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3rd INTERNATIONAL CONFERENCE ON COMPUTATIONAL APPLIED SCIENCES AND ITS APPLICATIONS (ICCASA 2025)

20th - 21st September, 2025.

Souvenir

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ABOUT THE UNIVERSITY

UEM Jaipur was established in the year 2012 by Ordinance 11 of 2011 and Act No 5 of 2012 of Govt of Rajasthan. UEM Jaipur has achieved the awards of "Best Private University in North India" and "Best Emerging University in North India".

UEM Jaipur has been established by the IEM group, Kolkata. The IEM UEM group is an acclaimed educational group amongst the industry-centred academic training organizations of today. IEM has set sublime standards in addressing the technical and managerial resource shortage in the new era of dynamic globalization. The IEM UEM group has risen to fame for its strong foundation in teaching and R&D in multifaceted areas. It aims to serve the future generation as well as the Nation through its commitment towards self sufficiency and unmatchable excellence.

Since its inception, the IEM UEM group has surpassed innumerable benchmarks of achievements and accreditations. Today IEM flaunts a colossal network of expansive operations led by an awe-inspiring student force who are the torchbearers of a better tomorrow.

The IEM UEM Group has opened up the doors for young minds who dare to dream. It encourages the spirit of free enquiry and imagination. In this temple of learning, dreams take shape. The educational group attempts to inculcate the sense of human values and discipline in students to make them respectable human beings. It encourages learners to learn, to realize their potential and imbibe the best practices.

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ABOUT CONFERENCE

The vision behind organizing this conference is to provide an excellent forum for researchers, scientist and industrialist from interdisciplinary areas to showcase their current contribution in the recent area of Physical Sciences. The objectives of International Conference on Computational Applied Sciences and it's Applications (ICCASA-2025) are to abreast the young minds from Institutes, Universities, Colleges and Industries across the country, with the latest advancements in the field of this area, and providing them an opportunity to share their recent researches and views in various fields of Physical Sciences and theis applications for the ultimate benefit of the Society and Industry. The broad aim of the conference is to groom the young scientists' minds to face the challenges of future for effective and efficient professional responsibilities. The conference will cover a wide range of topics in the form of plenary speakers, keynote speakers, invited talks & contributory papers presentations.

ABOUT DEPARTMENT

The primary objective of including Applied Sciences Subjects in Engineering studies is to train the manpower required to deal with the problems faced by software industry through knowledge of science and scieintific computational techniques. The curriculum is interdisciplinary in nature and course contents provide a broad understanding of the different aspects of engineering. Our aim is to impart in depth training in the analysis of problems relevant to industry.

ORGANIZING TEAM

CONVENERS

Dr. Praphull Chhabra	**Professor (Department of Mathematics) UEM Jaipur**
Dr. Tarun Sharma	**Associate Professor(Department of Mathematics) UEM Jaipur**

CO - CONVENER

Dr. Arnab Palui	**Associate Professor(Department of Physics) UEM Jaipur**

ORGANIZING TEAM

Dr. Rahul Sharma	**Associate Professor(Department of Mathematics) UEM Jaipur**
Dr. Anamika Khaskel	**Associate Professor(Department of Chemistry) UEM Jaipur**
Dr. Pallavi Malik	**Assistant Professor(Department of Mathematics) UEM Jaipur**
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Mr. Rakesh kumar Sharma	**Research Scholar(Department of Chemistry) UEM Jaipur**
Ms. Santosh kumari Bajiya	**Research Scholar(Department of Chemistry) UEM Jaipur**
Ms. Afsana Fazal	**Research Scholar(Department of Chemistry) UEM Jaipur**
Ms. Rachna Kumawat	**Research Scholar(Department of Chemistry) UEM Jaipur**

Message from the Chancellor

All Members

It gives me immense pleasure to know that the Department of Applied Sciences, UEM, has organized an International Conference on Computation Applied Sciences & its Applications, which will be held in hybrid mode on 20th & 21st September 2025.

It is worth appreciating that many young researchers are participating in the conference with their views and experiences. I hope the outcome of the conference will definitely provide guidelines and practical recommendations to the participants in this important field.

I wish to convey my best wishes for the success of the conference.

All the best

Prof. Banani Chakrabarti

Chancellor

University of Engineering & Management,

Jaipur

Message from the Vice-Chancellor

I sincerely congratulate the humble efforts of the organizing committee of the conference, Department of Basic Sciences, UEM, Jaipur, in providing a platform for students, academicians and researchers to share ideas and research outcomes through the conference.

With the huge and enthusiastic presence of adepts, young and brilliant researchers, business & industry delegates, and outstanding student communities, the conference gives an insight into new research, cutting-edge technologies, challenges, and innovations in the field of physical sciences, which generates tremendous attention. The programme is already looking great and the networking opportunities are going to be fantastic.

I am delighted to invite you to the 3rd International Conference on Computation Applied Sciences & its Applications, which will be held in an offline format in September 2025.

With gratitude
Prof. (Dr.) Biswajoy Chatterjee
Vice-Chancellor,
University of Engineering & Management
(UEM), Jaipur

Message from the Pro Vice-Chancellor

I would cordially invite you to the 3rd International Conference on Computation Applied Sciences & its Applications, which will be hosted by the Department of Basic Sciences at the University of Engineering & Management, Jaipur.

I think it would bring together passionate scholars, students, practitioners, academicians, and industry experts on a single platform to address new paradigms and research problems in physical and applied sciences.

Therefore, I implore everyone to help us create a healthy, calm, and fascinating environment for the conference.

Prof. (Dr.) Satyajit Chakrabarti

Pro-Vice Chancellor

University of Engineering & Management

Jaipur, Rajasthan

Message from the Registrar

The 3rd International Conference on Computation Applied Sciences & its Applications is organized by the Department of Basic Sciences, UEM, Jaipur in September 2025.

On behalf of the organizing committee, I encourage all researchers, students, intellectuals, and professionals in connected sectors to join in this academic feast for sharing and presenting related work. This conference invites papers on Basic sciences to address themes such as debating innovation and obstacles in the real world and supporting economic development. The broad aim of the conference is to groom young scientists' minds to face the challenges of the future for effective and efficient professional responsibilities.

I congratulate all participants, members, industry experts, and students for the success of the conference.

With utmost regards
Prof. (Dr.) Pradeep Kumar Sharma
Registrar & HOD Physics ,
University of Engineering & Management
(UEM), Jaipur

Message from the Convener

It is with great pleasure and a deep sense of privilege that I extend a warm welcome to each one of you to the 3rd International Conference on Computational Applied Sciences and its Applications (ICCASA-2025). Organized by the Department of Applied Science, University of Engineering and Management, Jaipur, this prestigious conference will be held on 20th & 21st September, 2025.

Over these two days, participants will have the opportunity to engage in insightful discussions, explore cutting-edge research findings, and exchange innovative ideas. ICCASA-2025 aspires to serve as a dynamic platform for collaboration, networking, and knowledge sharing—fostering both academic enrichment and professional growth.

I eagerly look forward to welcoming you to ICCASA-2025 and to witnessing the meaningful exchange of ideas and the creation of lasting connections among scholars, researchers, and professionals from across the globe.

Best regards

Dr. Praphull Chhabra

Professor, Mathematics

Message from the Convener

It gives me immense pleasure to warmly welcome you all to the 3rd International Conference on Computational Applied Sciences and its Applications (ICCASA-2025), being held on 20th & 21st September, 2025.

It is truly an honor to witness this distinguished gathering of researchers, academicians, industry professionals, and experts who have come together to exchange knowledge and explore innovations in the field of computational applied sciences.

This year's conference promises to be an enriching experience, featuring eminent keynote speakers, insightful plenary sessions, technical paper presentations, poster sessions, and interactive panel discussions. The carefully designed agenda aims not only to enhance academic and professional understanding but also to create opportunities for networking, collaboration, and the sharing of diverse perspectives.

