrial implementation. Recent advances in green synthesis, machine learning-guided material design, and in-situ monitoring techniques offer promising pathways to overcome these limitations. This paper discusses the fundamental principles of nanoscale synthesis, the major obstacles encountered in experimental practice, and emerging strategies aimed at improving precision, reproducibility, and sustainability in nanomaterial production.

Keywords: Nanotechnology; Nanoscale Synthesis; Nanomaterials; Scalability; Green Chemistry; Reproducibility



SERVO CLOCK ON ARDUINO

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ABSTRACT

This paper critically examines the implications of using Arduino-based servo motors in the construction of a mechanical clock system, focusing on the potential drawbacks and ethical concerns of replacing traditional timekeeping mechanisms with automated, AI-driven solutions. The project centers on an Arduino microcontroller controlling three servo motors that operate the hands of a clock. While the technology behind this system promises precision and simplicity, it raises significant questions about the increasing reliance on automation for even the most fundamental human tasks, such as telling time. By utilizing a Real-Time Clock (RTC) module for accurate timekeeping, this project bypasses the need for human oversight, thus diminishing personal interaction with the passage of time. Servo motors, controlled by Arduino's Pulse Width Modulation (PWM) signals, may appear efficient, but they come with concerns regarding mechanical wear, limited lifespan, and energy consumption. This automation is not a simple enhancement, but rather a step toward eliminating human agency in timekeeping, which has traditionally been a manual, interactive process. The project's reliance on a pre-programmed microcontroller, rather than a natural, mechanical, or analog solution, raises questions about the diminishing role of human craftsmanship and creativity in the design of everyday objects. This shift towards automated solutions risks overshadowing the deeper, more meaningful connections humans once had with the tools they created and used. Additionally, the increasing sophistication of these systems could contribute to further technological dependency, which may lead to greater isolation and reduced reliance on traditional, human-centric methods of problem-solving. The implications of such developments, particularly in educational contexts, are explored, highlighting concerns about the future of human engagement with technology. The paper suggests that while Arduino-based servo clocks are innovative, they also represent a step towards over-automation and a diminishing of human connection to time itself.

Keywords: Arduino; Servo Motor; Real Time Clock; PWM Control; Microcontroller



SURVEY OF QUANTUM COMPUTING AND QUANTUM PROCESSORS

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ABSTRACT

In this paper, a detailed survey on quantum computing and quantum processor technologies is presented. Quantum computing has emerged as a promising computational framework that harnesses the principles of quantum mechanics to execute operations beyond the scope of classical machines. The quantum processor forms the central hardware platform responsible for manipulating qubits through quantum gates, measurement schemes, and controlled interactions. Various quantum processor architectures such as superconducting, trapped-ion, and photonic platforms have been developed, each with unique operational principles and engineering constraints. This survey discusses the foundational concepts of quantum computing, reviews the major processor technologies, highlights the current challenges, and compares different architectures based on performance metrics. The intention of this work is to provide a clean, structured overview that supports further research in this domain.

Keywords: Quantum Computing; Qubits; Quantum Processor; Superconducting Technology; Trapped-Ion Systems; Photonic Architecture



AN ADAPTIVE USER-CENTERED USABILITY MODEL FOR ACCESSIBLE E-TRANSPORTATION APPLICATIONS

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ABSTRACT

Introduction and Purpose: In the modern digital era, the integration of computer science and information systems plays a vital role in creating technologies that enhance user experiences, especially for individuals with visual impairments. Although e-transportation services are increasingly adopted worldwide, many of their mobile applications do not adequately meet the accessibility needs of this user group, thereby restricting their independence and confidence in using such services. This study examines how visual design, navigation design, and information design influence the competitive advantage of e-transportation mobile applications. **Materials and Methods:** A questionnaire was distributed to 400 visually impaired individuals in Jordan to explore how these design elements affect the applications' market position and overall effectiveness. The research is divided into two major parts: the first focuses on identifying the challenges, preferences, and needs of visually impaired users, while the second applies these findings to develop an accessible, intuitive, and user-friendly e-transportation application. **Results:** The findings revealed that visual design had the greatest effect on competitive advantage ($\beta = 0.328$, $p = 0.000$), followed by navigation design ($\beta = 0.268$, $p = 0.001$) and information design ($\beta = 0.213$, $p = 0.001$). Additionally, the inclusion of the Technology Acceptance Model (TAM) enhanced the model's explanatory power ($\beta = 0.472$, $p = 0.000$) and moderated the relationship between user interface design and competitive advantage ($\beta = 0.170$, $p = 0.028$). **Discussion and Conclusion:** The study concludes that visual, navigation, and information design significantly contribute to strengthening the competitive advantage of e-transportation applications, with visual design being the most influential factor. Supported by TAM analysis, the results emphasize that improving usability and accessibility through structured interfaces, voice-assisted features, and clear navigation cues enhances user satisfaction, loyalty, and independence, particularly among visually impaired users.

Keywords: E-Transportation; Accessibility; Visually Impaired Users; User-Centered Design; Mobile Application Competitiveness



SIMULATION AND MEASUREMENT OF THE MAGNETIC FIELD RADIATION FOR A PLANAR INDUCTOR

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ABSTRACT

Reducing the size of electronic components (passive components in particular) has become a major necessity since the electronic circuits are minimized. Among these components, we can mention an essential component in radiofrequency applications, high frequencies applications and power electronics: it is the planar inductance, the most disruptive component. The aim of our work is the characterization of radiation and shielding. So in the following paper we will compare simulation results of magnetic radiation for a planar inductance with measurements results. For that, two structures are fabricated: planar inductors with and without magnetic layer (Figure 1), and then we measure the magnetic field radiation using a bench characterization. These two structures have been simulated and compared with measurement results. Results are illustrated in Figure 2 and Figure 3.

Figures:

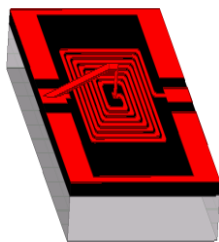


Figure 1. Planar inductance with one magnetic layer.

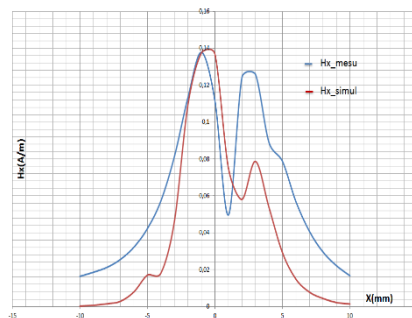


Figure 2. Repartition of magnetic field H_x .

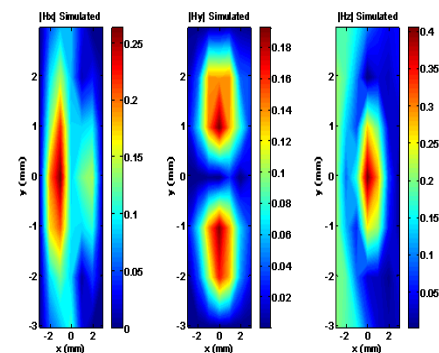


Figure 3. Cartographic of magnetic field.

Keywords: Cartographic; Radiation; Magnetic; Simulation



QUANTUM TECHNOLOGIES OF NANOSTRUCTURED MATERIALS: THEIR IMPACT ON SOCIAL DEVELOPMENT IN THE FIELDS OF RADAR, ELECTRONICS AND TELECOMMUNICATIONS

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ABSTRACT

Introduction and Objective: Rapid advancements in quantum technologies and nanostructured materials are transforming modern radar systems, electronics, and telecommunications. These innovations not only enhance technological performance but also exert a significant influence on social and economic development. The objective of this study is to analyze the application of quantum technologies based on nanostructured materials and to evaluate their impact on communication efficiency, security, and broader socio-economic processes from a social science perspective. **Materials and Methods:** The study is based on an analytical review of scientific literature and contemporary technological developments related to quantum nanomaterials. The research examines their functional role in information transmission, signal processing, and system security. In addition, socio-economic factors such as digital transformation, labor market dynamics, and changes in educational systems are analyzed using a qualitative and comparative approach. **Results:** The findings indicate that quantum technologies utilizing nanostructured materials significantly improve the efficiency, reliability, and security of radar and telecommunication systems. These technologies facilitate faster data processing, higher-quality communication, and increased protection of information systems. Moreover, their implementation contributes to the acceleration of digitalization processes and the emergence of new professional competencies in the labor market. **Discussion and Conclusion:** The study demonstrates that the development and integration of quantum technologies have substantial social implications. From a socio-economic perspective, these technologies influence workforce transformation, stimulate innovation-driven education, and support sustainable technological progress. The results highlight the strong interconnection between scientific and technological advancement and societal development, emphasizing the importance of integrating social considerations into future strategies for the implementation of quantum technologies.