I would like to take this opportunity to express my sincere gratitude to the organizing committee, program chairs, and technical reviewers whose tireless efforts have ensured the quality, relevance, and success of this conference.

I wish each of you a productive, inspiring, and memorable ICCASA-2025.

Best regards

Dr. Tarun Sharma

Associate Professor, Mathematics

Message from the Co-Convener

It is my great pleasure to extend a warm welcome to all of you to the 3rd International Conference on Computational Applied Sciences and its Applications (ICCASA-2025), scheduled on 20th & 21st September, 2025.

We are truly honored to host this esteemed gathering of researchers, academicians, industry leaders, and experts who have come together to share knowledge, foster innovation, and advance the frontiers of computational applied sciences.

This year's conference is designed to be an intellectually enriching experience, featuring renowned keynote speakers, thought-provoking plenary sessions, technical paper presentations, poster displays, and dynamic panel discussions. Beyond academic exchange, ICCASA-2025 offers valuable opportunities for networking, collaboration, and the cross-pollination of ideas from diverse perspectives.

I extend my heartfelt gratitude to the organizing committee, program chairs, and technical reviewers whose dedication and hard work have been instrumental in ensuring the success, quality, and impact of this conference.

May ICCASA-2025 be a truly productive, inspiring, and memorable experience for each of you.

Best regards

Dr. Arnab Palui

Associate Professor, Physics

CALL FOR PAPERS

ICCASA-2025

3rd International Conference on Computational Applied Sciences & it's Applications (ICCASA-2025)

Date: 20 - 21 September 2025

Mode: Hybrid

Organized by: Department of Basic Sciences, UEM Jaipur

Venue: University of Engineering & Management, Jaipur

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ABOUT UEM JAIPUR

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Thrust areas of the Conference (But not limited to.....)

- Mathematical Modelling & Simulation in Engineering & Applied Sciences
- Emerging technologies in Artificial Intelligence & Deep Learning
- Theoretical & Computational Fluid Dynamics
- Microfluidic Devices & Biomedical Applications
- Environmental and Ecological Modelling
- Decision Analysis and Risk Management
- Stochastic and Robust Optimization
- Mathematics and Computational Science with AI
- AI for Energy and Sustainability
- Synthetic Organic Chemistry
- Nonlinear Dynamics and Chaos Theory
- Nanotechnology and Nano-materials
- Applied Nuclear Science and Engineering
- Recent Trends in Condensed Matter and Plasma Physics
- Green and Sustainable Chemistry
- Magnetic Materials and Applications
- Statistical Methods in Applied Sciences
- Computational Astrophysics
- Spectroscopy and Atmospheric Chemistry
- Catalysis
- Mathematical Biology and Bioinformatics
- Quantum Computing and Quantum Information Science
- Applied Game Theory in Engineering & Economics
- Reinforcement Learning and Autonomous Systems
- AI for Healthcare and Precision Medicine
- Quantum Materials and Quantum Optics
- Soft Matter Physics and Biophysics
- High Energy Physics and Particle Accelerators
- Artificial Photosynthesis and CO_2 Reduction
- Green Energy and Hydrogen Fuel Cells
- Computational Chemistry and Drug Discovery

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For registration regarding issues: Dr. Pallavi Malik (+91- 9799474109)

For publication regarding issues: Dr. Praphull Chhabra (+91- 9783372873)

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IMPORTANT DATES

ABSTRACT SUBMISSION/ PAPER SUBMISSION
15/08/2025

ACCEPTANCE MAIL FOR PRESENTATION
24/08/2025

REGISTRATION ENDS
31/08/2025

CONFERENCE DATE
20th & 21st Septmber, 2025

Keynote Speakers

1. Prof. (Dr.) Anoop Kumar Mukhopadhyay
Former Chief Scientist , CSIR CGCRI, Kolkata
Title of Talk: Journey of a Dream from Science to Technology: Prospects and Challenges

2. Prof. (Dr.) O.D. Makinde
Professor (Applied Mathematics and Computations) Faculty of Military Sciences Stellenbosch University, South Africa
Title of Talk: A Novel Computational Framework for Nonlinear Challenges in Science and Engineering Using Hermite–Padé Techniques

3. Dr. Dharmendra Tripathi
Associate Professor (Department of Mathematics) NIT, Uttarakhand
Title of Talk: Transient Tumor-Induced Disruption of Peristaltic Flow

4. Prof. (Dr.) Anil Kumar
Professor (Department of Chemistry) BITS Pilani, Rajasthan
Title of Talk: Transition Metal-Catalyzed C-H Bond Functionalization of Heterocycles

5. Prof. (Dr.) Abhijit Kumar Das
Senior Professor (School of Mathematical & Computational Sciences) IASC, Kolkata
Title of Talk: Applications of Computational Methods in Science and Technology

6. Prof. (Dr.) Haci Mehmet Baskonus
Faculty of Education Harran University, Turkey

7. Dr. Sarita Kumari
Associate Professor (Department of Physics) UOR, Jaipur
Title of Talk: Exploring Perovskites for Solar Energy: A DFT Approach to Structural, Electronic, and

8. Dr. Ritu Agarwal
Assistant Professor (Department of Mathematics) MNIT Jaipur
Title of Talk: Modelling Uncertainty and Memory in Dynamical Systems through a Fractional

9. Dr. Sunil Panday
Associate Professor and HOD (Department of Mathematics) NIT Manipur
Title of Talk: Advanced Multipoint Iterative Schemes with and without Memory for Solving Nonlinear Equations

10. Dr. Sachin Kumar
Associate Professor (School of Basic Sciences), Central University of Punjab
Title of Talk: Invariance Analysis of Differential Equations.

11. Dr. Naresh Kumar
Assistant Professor (Department of Mathematical and Physical Sciences) University of Nizwa, Oman.
Title of Talk: Vision and Learning from Human to Machine Towards Automated & Intelligent Systems

12. Dr. Pradeep Kumar
Associate Professor (Department of Chemistry) MNIT Jaipur
Title of Talk: The puzzle of high lifetime and low stabilization of $HO_3^{\bullet}$: Rationalization and Prediction

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3rd INTERNATIONAL CONFERENCE ON COMPUTATIONAL APPLIED SCIENCES AND ITS APPLICATIONS (ICCASA 2025)
20th & 21st September, 2025.

Development of an IoT-based Smart Pill Dispenser for Medication Management

G. Uma Devi
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Abstract: In this age of technology, proper medication conformity for the patient and elderly is becoming an increasingly major issue. A phenomenal percentage of medical problems arise from medication intake in the wrong manner, either under the assumption of improper timings or switching between various drugs. To compensate for this issue, a smart solution in the form of an Internet of Things (IoT)- based Smart Pill Dispenser (SPD) has been proposed. The SPD is a one-day medication management system that delivers the right pill at the right time using an automated system. It is connected to a web interface for convenience, making it easy for patients and elderly people to take their medications effectively. The system employs an ESP32 microcontroller, servo motor, OLED display, and a web interface to deliver a smooth medication experience. This paper explains the design, operation, and possible implications of this intelligent pill dispenser.

Keywords— Medication Conformity, Internet of Things (IoT), Smart Pill Dispenser (SPD), Medication Management, ESP32

3rd INTERNATIONAL CONFERENCE ON COMPUTATIONAL APPLIED SCIENCES AND ITS APPLICATIONS (ICCASA 2025)
20th & 21st September, 2025.