Keywords: Nanostructured Materials; Quantum Technologies; Radar; Electronics; Telecommunications



COLD START OF AN IOT-BASED SMART GREENHOUSE: SYNTHETIC DATA GENERATION, SENSOR-FAULT INJECTION, AND LIGHTWEIGHT ANOMALY DETECTION

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ABSTRACT

IoT-based smart greenhouses use sensors (temperature, relative humidity, CO₂) and actuators to maintain a stable microclimate, but measurement reliability can be degraded by missing data, outliers, stuck-at readings, and calibration drift. This issue is exacerbated in low-cost projects by the cold-start phase, when the historical data needed to test algorithms are not yet available. This work proposes a reproducible, no-real-data methodology based on generating multivariate synthetic time series and performing controlled sensor fault injection to build ground truth. Anomaly detection is carried out using a lightweight, unsupervised Isolation Forest approach (suited to multivariate data) and is compared against a threshold-based baseline. Evaluation relies on classification metrics (precision, recall, F1-score) and a control-stability indicator (time spent outside the setpoint band). The ultimate goal is to provide a simple framework that enables rapid validation already at the design stage of monitoring and fault-tolerance strategies for IoT greenhouse systems.

Keywords: Smart Greenhouse; Internet of Things (IoT); Cold Start; Synthetic Data; Fault Injection; Sensor Faults; Anomaly Detection; Isolation Forest



IMPACT OF THE WILLIAMS PARAMETER ON NUMERICAL ACCURACY: A COMPARATIVE ANALYSIS OF RA AND RAW TIME FILTERS

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ABSTRACT

The Robert–Asselin (RA) time filter is ubiquitous in numerical weather and climate modeling, primarily for its ability to damp the spurious computational mode associated with the leapfrog time-stepping scheme. Despite its utility, the RA filter suffers from a critical mathematical deficiency: it fails to conserve the mean state across its three operational time levels. This non-conservation results in undesirable damping of the physical mode and a significant degradation in numerical accuracy. To rectify this, the Robert–Asselin–Williams (RAW) filter introduces a redistribution of filter weights that ensures mean-state conservation, thereby recovering third-order accuracy and significantly mitigating amplitude errors without increasing computational cost. In this study, we investigate the specific dynamical influence of the Williams correction term. We perform a comparative analysis between the classic RA and the modified RAW schemes, with a specific focus on the sensitivity of the solution to the Williams parameter. Our methodology involves a controlled modification where the Williams parameter is nullified in the second phase of the time-stepping algorithm. By contrasting the spectral characteristics and error norms of the standard RA filter against the RAW filter under this constrained formulation, we aim to isolate the parameter’s precise effect on stability and accuracy. This study examines the balance between computational mode suppression and physical mode consistency, providing necessary guidance for optimizing time-integration schemes in global circulation models.

Keywords: Time Filter; Time Step; Stability Analysis; Error Analysis



DESIGN AND IMPLEMENTATION OF A BLUETOOTH MESH-BASED WIRELESS CONTINUITY TEST SYSTEM FOR AIRCRAFT CABLE HARNESSES

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ABSTRACT

In modern aircraft assembly lines, cable harness continuity tests are largely performed using manual and error-prone methods due to the inadequacy of automated platform solutions. This study aims to design and prototype an intelligent continuity test system that automates test processes, is wireless, supports multiple terminals, and increases operational efficiency to address this critical quality control need. The proposed system runs on the nRF52840 SoC, developed using a System-on-Chip (SoC) approach and supporting Bluetooth 5.0 (BLE) Mesh-based multi-hop communication. Thanks to the embedded software developed using Zephyr RTOS and nRF Connect SDK, the BLE stack, display, SD card, and mapping operations are executed simultaneously and stably on a single processor. The physical prototype developed as a result of the work aims to reduce errors compared to manual methods and achieve at least a 15% increase in efficiency by providing testing capabilities on the platform. The system offers the potential for a domestic solution that could reduce external dependency and costs in the aviation and defense industries.

Keywords: Continuity Test; Cable Harness; Bluetooth Mesh; Embedded Systems; Avionics



INVESTIGATING THE IMPACT OF SUB-T_g, NEAR-T_g, AND POST-T_g HEAT TREATMENTS ON BAND GAP AND REFLECTION INTENSITY

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ABSTRACT

Polymer Optical fiber (POFs) offer exceptional durability for sensing, yet their fabrication has historically required chemical etching that damages the fiber surface. To solve this, our work utilizes a thermal-only method to tailor Polymethyl Methacrylate (PMMA) fibers, eliminating chemical exposure entirely. We explore a multi-stage heat treatment strategy targeting three specific thermodynamic states relative to the glass transition temperature (T_g): the relaxation phase (Sub- T_g), the transition phase (Near- T_g), and the viscous flow phase (Post- T_g). By combining standard reflection spectroscopy with Tauc plot analysis—applied via the Kubelka-Munk transformation—we mapped how heat alters both the physical geometry and the electronic landscape of the material. Our data reveals a distinct behavior across regimes: lower temperatures (80°C) primarily relax internal manufacturing stresses, resulting in a highly stable optical signal. Heating the fibers above T_g (130°C), however, forces significant structural disorder. This appears as a distinct 'red shift' in the optical band gap alongside higher Urbach energy. This induced disorder is advantageous: it produced a 25% increase in refractive index sensitivity over the control group. Beyond its role in geometry, heat treatment proves to be an effective mechanism for 'thermo-optic tuning,' offering a sustainable alternative for developing sensitive intrinsic sensors.

Keywords: Polymer Optical Fiber; Tauc Plot; Kubelka-Munk; Thermal Annealing; Optical Sensors



METAL–ORGANIC FRAMEWORKS (MOFS) AS CATALYSTS/PHOTOCATALYSTS FOR ORGANIC SYNTHESIS

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ABSTRACT

Metal–Organic Frameworks (MOFs) are a class of highly porous crystalline materials that have attracted significant attention as catalysts and photocatalysts for organic synthesis due to their high surface area, tunable pore structure, and well-defined metal active sites. This research aims to develop MOF-based catalysts and photocatalysts for the sustainable and efficient synthesis of organic and biologically active molecules. Particular emphasis is placed on the incorporation of transition metals into MOF structures to enhance catalytic and photocatalytic activity, selectivity, and stability under mild reaction conditions. Comprehensive characterization techniques, including X-ray diffraction (XRD), Brunauer–Emmett–Teller (BET) surface area analysis, Fourier-transform infrared spectroscopy (FTIR), and thermal analysis, are employed to elucidate the structure–activity relationships. The expected outcomes include the identification of efficient, stable, and recyclable MOF-based catalysts, offering environmentally friendly alternatives to conventional catalytic systems for applications in organic and pharmaceutical synthesis.

Keywords: Metal–Organic Frameworks; Heterogeneous Catalysis; Photocatalysis; Organic Synthesis; Sustainable Chemistry



NONLOCAL ELLIPTIC EQUATIONS WITH SINGULAR SOURCES

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ABSTRACT

In the present paper, we study the existence of solutions for the singular nonlinearities in non-local elliptic equations. We consider the problem

$$\begin{cases} A(u) = \frac{f(x)}{u^\alpha} & , \text{ in } \Omega, \\ u = 0 & , \text{ on } \mathbb{R}^N \setminus \Omega, \\ A(u) = \Delta^s u + \beta(x), \end{cases}$$

where β is a non-decreasing real function, continuous on \mathbb{R} , surjective, such that $\beta(0) = 0$ and satisfying $|\beta(x)| \leq M|x|$ where M is a positive constant. $\alpha \geq 1, s \in (0, 1)$ is the fractional order, Ω is a bounded regular domain in $\mathbb{R}^N, N \geq 2$ and f is a non-negative function belonging to an appropriate Lebesgue space $L^m(\Omega)$. We adapt the results of N. Elharrar, J. Igbida and H. Talibi on the $p(\cdot)$ – Laplacian problem with nonlinear singular terms to the fractional case with $p(x) = 2$.