Iris Recognition in Cybersecurity: Advancements, Challenges, and Future Directions

Sunil Sharma[1], Rahul Kumar Garg[2], and G. Uma Devi[3]

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Abstract: The authentication system based on technological iris recognition delivers highly accurate defensive protection for banking operations along with control points and mobile devices. The fixed nature of iris retina patterns stops identification fraud attempts from occurring. Defenders receive both increased risk prevention together with fast authentication and precise results by implementing artificial intelligence and deep learning algorithms and multiple biometric identification methods. The deployment of secure iris authentication encounters multiple obstacles because attackers can perform spoofing attacks on this system while facing difficult database security requirements and demanding operational conditions and limited scalability potential. Basic defence mechanisms against threats come from anti-spoofing systems coupled with liveness detectors but AI anomaly detection systems running from edge computing platforms deliver effective security capabilities and fast processing for the Aadhaar type of large structures. Pursuing three vital research developments will enhance security functionalities and increase system capabilities together with privacy protection biometric cancelation quantum encryption and decentralized authentication systems development. The modern digital identity verification system depends on iris recognition technology because its secure and efficient protection methods protect users against cyber threats.

Keywords: Iris recognition, biometric authentication, cybersecurity, spoofing attacks, ensemble learning, rejection mechanism, transfer learning.

Anti-Adjacency and Anti-Incidence Matrix of Total graph of some Graphs

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2Department of Education, University of Kerala, Thiruvananthapuram, Kerala, India
Department of Mathematics, University College, Thiruvananthapuram, Kerala, India

Abstract: The Anti adjacency matrix plays a vital role in the field of Chemical graph theory. The concept of anti adjacency matrix was introduced by M. Edwina and K.A. Sugeng. The total parameters of a graph G can be viewed as a vertex parameters of its total Graph $T(G)$. In this paper we characterize the Anti adjacency matrix of T(G) by introducing the anti incidence matrix. Also we find out the spectra of anti incidence matrix for some class of graphs.

Numerical Investigation of Hemispherical Flattening Contact with Deformable Substrate Interaction: A Finite Element Study

Tamonash Jana[1, a)], Chandni Mallick[1], Arijit Chowdhury[1], Triyasha Maity[1], Rimjhim Majumdar[1]
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Abstract: The contact between rough surfaces is a fundamental physical problem, influencing friction, wear, and material reliability. At the micro scale, contact occurs via discrete asperities whose complex interactions determine macroscopic response under load. Classical contact mechanics theories, such as Hertzian contact, assume a homogeneous, rigid substrate beneath the contacting asperity, limiting their applicability for modern materials systems involving layered structures, thin films, and compliant substrates. In this study, we present a detailed numerical investigation of the contact mechanics of a hemispherical asperity interacting with a deformable substrate using a finite element approach implemented in ANSYS APDL. The model incorporates distinct material properties for the asperity and substrate, enabling simulation of layered systems typical in advanced engineering applications. The evolution of contact force, contact area, stress distributions, and deformation patterns are analysed in detail. The results reveal significant deviations from traditional Hertzian predictions arising from substrate deformability and material heterogeneity. These findings highlight the essential role of multi-material, deformable contact mechanics modelling and provide quantitative insights into the interplay between asperity and substrate mechanics. This work contributes to the advancement of predictive simulation methods

crucial for the design and optimization of engineered surfaces, coatings, and micro-scale contact phenomena.

On (*p, q*)-Analogues of Elzaki transform

Lata Chanchlani[1], Jai Prakash[2], Subhash Alha[3]

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Abstract: In this paper, we introduce the first and second kinds of (*p, q*)-Elzaki transforms and establish their relationships with corresponding (*p, q*)-Laplace transforms. We derive several properties of these transforms, including linearity, convolution, change of scale, transforms of the (*p, q*)-derivative, and integral properties. To illustrate the applicability, we compute transforms of some basic functions. Furthermore, we demonstrate the usefulness of (p, q)-Elzaki of the first kind by solving (*p, q*)-differential equations.

Keywords: (*p, q*)-calculus, (*p, q*)-Elzaki transform, (*p, q*)-derivative, (*p, q*)-functional equations.

Uniformly convergent finite element strategy for singularly perturbed Burgers-Fisher and Burgers-Huxley equation based on exponentially fitted splines

Brehmit Kaur
Sri Guru Granth Sahib World University, Fatehgarh Sahib Punjab, INDIA

Abstract:

Boundary layer problems arise during the simulation of gas behavior, wave prop- agation, nerve pulse circulation, etc. The current work involves numerical treatment of Burgers-Fisher and Burgers-Huxley problems involving singular perturbation vari- ables using adaptive finite element method. In the beginning, Implicit Euler method has been considered for temporal discretization. Layer-adapted Shishkin mesh refine- ment has been carried out to resolve the sharp boundary layers. To treat non-linearity arising in the problem, quasilinearization process has been taken into consideration. Finite element technique has been used for spatial discretisation based on exponen-

tially fitted splines. Numerical experiments have been carried out. The proposed adaptive scheme has been proved to be uniformly convergent w.r.t. singular pertur- bation parameter.

Fractional-Order Control Models for Adaptive Neural Controllers in Robotics

Anil Kumar Menaria*

Abstract:

This paper investigates the integration of fractional-order calculus with adaptive neural controllers to enhance robotic system performance. Fractional-order control models, utiliz- ing non-integer order derivatives, offer superior modeling of complex dynamics due to their memory-dependent properties. We propose a novel fractional-order neural proportional- integral-derivative (FONPID) controller, optimized using a hybrid particle swarm opti- mization (PSO) algorithm. The controller addresses nonlinearities and uncertainties in robotic manipulators. Stability is analyzed using the Lyapunov method, and numerical simulations demonstrate improved tracking accuracy and energy efficiency compared to integer-order controllers. Applications to a 3-Degrees of freedom (DoF) robotic arm are presented, with graphical analyses illustrating enhanced transient response and robustness. The paper concludes with future research directions for fractional-order control in robotics.

A mathematical model of lifestyle dynamics to determine the stage conversion and progress rate of Diabetic Retinopathy for affected and healthy individuals

Anjali Anjali1 Sandhya Soman1*

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Abstract: Diabetic Retinopathy (DR) is a significant complication of diabetes, driven by a complex interplay of intrinsic and extrinsic factors, including nutritional de- ficiencies and environmental influences. This study investigates the mathematical framework for the DR number, categorized into two components: representing the risk increase due to inherent nutritional malproportion, and reflecting the influence of individuals with DR practicing inadequate nutrition on healthy individuals. The findings reveal that it is directly proportional to intrinsic factors and inversely pro- portional to protective nutritional parameters. Similarly, it is driven by external factors and inversely influenced by environmental and nutritional quality param- eters. The study emphasizes the critical role of micronutrients such as calcium and potassium in mitigating DR risk. Poor dietary habits not only heighten in- dividual susceptibility but also contribute to community-level risk through shared environmental and social factors. By

addressing these nutritional and lifestyle components, effective prevention strategies for DR can be developed, promoting healthier outcomes for individuals with diabetes.

TCAD Based Modeling Of A GaAs/CdTe Type-II Quantum Dot Solar Cell: Targeting Effective Photogeneration And Thermal Analysis

Indranil Maity[1, a)] and Arighna Bhattacharjee[2, b)]

[1]*Department of Electronics and Communication Engineering, Institute of Engineering and Management, University of Engineering and Management, Kolkata, India*

[2]*Department of Electronics and Communication Engineering, Institute of Engineering and Management, Kolkata, India*

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Abstract: In this study, the optical and electrical characteristics of a newly designed quantum dot solar cell (QDSC) incorporating cadmium telluride (CdTe) quantum dots were investigated. Simulations were carried out using the Silvaco TCAD ATLAS platform. The modeled configuration featured CdTe quantum dots embedded in the active region, followed by a gallium arsenide (GaAs) layer, a nickel oxide (NiO) hole transport layer, and a zinc oxide electron transport layer. Unlike conventional photovoltaic devices, QDSCs exhibit multiple exciton generation (MEG), allowing a single absorbed photon to generate multiple charge carriers, thereby enhancing their potential efficiency. The parameters obtained were said to have an output power efficiency, V_{oc}, J_{sc}, and fill factor of 36.95%, 1.054 V, 45.8 mA/cm², and 0.76, respectively, under simulated AM1.5g illumination at normal incidence. The formed structure was able to separate charge, reduce recombination loss, and optimize the absorption of photons at wavelengths between 300 and 750 nm. The calculated parameters, such as the J-V profile and characteristic absorbance at different wavelengths, and the energy band diagram show that the proposed CdTe QDSC is a viable option because of its scalability and performance. Temperature analysis across 300-350 K was also performed which showed that the solar cell is stable and depicts predicted trends according to the theoretical studies present. Accordingly, in this work, critical information on designing and optimising future-generation solar cells is pointed out, and the significance of QDSCs in future-generation cutting-edge renewable energy technologies are also highlighted.

Keywords. GaAs/CdTe Quantum Dots, Solar cell, Multiple excitation generation (MEG), Output Power Efficiency, Fill factor.

The Discrete Fractional Taylor's Formula

Manisha

Abstract:
This study develops a Discrete Fractional Taylor's formula, extending the classical Taylor's framework to discrete domains through fractional-order differences, effectively capturing non-local and memory-dependent behaviours. The formula represents a function as a finite sum of fractional-order falling factorial terms with a remainder, enhancing approximation accuracy for functions with complex growth patterns. This generalization bridges discrete fractional calculus and numerical approximation theory, offering a powerful analytical tool for modelling processes with hereditary effects in discrete settings. Its applications range from numerical analysis, signal processing, chaotic maps, and control theory to the discrete modelling of physical, biological, and engineering systems exhibiting fractional dynamics. To establish the formula, new relations for the forward Caputo-type fractional difference and sum operators are derived, along with new mean value theorems for these operators. Illustrative examples demonstrate the formula's convergence properties and advantages over integer-order discrete expansions.

LINEAR OPERATORS AND SEMI-HILBERTIAN STRUCTURE IN BANACH SPACES

JEET SEN, HRICHA SAMANTA

Abstract: We study semi-Hilbertian structure in Banach spaces, induced by a distinguished class of bounded linear operators, by introducing the notion of semi-norm generating operators. Our primary concern is to explore the corresponding orthogonality relation in operator spaces. Given a semi-norm generating operator A on a reflexive smooth Banach space X, we characterize the $A-$Birkhoff-James orthogonality of $A-$bounded and compact operators on X, separately for the real case and the complex case. Analogous characteriza- tions for the $A-$Birkhoff-james orthogonality of $A-$bounded operators which are not necessarily compact, are also obtained by considering $A-$norming se- quences. Our study generalizes and extends the scope of earlier studies on semi-Hilbertian structure in Hilbert spaces, induced by a positive operator.

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Influence of Nanoparticle Shape on MHD Nanofluid Flow in a Porous Medium with Slip Effects

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Abstract: The present study investigates the impact of nanoparticle geometry on the hydrodynamic and thermal behavior of nanofluid flowing past a flat surface in the presence of a magnetic field. The model incorporates first-order velocity slip and porous medium resistance to better capture practical transport phenomena. By applying similarity transformations, the governing nonlinear partial differential equations are reduced to a set of ordinary differential equations, which are then solved numerically using MATLAB's bvp4c algorithm. The accuracy of the numerical approach is further verified through the optimal auxiliary functions method. Results reveal that increasing the magnetic parameter suppresses fluid velocity, whereas a higher nanoparticle volume fraction promotes momentum transport. Enhancement in the porosity parameter intensifies temperature fields, while greater slip effects diminish thermal boundary layers. Comparisons among different nanoparticle shapes demonstrate that shape factor plays a decisive role in modifying skin friction and heat transfer rates. Overall, the findings highlight that improvements in thermal transport are more significant than drag reduction under the considered conditions. Streamline and isotherm visualizations are also presented to provide deeper insight into the velocity and temperature distributions associated with various nanoparticle geometries.

Keywords: Nanofluid, Nanoparticle shape factor, MHD, Porous medium, Velocity slip.

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Effect Of Virtual Autism On Children: Studying Behavioral Changes Among Children With Digital Exposure Using Machine Learning Algorithm

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Abstract:

As children's use of mobile devices continues to concern researchers, society finds itself in a digital domain where such innovations are growing very rapidly. This article addresses development of autism which develops in children at the age of 2 months to 5 years of age which occurs mainly by excessive use of screens.

Excessive screen exposure among children is connected to behavioral patterns resembling autism. This study explores how prolonged digital engagement affects speech development and social interactions, highlighting potential risks and the need for alternative activities. This study is done using the Random Forest Technique among the machine learning algorithms. Understanding these effects can benefit parents and educators adopt strategies and new ways and methods in reducing screen dependence and promote healthier cognitive and social development among and within the younger children.

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Analysis of the Temperature profile in the plasma discharge of a Ceramic Metal Halide Lamp

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Abstract: The Ceramic Metal Halide (CMH) lamp is a high-intensity discharge (HID) lamp that is widely used for indoor and outdoor light production as well as horticultural and aquarium lighting. CMH lamps generate light when electricity interacts with a gas initially filling a ceramic arc tube filled with metallic halides and mercury vapor that also produces both visible and ultraviolet light. A CMH lamp generates a significant amount of heat as a result of the plasma discharge, therefore understanding the temperature profile in the plasma discharge is critical for the performance and efficiency of any CMH lamp allowing for optimal design and operating parameters for CMH lamps. Many different techniques could be used including thermal imaging, optical emission spectroscopy, and computational fluid dynamics. The analysis in this case will offer insight to the conduction mechanisms related to light produced in CMH lamps as well as the energy transfer mechanisms related to solid, liquid and gas states. The analysis will potentially lead to improving lamp efficiency and impact on the environment. In this paper a MATLAB model has been used to study the wall temperature characteristics of the metal halide lamp and discusses the use of temperature profiles of the plasma discharge of the arc tube. The set of physical lamp parameters that will optimize the lamp ballast interaction is encouraged. There are different aspects in terms of the dynamics of the plasma, wall and electrodes; furthermore, some set of thermo energy balance equations have been discussed. Finite element analysis using MATLAB has been used to evaluate the temperature profile of the tube. The results hence obtained provided sufficient insight to the life of the electrodes alongwith the change in temperature.

Keywords: Ceramic Metal Halide Lamps; plasma discharge; temperature; Finite element analysis.

Crank-Nicolson Finite Difference Scheme for Solving The Space Fractional Stochastic Diffusion Equation

Archana Mourya

Abstract:

The primary objective of this paper is to propose a Crank-Nicolson scheme tailored to analyze a time-space fractional stochastic diffusion equation subject to additive and multiplicative noise. Using the Caputo definition for time fractional derivatives and the shifted Grunwald-Letnikov definition for space fractional derivatives, a fractional order Crank-Nicolson finite difference scheme is devised to obtain a numerical solution. There is considerable attention on examining the stability and convergence properties of this fractional order Crank-Nicolson method. To validate the effectiveness of the developed method, a comprehensive investigation using a test problem is conducted to assess its accuracy. The study harnesses the power of Python software to perform numerical simulations, demonstrating the efficiency and effectiveness of the proposed scheme. These simulations demonstrate that the numerical method developed effectively provides approximate solutions for the space fractional stochastic diffusion equation, under the influence of additive and multiplicative noise. Furthermore, the results gleaned from surface plots of the numerical solution for the test problem unveil a notable trend: as the intensity of the noise increases, disturbances in the surface of the mean solution escalate, underscoring the impact of noise on the system's behavior. By offering a thorough analysis and validation of the proposed scheme, this research contributes valuable insights to the broader fields of applied mathematics and computational sciences.