Keywords: Fractional Laplacian Problem; Nonlinear Singular Terms to the Fractional; Existence of Solutions for the Fractional Laplacian Problem



EVALUATING THE EVOLUTION AND OPTIMIZATION PATHWAYS OF RENEWABLE ENERGY-DRIVEN DESALINATION

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ABSTRACT

Seawater desalination has become a pivotal solution to address the growing scarcity of freshwater, a global challenge exacerbated by various factors, including rapid population growth, urbanization, and the impacts of climate change. This issue is particularly acute in arid and semi-arid regions, such as the Middle East and North Africa, where renewable water resources are limited and insufficient to meet the rising demand for water in drinking, agriculture, and industry. Desalination technologies, such as reverse osmosis and multi-effect distillation, have played a significant role in providing a reliable source of fresh water from saline resources. However, they face major challenges, including high energy consumption, elevated operational costs, and environmental impacts, such as greenhouse gas emissions and the management of brine waste. In light of these challenges, integrating renewable energy sources, such as solar, wind, and geothermal energy, emerges as a promising option to reduce dependency on fossil fuels, mitigate environmental impacts, and enhance the sustainability of desalination systems. Additionally, renewable energy technologies offer innovative solutions for remote areas lacking traditional infrastructure. Despite the great potential that renewable energy offers for improving desalination systems, obstacles remain, including the high costs of advanced technologies, technical challenges related to the variability of renewable energy sources, and the complexities of integrating them with energy-intensive processes. The development of innovative desalination systems powered by renewable energy represents a significant opportunity to enhance the sustainability of water resources. With advancements in technology, there is increasing interest in designing optimized hybrid systems, utilizing advanced materials to reduce energy consumption, and employing artificial intelligence to improve the efficiency and management of these systems. This paves the way for meeting freshwater needs while significantly minimizing environmental impacts.

Keywords: Seawater Desalination; Water Scarcity; Renewable Energy; Reverse Osmosis; Multi-Effect Distillation; Hybrid Systems



THE INFLUENCE OF NANO-ADDITIVES ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF GEOPOLYMER COMPOSITES: A COMPREHENSIVE REVIEW

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ABSTRACT

Geopolymer composites have emerged as eco-friendly alternatives to Portland cement, offering low-carbon pathways for sustainable construction. Key objectives of this comprehensive review systematically examine the influence of nano-additives such as nano-silica, nano-alumina, graphene, carbon nanotubes, and nanoclays on the microstructure and mechanical properties of geopolymers over the past 15 years (2010–2026). The review is focused on material issues and possibilities of geopolymer modification by nanoadditives and creation of smart composites for different applications. The main research method is a systematic analysis of the literature using the Scopus database and keywords connected with “geopolymer composite” and “nanoadditive”. Drawing from mainly peer-reviewed studies, the analysis key mechanisms include nucleation enhancement, pore refinement, interfacial bonding, and matrix densification, which collectively improve compressive strength, flexural toughness, and crack resistance. Results indicate the wider range of nanoadditives in geopolymer composites. The review highlights the influence of the amount of additive (optimal dosages), dispersion challenges (e.g., agglomeration via ultrasonication) on the final properties of the composites. Comparative meta-analysis reveals superior performance relative to cementitious materials, with nano-modified geopolymers exhibiting higher durability under cyclic loading. Gaps identified include long-term aging data and scalability for industrial applications. Future directions emphasize bio-inspired nano-additives for self-healing and multifunctional properties. By bridging synthesis, characterization and performance metrics, this review provides researchers and engineers with actionable insights to advance high-performance, circular geopolymer technologies for resilient infrastructure.