A NEW PARAMETRIC FUZZY DIVERGENCE MEASURE AND ITS APPLICATION IN MULTI CRITERIA DECISION MAKING (MCDM)

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Abstract:

The fuzzy divergence measure provides an information-theoretic distance between two fuzzy sets. It has proven effective in a variety of application contexts. This paper's goal is to suggest a fuzzy divergence metric for handling decision-making issues. First, a novel fuzzy divergence is defined and its fundamental and advanced mathematical features are demonstrated. Furthermore, we demonstrate the validity of the developed fuzzy divergence as a fuzzy distance measure. Lastly, an explanation of how to use it in a case study of multi-criteria decision making has been provided to help select the optimal choice. To demonstrate that the suggested function is more rational in the decision-making process than other earlier metrics, an exemplary example has been examined.

Investigation of Heat Transfer and Flow Behaviour of Williamson Fluid in Converging–Diverging Channels of Stretching/Shrinking Surfaces

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Abstract: The Williamson fluid model is a widely used non-Newtonian fluid flow model. This study investigates the heat transfer and flow behaviour of such a fluid in a converging-diverging channel, considering the effects of a stretching or shrinking surface. The fundamental momentum and energy equations are formulated based on the Williamson fluid characteristics and are solved using appropriate boundary conditions. A mathematical model is developed and solved numerically using the bvp4c method, a fourth-order boundary value problem solver in MATLAB software. The effect of various parameters on both the velocity and temperature profiles is then analysed.

The Analysis of the Latest Parametric Divergence Measures

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Abstract: Divergence measures are being utilized in measuring the distance or like among a limited number of likelihood dispersions or probability distributions (both discrete and continuous), so it is always desirable to find a new measure. In this work, some parametric divergence measures have been introduced, these are six in numbers and each of which is having infinite number of elements. Additionally, these measures' qualities and a few relationships with other measures need to be evaluated. For further comprehension, graphic comparison is also performed

Key Characteristics of Functions in the Domain of Multicomplex Variables

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Abstract: In this paper we consider the multicomplex space $\mathbb{C}_n$ which is a special generalisation of bicomplex space $\mathbb{C}_2$. Here we want to establish the multicopmplex version of cauchy's Integral formula for higher order derivatives and Cauchy's Inequality. Also, we derive the multicomplex version of Roche's theorem.

Keywords and phrases: Multicomplex valued space, multicomplex number, idempotent representation.

An EfficientNetB1 and SVM-based hybrid framework for Automated Classification of Breast Histopathology Images

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Abstract:

Background: Accurate and at an early stage diagnosis of any disease is beneficial for better treatment, resulting in enhanced survival rate, specifically for breast cancer it is paramount. Histopathological analysis of tissue slides is the definitive method for diagnosis, but it can be a time-consuming process subject to inter-observer variability. Therefore, the development of robust Computer-Aided Diagnosis (CAD) systems is essential to assist pathologists.

Objective: In this study, our objective is to develop an automated and effective diagnosis system using deep learning for the automated classification of breast tumors as benign or malignant from histopathology images.

Methods: We implemented a powerful two-stage classification pipeline. A pre-trained Convolutional Neural Network (CNN), specifically the EfficientNetB1 architecture, was utilized as a feature extractor to generate high-level, discriminative features from the image data. These deep features were then used to train a Support Vector Machine (SVM) classifier, which performed the final binary classification. The model's performance was rigorously evaluated on a held-out test dataset.

Results: The proposed EfficientNetB1+SVM model demonstrated high efficacy, achieving a classification accuracy of 95.28% on the test data. This result indicates a strong capability to accurately differentiate between benign and malignant tissue samples.

Conclusion: The combination of transfer learning using EfficientNetB1 and a classical machine learning classifier like SVM provides a highly effective and accurate solution for automated breast tumor detection. This hybrid approach shows significant promise for integration into clinical workflows as a reliable CAD tool to support pathologists, potentially improving diagnostic speed and consistency.

Keywords: Breast Tumor Detection, Convolutional Neural Network, Support Vector Machine, EfficientNetB1, Accuracy.

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Response of MHD flow of Blood through a Stenosed Human Artery- A Mathematical Model

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Abstract:

Mathematical models are developed to establish a relationship between mathematics and real- life problems. As blood contains some suspended particles of ferrous and ferric substances so it exhibits magnetic behavior. In this dissertation, a mathematical model is developed to study the physical and rheological behavior of the flow of blood through a constricted human artery. The artery is represented by a long cylinder having constrictions in different locations. The well-known Casson fluid model is accepted to represent non-Newtonian nature of blood. The axisymmetric shape of the growth is characterized by the well-known exponential model. The coupled differential equations governing the MHD (Magnetic-Hydro-Dynamic) flow of blood are solved under appropriate boundary conditions. The expressions explored analytically and graphically reveal considerable alterations in the flow characteristics due to the presence of iron particles in the blood and the shape of stenosis. It gives an opportunity to estimate the qualitative and quantitative effects of various physical and rheological parameters on the blood flow in the artery.

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Voltage Crest Factor Effects on Rapid Start Fluorescent Lamps with HPF

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Abstract: Most lighting professionals have already explored the topic of lamp expectancy for CFL. It is also commonly understood that different factors continually affect the life and performance of CFL. Lamp current crest factor, for instance, is a crucial piece of data in terms of lamp life. For CFLs, the empirically established range of lamp current crest factor should be 1.9 to 2.1. So suggesting a proper heating of the lamp electrodes without causing any damage to them. In the majority of the high power factor (HPF) lamps it was found that the crest factor of the lamp current lies within the stipulated limit. But whatever if the heating of the electrodes is not proper it will lead to sputtering of the coating on the electrode and if it is more than proper evaporation will take place. In both the instances lamp electrodes are susceptible to wear. The lamp starting voltage has been found to be a crucial parameter which controls the necessary and adequate heating of the lamp electrodes. In this paper investigates the influence of high power factor (HPF) circuit on self-ballasted lamp life by considering the lamp voltage crest factor. Experiment conducted on various types of 18W lamps data for lamp voltage crest factor has been gathered. Information about the lamp voltage crest factor and corresponding change in electrode temperature are included in this paper's research. The lamps used in this paper undergo a 5 minute on and 5 minute off cycle. The improved circuit lamps are compared to the other types. Lastly, the preheat voltage of the lamp is considered while regulating the crest factor voltage for the ballast of the lamp employing the IR215X IC. The physical reduction in light life is observed. The data are plotted and analyzed using MATLAB. An empirical relationship was obtained from the curve fitting tool with the set of results obtained. This work is adding to an important component of HPF circuitry by exploring a creative parameter that affects the lifespan of HPFs.

Keywords—High power factor; lamp current; lamp voltage crest factor; lifetime

Radio Labeling of a Zero-divisor Graph and Prime Ideal Graph

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Abstract:

A radio labeling of a graph G is a function $\gamma : V(G) \rightarrow N$ such that $|\gamma(x) - \gamma(y)| \geq 1 + diam(G) - d(x, y)$, for every pair of distinct vertices x, y of G. The radio number of G, denoted by $rn(G)$, is the minimum of $span(\gamma)$ taken over all possible γ, where $span(\gamma) = max\ \{1 + |\gamma(x) - \gamma(y)| : x, y \in V(G)\}$. In this paper, we provide a lower bound for the radio number of the zero-divisor graph of $Z_p\alpha$ and the prime ideal graph of a commutative ring with unity. We also present two necessary and sufficient con- ditions to achieving this lower bound. Furthermore, the exact radio number for these graphs are obtained. The radio number of the zero-divisor graph of $Z_p\alpha$ derived in[10] has some error, which we have rectified.

FALL DETECTION AND PREVENTION USING MEMS SENSOR AND GALVANIC VESTIBULAR STIMULATION

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Abstract: Falls are a top cause of injury among the impairments, typically leading to serious health complications and detection systems only start to work once a fall has occurred. This project develops a proactive, real-time fall detection and prevention technique to prevent risk of injury by identifying and preventing falls before they occur. MEMS(Micro-ElectroMechanical Systems) sensors and force sensor constantly keep track of a user's posture, balance, and force displacement, weight transfer patterns. When it identifies a potential fall, the system engages immediate corrective support to stabilize the user's body. Vestibular Stimulator activated and trigger vestibular nerve in the inner ear which enhance balance more effectively. This dual-action response not only helps body to respond suitably to instability also prevent fall. For improved accelerometer system is linked with a mobile application through the Blynk gets information from sensors and sends it to caregivers or healthcare staffs. In case of a serious situation, alarms, providing prompt intervention. The smart system is designed to provide prevention of falls, providing an allrounded solution that enhances the quality of life for elderly individual.

Some New Results on Prime Antimagic Label- ing

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Abstract: An *prime antimagic labeling* of graph $G = (V(G), E(G))$, a bijection $f: V(G) \rightarrow \{1, 2, 3, ..., |V(G)|\}$ such that every pair of adjacent vertices u and v, gcd $(f(u), f(v)) = 1$ and the induced edge labeling $f(uv) = f(u) + f(v)$ are all distinct. In this paper, we discussed prime antimagic labeling of armed crown, triangular snake, tadpole, coconut tree, double comb and cycle C_n with one chord.

Keywords: Prime graph, Antimagic graph, Prime antimagic graph.

The Line Graph of the Identity Graph of Finite Cyclic Group

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Abstract: The interconnections between groups and graphs is an emerging area of research. One particular instance is the identity graph of a group introduced by Kandasamy. In this paper, we discuss about some graph invariants such as diameter, girth, connectivity, minimum degree, independence number, matching number and covering numbers of the line graph of the identity graph of finite cyclic groups.

ET-ELM: Hybrid Sequential Wrapper-based feature selection for Intrusion Detection on CIC-DDoS2019

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Abstract: As data volume and complexity in networks increase, accurate detec- tion requires optimal feature selection to enhance detection efficiency and reduce computation overhead in security systems. This paper proposes a hybrid wrapper- based sequential feature selection approach that efficiently determines key fea- tures through the integration of the Extra Trees classifier and Extreme Learning Machine (ET-ELM). These best-chosen attributes are then utilized to train ma- chine learning classifiers such as RF Classifier, Linear SVC, Extra Trees Classi- fier (ETC), and Gradient Boosting models in order to identify Distributed Denial- of-Service (DDoS). Furthermore, the dataset is balanced prior to training to in- crease model resilience. When compared to baseline approaches on the CIC- DDoS2019 dataset, the suggested methodology outperforms them in terms of de- tection accuracy. Specifically, with feature selection and a balanced dataset, mod- els such as Extra Trees Classifier attained an accuracy of 99.93%, beating the unoptimized technique and demonstrating the method's usefulness in real-time detection.

Attention is the Key to Explainability: Unveiling the Neural Mechanisms of AI Moral Reasoning

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Abstract: The proliferation of artificial intelligence systems in decision-making contexts necessitates robust mechanisms for detecting ethical complexity in textual content. This dissertation presents a novel, scientifically rigorous framework that leverages transformer attention mechanisms with minimal vocabulary dependency to identify morally complex scenarios in text. Unlike existing approaches that suffer from methodological flaws in cluding data leakage and over-parameterization, our framework employs fixed parameters throughout experimentation, ensuring true generalization measurement. Our approach utilizes only 24 carefully selected keywords across seven ethical categories, grounded in moral foundations theory, combined with structural pattern recognition for ethical dilemmas. The framework demonstrates remarkable consistency, achieving 91.2% accuracy across three diverse transformer ar chitectures: GPT-2 Small (124M parameters), DialoGPT Small (117M parameters), and DistilGPT-2 (82M parameters). Sta tistical analysis reveals highly significant class separation (p ¡ 0.000001) with large effect size (Cohen's d = 1.141), indicating both statistical and practical significance. The framework's architecture-agnostic design incorporates a theoretically-grounded layer selection algorithm that automati cally adapts to models with varying depths while maintaining middle-layer selection principles. Comprehensive evaluation on 34 diverse ethical scenarios spanning medical, legal, business, and technology domains validates the framework's generalizability and robustness. This research makes significant contributions to ethical AI, transformer interpretability, and methodological standards in machine learning evaluation. The demonstrated effectiveness of minimal-vocabulary approaches challenges prevailing assump tions about complexity requirements in ethical reasoning sys tems while establishing new benchmarks for scientific rigor in attention-based AI research.

A Matrix-Based Hybrid Deterministic-Stochastic Inventory Model with Time-Varying Demand and Partial Backordering

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Abstract : This study proposes a novel hybrid deterministic-stochastic inventory model using matrix-based techniques to manage multi-item systems with time-varying demand and partial backordering. Extending previous models based on diagonal matrices, we introduce a time-indexed demand matrix that captures seasonal and trend-driven changes. Stochastic elements, including demand variability and probabilistic lead times, are modelled using distribution-based matrices. Partial backordering is represented through a backorder proportion matrix, allowing for realistic customer service dynamics. The objective is to minimize total expected cost—comprising ordering, holding, and backordering costs—using a simulation-optimized matrix algorithm. A numerical example based on a hospital supply scenario illustrates the applicability and computational advantages of this framework. The results highlight the robustness and scalability of matrix-based hybrid inventory systems under uncertain and dynamic demand conditions.

Simulation of Non-Newtonian two phase fluid flow around lower stagnation point of a solid sphere

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Abstract: This paper deals with a two-phase fluid flow with dust particles near the lower stagnation point of a heated solid sphere. The impact of volume fraction of dust and nanoparticles, viscoelastic parameter, magnetic field and Prandtl number on the flow are studied. The partial differential equations are converted to ordinary differential equations by applying suitable transformation. Then, the non-linear differential equations are solved numerically using MATLAB built-in bvp4c approach. The results for velocity, temperature and concentration of dust and fluid phases are presented graphically for various flow parameters and shear rate, rate of heat transfer and mass transfer present in tabular forms.

Intermittent Behaviour of DC Discharge Plasma in the Presence of Negatively Biased Grid

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Abstract: Intermittency is a hallmark of complex dynamical systems and frequently emerges in nonlinear plasma discharges, especially near bifurcation points and in regimes characterized by Negative Differential Resistance or Double Layer Formation. In such conditions, plasma fluctuations often exhibit a random alternation between regular and chaotic phases, reflecting an underlying interplay between order and instability. This study presents an experimental investigation of intermittent oscillations in a plasma triode system operated in a glow discharge regime, configured with a coaxial mesh cathode, a spherical anode, and a negatively biased intermediate grid. The introduction of the grid facilitates selective confinement of nonthermal electrons, leading to the formation of sheath structures and potential wells that promote burst-like oscillations in the floating potential. A detailed nonlinear analysis of the Hurst exponent and positive Lyapunov exponent estimation (λ) is concurrently used to verify the presence of complexity and the transition of periodicity into chaos. To gain theoretical insight, the experimental results obtained from the plasma triode system designed are compared with the simulations of the forced Van der Pol oscillator - a canonical nonlinear model known for its rich dynamical behavior under external forcing. Numerical solutions reproduce key features of the observed plasma dynamics, including regular-to-burst transitions and phase space structures of regular-chaotic phase durations. This comparison supports the notion that the present plasma triode system functions as a nonlinear, driven-dissipative oscillator. Overall, the study demonstrates a close correspondence between experimental plasma behavior and theoretical models of intermittency in DC discharge plasma. The findings enhance our understanding of nonlinear plasma dynamics and highlight the role of grid-induced control in modulating its complex behavior, which will greatly help in the future design and regulation of discharge plasmas in various applications requiring stability amidst nonlinear transitions.