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Keywords: Geopolymer Composite; Nanoadditive; Nanomaterial



AI-DRIVEN CYBER THREAT DETECTION FRAMEWORK FOR PROTECTING CRITICAL INFRASTRUCTURE IN THE UNITED STATES

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ABSTRACT

The rapid digitalization of critical infrastructure in the United States has significantly increased exposure to sophisticated cyber threats that endanger national security, economic stability, and public safety. Key sectors such as energy, transportation, healthcare, financial services, and water systems rely heavily on interconnected information systems, making them attractive targets for advanced persistent threats and large-scale cyberattacks. This study proposes an AI-driven cyber threat detection framework that integrates machine learning, deep learning, and real-time anomaly detection to identify malicious activities with high accuracy. The framework analyzes network traffic, system logs, and user behavior patterns to detect zero-day attacks, malware, and insider threats. Experimental evaluation demonstrates that the proposed model achieves superior detection performance and lower false-positive rates compared to traditional signature-based security approaches. By enabling proactive threat identification and rapid response, the framework enhances the resilience of U.S. critical infrastructure systems. The findings highlight the potential of artificial intelligence to strengthen national cybersecurity defenses, safeguard essential services, and support the United States' strategic objective of maintaining a secure and trustworthy digital ecosystem.

Keywords: Cyber Threat Detection; Machine Learning; Security Systems



HYBRID DECISION SUPPORT SYSTEMS FOR FOREX TRADING USING FUZZY AND BINARY LOGIC

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ABSTRACT

Most existing approaches to algorithmic trading rely on binary logic and traditional technical analysis, which limits their ability to account for market uncertainty and rapidly changing dynamics. Although fuzzy logic has been explored as an alternative, prior studies are often restricted to specific markets or lack integration with adaptive methods such as machine learning. In addition, comparative evaluations of different logical paradigms remain scarce, and the potential of multi-timeframe analysis is largely underutilized. This motivates the development of a hybrid decision support system (DSS) that combines multiple analytical approaches. This study proposes a multi-timeframe hybrid DSS for algorithmic trading based on fuzzy and classical binary logic with probabilistic elements. Trading signals are generated using forecasts from a Random Forest model, trained via cross-validation to predict Open, High, Low, and Close (OHLC) values as well as associated confidence levels. A Mamdani-type fuzzy inference system is used to implement the fuzzy logic component. Both the fuzzy-based and binary-based DSS were developed in the MQL5 programming language and evaluated through backtesting on the MT5 platform. Experimental results demonstrate a clear advantage of the fuzzy logic-based DSS. It achieved a Win Rate of 60.81%, an annual return of 58%, and a Sharpe ratio of 1.33. In contrast, the binary logic-based system produced a Win Rate of 34.16%, an annual return of -95.46%, and a Sharpe ratio of -5. These findings indicate that incorporating fuzzy logic and probabilistic reasoning within a multi-timeframe framework significantly improves decision quality and trading performance. The proposed methodology provides a foundation for more robust decision support systems in financial markets and can be extended in future work through improved time series forecasting techniques.

Keywords: Algorithmic Trading; FOREX; Machine Learning; Fuzzy Logic; Mamdani



THE IMPORTANCE OF PERFORM EMC PRE-COMPLIANCE TEST IN SEMI-ANECHOIC CHAMBER OR OPEN AREA TEST SITE (OATS)

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ABSTRACT

Introduction and Objective: The growing complexity of electromagnetic environments in which modern vehicles operate has increased the relevance of electromagnetic compatibility (EMC) in the automotive sector, particularly with the expansion of electric vehicles. Power electronic converters and electric motors act as significant sources of electromagnetic emissions, making EMC pre-compliance testing an essential step during vehicle development. This study aims to highlight the importance of performing electromagnetic field measurements in controlled environments, such as semi-anechoic chambers and Open Area Test Sites (OATS), in order to ensure reliable and accurate EMC assessments. **Materials and Methods:** Electric and magnetic field measurements were performed using a simple and theoretically well-known configuration composed of two parallel metallic plates energized by a DC voltage. Experimental measurements were carried out in a non-controlled laboratory environment and compared with analytical calculations and numerical simulations developed using CST Microwave Studio®. The differences between measured and simulated results were analyzed to evaluate the influence of environmental electromagnetic noise on the measurements. **Results:** The analytical calculations and numerical simulations showed good agreement with each other. However, the experimental measurements presented significant deviations, with errors reaching values close to 30%. These discrepancies were mainly attributed to external electromagnetic interference and the influence of the measurement equipment on the test setup. **Discussion and Conclusion:** The results demonstrate that electromagnetic field measurements performed outside controlled environments may lead to inaccurate and unreliable results, even for simple test configurations. Therefore, the use of semi-anechoic chambers or OATS is essential to minimize environmental interference and ensure measurement repeatability. This reinforces the importance of controlled environments in EMC pre-compliance testing, especially in the development and validation of electric vehicles.