Graph-Based Learning of Functional Substructures for Molecular Drug Design

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Abstract: The identification and understanding of functional substructures within drug-like molecules are central to modern computational drug discovery. These substructures, such as aromatic rings, hydroxyl groups, and amines, often determine a molecule's pharmacological activity, bioavailability, and toxicity. In this study, we propose a graph-based machine learning framework that aims to automatically detect and learn meaningful chemical substructures without the need for labeled data. Our approach models molecules as graphs, where atoms are represented as nodes and chemical bonds as edges, preserving both the topological and chemical properties of the molecule.cWe employ Graph Neural Networks (GNNs) to capture both local and global interactions within the molecular graph. To enhance learning without requiring extensive annotations, we integrate self-supervised learning techniques that allow the model to distinguish and embed functionally relevant subgraphs by maximizing structural and chemical consistency within the graph. This framework is tested using the publicly available ZINC250K dataset, which contains a diverse range of drug-like compounds. Additionally, we analyze the correlation between the discovered substructures and standard chemical evaluation metrics such as Quantitative Estimate of Drug-likeness (QED) and LogP, demonstrating the model's capability to uncover chemically interpretable patterns. The proposed method has the potential to accelerate early-stage drug design by offering interpretable insights into molecular structure and functionality. Furthermore, it lays the groundwork for future generative models that could construct molecules with targeted substructures or properties, guided by learned embeddings. This research contributes to the intersection of graph learning, cheminformatics, and AI-driven molecular analysis.

Keywords: Computational Drug Discovery, Graph Neural Networks, Functional Groups, Molecular Graphs, Self-Supervised Learning, ZINC Dataset, QED Score, Molecular Property Prediction

Mathematical models and parameters to estimate carrying capacity of a tourist destination

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Abstract: Tourism lies at the very bedrock of human civilization, tourism is no longer a means to merely satiate ones basic needs, as tourism fulfilled needs for water, fodder, food etc. to human being and accompanying pets in the ancient time. Now a days it is being presented as a well crafted product. It has many component viz. transport, hospitality, healthcare, adventurism etc. Nonetheless tourism as a product is quite different when compared to factory outlets. This paper is an attempt to develop a mathematical model and introduces measure of tourism susceptibility χ, and about how tourism as a products is carved out of integrating various services viz. travel, accommodation, fitness, cultural, adventurism, health, ecotourism, pilgrimage sites etc. Through this model stages of growth of tourism and all its integrands could be efficiently and effectively managed and risk could be minimized, and welfare of hosts could be assured. This studies the saturation point i.e. the maximum growth of tourism until physical carrying capacity is being achieved. It estimates that velocity of money, increases as tourism grows provided ample physical infrastructure to support it at destination is easily available. Expression for Seigniorage revenue out of tourism is being established, This model also aims to predict that tourism gain could be realized and sustained through monetary feedback mechanism responsive to coupling effects, and sustainable development of natural environment.

Inflationary Scenario in Bianchi Type VIII Space Time with Bulk Viscosity using Flat Potential in General Relativity

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Abstract:

This paper has been written to study an anisotropic Bianchi Type VIII cosmological model which incorporates a Higgs scalar field with flat effective potential and a bulk viscous fluid. The model is described under the condition that the shear scalar and the scalar expansion are proportional, which leads to the relation $A = B^n$ concerning the scale factors. It is further assumed that V=constant, which results in non-linear differential equations that are solvable. Solutions of the model are presented in terms of a scalar field and metric functions. Other important parameters, such as scalar expansion, shear scalar, Hubble parameter, volume, and deceleration parameter, have been computed and have been shown to result in accelerated expansion in contrast with the inflationary behaviour of the universe during early times.

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Analytical Solution of the Fractional-Order T. Regge Problem Using the Shehu Transform Method

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Abstract: This study introduces an analytical solution to the fractional-order T. Regge problem using the Shehu transformation method a relatively new integral transform developed for solving fractional differential equations (FDEs). The T. Regge problem, commonly encountered in quantum mechanics and mathematical physics, becomes more complex when extended to fractional orders due to the presence of memory effects and nonlocal behaviours. By applying the Shehu transform, the original fractional differential equation is systematically converted into a simpler algebraic equation in the transform domain, facilitating an efficient solution process. The paper derives the necessary transformation properties for fractional derivatives and integrals and applies them to the fractional T. Regge model. Several examples are provided to demonstrate the accuracy, applicability, and computational advantages of the method. The results confirm that the Shehu transformation offers a powerful alternative for solving a wide range of fractional-order problems, contributing meaningfully to the field of fractional calculus and its applications in science and engineering.

Keywords: Shehu Transformation; Fractional-Order T. Regge Problem; Fractional Differential Equations; Fractional Derivatives; Analytical Solution Methods.

Artificial Intelligence Revolutionizes the Financial Markets

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Abstract: The paper deliberates on how Artificial Intelligence (AI) revolutionizes the financial markets through algorithmic trading, risk management, fraud detection, and sentiment analysis discussions. Machine learning, NLP, and predictive analytics are some AI technologies that have changed the way markets work in ways characterized by increased efficiency, precision, and automation. This study, through a qualitative review of relevant academic literature, industry reports, and case studies, underlines how AI enhances decision-making and helps optimize market performance. The paper goes on to explain that AI Sentiment Analysis could estimate the market sentiment out of unstructured data, yet the complexity of human language is a limiting factor. The conclusion derived is that in the same way, AI is realigning the financial markets, ensuring maximum potential in addressing issues of transparency, regulatory compliance, and mitigation of risks would be very important.

Impact of Global Marketing Cost on the Sale of Amazon: Using Linear Regression

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Abstract: This research paper aims to explore and measure the relationship between the marketing cost on sales of Amazon worldwide. Growing Amazon's global footprint raises the importance of understanding the relationship between marketing expenditures versus overall sales. In pursuing this goal, a simple regression analysis was executed using data of Amazon company from 2010 to 2023. This analysis was evidenced by the use of STATA. The data used in this study came from secondary sources. Specifically, the findings suggest that increased investment in marketing activities leads to higher revenue generation, thereby validating the importance of strategic marketing expenditures. This study offers critical insights that can inform Amazon strategic decisions, particularly regarding budget allocations for marketing. Moreover, the findings benefit current and future investors, policymakers, and competitive brands looking to understand the dynamics of global marketing impacts. This research is unique in its comprehensive global focus, contrasting with prior studies that primarily explored the relationship between marketing costs and sales within specific regions or markets. By examining this relationship worldwide, this study provides a more holistic understanding of how marketing efforts contribute to sales growth in diverse markets worldwide.

Solution of Fractional Lotka-Volterra System Using Laplace Adomian Decomposition Method

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Abstract:

The Lotka–Volterra system has long served as a foundation for studying predator–prey dynamics in ecological systems, significantly advancing the understanding of population interactions. In this work, we study the fractional-order Lotka–Volterra system by employing the Caputo-type fractional derivative to incorporate memory effects, enabling past states to influence present population behavior. The system is solved using the Laplace Adomian Decomposition Method (LADM). Predator and prey population trajectories are analyzed over various time intervals and fractional orders, and, in selected cases, absolute error comparisons between approximate and exact solutions demonstrate the high accuracy and computational efficiency of LADM.

Night-time Screen Use and Academic Performance: A Structural Equation Model of Sleep Quality Mediation among College Students

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Abstract: In recent times, with how fast the academic environment is getting digitalized, it is becoming very important to comprehend the impact of screen usage on academic outcomes of students. Our study analyses the relationship among screen usage before sleep, sleep quality, and academic outcomes within a college student population. By utilizing the analytical framework of Structural Equation Modelling (SEM), we develop a data-driven behavioral model that explores both direct and indirect impact of increased digital usage on academic performance, with sleep quality as a mediating factor. The results indicate that increased level of screen usage prior to bedtime significantly impairs sleep quality, that in turn, negatively impacts academic functioning of college students. These findings emphasize the critical need to encourage responsible digital habits and healthier sleep routines among students in order to improve their academic performance and overall wellbeing.