Keywords: Electromagnetic Compatibility (EMC); Electric Vehicles; Pre-compliance Testing; Semi-Anechoic Chamber; Open Area Test Site (OATS)



PREDICTING HYPERTENSION RISK USING ENSEMBLE MACHINE LEARNING MODELS: A COMPARATIVE AND STACKING-BASED APPROACH

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ABSTRACT

Hypertension is a major global health risk that makes a significant contribution to cardiovascular disease. Accurate and early prediction of hypertension risk can enable timely treatment and preventive measures. In this study, we used a publicly available hypertension dataset from Kaggle to develop and compare multiple machine learning models. These include simpler algorithms such as Logistic Regression, K-Nearest Neighbors, SVM, Decision Tree, Random Forest (RF), and Naive Bayes, as well as advanced models like XGBoost, Gradient Boosting, AdaBoost, LightGBM, CatBoost, and a custom stacking ensemble, where Random Forest and CatBoost served as base learners and XGBoost was used as the meta-learner. During data preprocessing, we removed missing values, created a new BMI-category feature using binning, encoded categorical variables, and applied SMOTE to address class imbalance. For model evaluation, we used Accuracy, Precision, Recall, F1-score, and AUC as performance metrics. Our results show that the stacking ensemble model outperformed all other classifiers across every metric, achieving an accuracy, precision, recall, and F1-score of 93.06%. This demonstrates that combining models can make hypertension risk prediction at an early stage more robust. We have shown that machine learning especially ensemble methods holds great potential for the early detection of hypertension, which can play a vital role in enabling timely preventive healthcare.

Keywords: Hypertension Prediction; Machine Learning; Ensemble Learning; Stacking Model; Healthcare Analytics



T.C.
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06.02.2026

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ENSTİTÜSÜ BAŞKANLIĞINA**

Üniversitemiz Mühendislik-Mimarlık Fakültesi ve İKSAD (İktisadi Kalkınma ve Sosyal Araştırmalar Enstitüsü) iş birliği ile 7-8 Şubat 2026 tarihlerinde (yüz yüze ve çevrim içi) düzenlenecek olan "II. Uluslararası Fen Bilimleri ve Uygulamalı Matematik Kongresi"ne düzenleme kurulu başkanı ve düzenleme kurulu üyesi olarak aşağıda adı-soyadı belirtilen öğretim üyeleri görevlendirilmiştir.

Bilgilerinizi ve gereğini rica ederim.

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10.02.2026

REF: Akademik Teşvik

İlgili makama;

II. Uluslararası Fen Bilimleri ve Uygulamalı Matematik Kongresi, 7-8 Şubat 2026 tarihleri arasında İstanbul'da 23 (Türkiye, Azerbaycan, Amerika Birleşik Devletleri, Çin, Fransa, Ukrayna, Gürcistan, Romanya, Türkmenistan, Pakistan, Kazakistan, Polonya, Brezilya, Filipinler, İran, Cezayir, Suudi Arabistan, Fas, Banglades, Hindistan, Nijerya, Irak, Malezya) farklı ülkenin (Türkiye 91 bildiri- Diğer ülkeler 99 bildiri) akademisyen/araştırmacılarının katılımıyla gerçekleşmiştir

Kongre 16 Ocak 2020 Akademik Teşvik Ödeneği Yönetmeliğine getirilen “Tebliğlerin sunulduğu yurt içinde veya yurt dışındaki etkinliğin uluslararası olarak nitelendirilebilmesi için Türkiye dışında en az beş farklı ülkeden sözlü tebliğ sunan konuşmacının katılım sağlaması ve tebliğlerin yarıdan fazlasının Türkiye dışından katılımcılar tarafından sunulması esastır.” değişikliğine uygun düzenlenmiştir.

Bilgilerinize arz edilir,

A handwritten signature in blue ink, likely belonging to Prof. Dr. Bahaddin SİNSOYSAL.

Prof. Dr. Bahaddin SİNSOYSAL
Istanbul Beykent University
CONGRESS PRESIDENT