Effect of Magnetic Field and Slip Velocity on Blood Flow through Stenosed Human Artery- A Mathematical Model

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Abstract:

A Mathematical model for blood flow in a stenosed human artery is developed. The artery is modelled as a long cylindrical tube of small radius while the blood flow is characterized by a Casson fluid model and axisymmetric nature of the growth (stenosis) manifested within the artery is represented by the exponential model. As blood contains suspended iron particles exhibiting magnetic property so the flow is subjected to magnetic intensity and magnetic intensity (H) is incorporated. The coupled differential equation governing MHD (Magnetic Hydrodynamic) flow are solved with appropriate boundary conditions. The no slip condition (discontinuity of blood velocity at the side of the blood vessel tube) is taken into consideration in this investigation. The theoretical analysis provides some interesting results on blood flow having importance in the rheological investigation. Appropriate initial and boundary conditions are associated with the model so that the system generates a mathematical model. It is sincerely believed that the theoretical investigation will throw light on the latest developments in physiology and rheology.

Impact of using stored treated municipal for irrigation on the microbial quality and safety of vegetable crops

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Abstract:

Water being the basic necessity of life for every creature, in the absence of pure water, a healthy and long life on the earth is not possible. It boots energy and gives important nutrients to the body; therefore, it having an important role in keep the population alive. The wastewater from the Razi petrochemical complex contains high levels of salts and heavy metals. In the present research, the effects of different wastewater dilution levels (0, 25%, 50%, and 100%) were studied on two wheat cultivars—Chamran and Behrang. The wastewater contained high levels of NH_4^+, NO_3^-, PO_4^{3-}, and SO_4^{2-}, and Mg, Ca, K, Na, Cu, Zn, Fe, M, and Ni. The toxic levels of mineral elements in the wastewater resulted in a significant decline in the K, P, Si, and Zn content of leaves. Irrigation with the wastewater resulted in a significant reduction in photosynthetic characteristics, including chlorophyll fluorescence (Fv/Fm and PIABS), intercellular CO_2, net photosynthesis, water use efficiency, and photosynthetic pigments. The reduction in photosynthesis was followed by a significant decrease in the carbohydrate content and, subsequently, plant height, leaf area, and grain yield. Increasing the wastewater concentration reduced leaf thickness and root diameter, accounting for the decrease in xylem and phloem vessels, the root cortical parenchyma, and mesophyll thickness. The bulliform cell size increased under wastewater treatment, which may suggest induction of a defense system against water loss through leaf rolling. Based on the observed negative effect of wastewater on the physiology, morphology, anatomy, and yield of two wheat cultivars, reusing wastewater with high levels of total suspended solids and salts for irrigation cannot be approved for wheat crops.

Aspects of Grindstone Chemistry on some Unusual Reactions

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Abstract:

Multicomponent reactions (MCRs) represent an effective way for the synthesis of widespread range of various heterocyclic compounds by one-pot process. The reaction proceeds efficiently under mechanochemcial conditions with no extra solvents, demonstrating sustainable simple procedure and green chemistry principles. Literatures revealed that the grinding technique mounting attention due to its ability to promptly and competently stimulate reactions between solid state materials. This review article highlights the role of mechanochemcial techniques for the synthesis of heterocycles on less known single-pot reactions of the last 20 years. This overview provides a concise yet comprehensive introduction to mechanochemcial synthesis emphasizing the prospects and challenges facing its adoption as a mainstream synthetic methodology.

Effect of Memory on Resonances in Van der Pol-Duffing System

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Abstract:

The analysis of the phenomenon of resonances in nonlinear dynamical systems are of central importance for their practical applications. In the present work, we have considered a well known nonlinear system, the Van der Pol-Duffing system, driven simultaneously by two frequency excitation. To analyze the memory effects of the resonance, a fractional order damping terms is added to the fundamental equation. The approximate analytical so- lution of such a system is obtained by using the standard multiple time scale method. The effect of memory on the frequency response have been studied, for different values of system parameters as well as excitation parameters, with obtained steady state phase-frequency and amplitude-frequency equa- tions.

Distinguishing Features of Complexity in Van der Pol Oscillator and Fractional Van der Pol Oscillator

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Abstract: Numerical simulation of both ordinary and fractional Van der Pol oscillator has been carried out to resolve the dynamical complexity issue of (1) Van der Pol oscillator and (2) its fractional counterpart which involves the memory effect. Application of phase portrait, bifurcation diagram and Poincare sections have been extensively used to find the distinguishing features of the dynamical complexity in these oscillators. In view of recent interest in such system viz. physics, computer science, electronics, economics, bio-sciences etc., particularly when the ordinary damping is replaced by its fractional counterpart, the present investigation becomes important, also from engineering perspective, as the characteristic features with regard to their dynamical complexity differs considerably as the control parameter values of the respective system varies. The response of the system depends on the control parameters of such systems with and without memory and provide a framework for the transitions between regular, quasi-periodic, chaotic dynamics etc. The study further provide necessary input/ basis required to understand the complex dynamics of systems with memory.

FRACTIONAL CALCULUS FOR THE NEW GENERALIZED WRIGHT HYPERGEOMETRIC FUNCTION

BHARTI CHAUHAN, RUPAKSHI MISHRA PANDEY, AND PRAKRITI RAI

Abstract: By means of extended beta function ${}^{\varphi}B^{(\gamma,\delta)}$, we introduced new extensions of generalized hypergeometric functions and discussed about image formulas using properties of the fractional calculus integral operators. Furthermore, using integral transforms some image formulas are also established.

A Fuzzy Logic-Based Recommendation System for Personalized Fashion E-Commerce

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Abstract: Online purchasing has rapidly expanded in the apparel industry, creating a complex and dynamic environment of consumer trends, preferences, and shopping habits. Demand forecasting, inventory management, and customized client engagement are all inefficient since traditional control systems are often unable to adapt to these changes in real-time. This study proposes a fuzzy logic-based recommendation system that enables decision-making in order to get around these issues. The system simulates the ambiguities and uncertainties that accompany online shopping using fuzzy logic. These include changing consumer preferences including age, purchase capacity, review ratings, discount, and payment method. An essential part of the suggested fuzzy system is recommendation systems.The complexity of the online retail environment in the clothing industry may be managed with the help of fuzzy logic, as this study shows. A total of 243 fuzzy rules are designed to interpret these inputs and produce accurate recommendations, with the defuzzification process primarily using the centroid method. The dynamic behavior of the fuzzy output is visualized in a rule viewer, demonstrating how the recommendation output shifts with changes in input. Surface viewer graphs further illustrate the interactions between different input variables and their influence on the recommendation output. These visualizations provide deeper insight into how fuzzy logic accommodates input variability and consumer diversity.

Inflationary Dynamics in Bianchi Type V Models: Mathematical Insights and Cosmological Implications

SUJIT KUMAR MAHTO

Abstract: This study investigates the inflationary dynamics within the framework of Bianchi Type V cosmological models, emphasizing the critical role of anisotropies in the early universe. By leveraging Einstein field equations and incorporating inflationary potentials, this research explores the isotropization process and its implications for cosmological evolution. A combination of numerical simulations and analytical approaches is employed to solve coupled differential equations governing the scale factors and anisotropic parameters. High-quality 3D graphs and comparative tables are utilized to illustrate the decay of anisotropic stress, the evolution of energy density, and the impact of varying inflationary potentials. The findings reveal an exponential decay of anisotropies during inflation, supporting isotropization theories and aligning with recent observational data. These results enhance the understanding of inflationary mechanisms in anisotropic cosmology and provide a robust foundation for addressing challenges in early universe dynamics. Future research directions include the integration of quantum gravitational effects into Bianchi models to further unravel the complexities of the universe's evolution.

Certain results involving Multivariable class of functions associated with extended Hurwitz Lerch Zeta Function

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Abstract: In this paper, some integral representation and generating relations for multivariable class of functions are established. This Class of function involves multivariable extended Hurwitz Lerch Zeta function and multivariable Mittag Leffleer function.So from the results for this multivariable class of functions can also be determined for the extended Hurwitz Lerch Zeta function and it's simpler function.

Behavioral Drift Based Approach for Fraud Detection using Dual Convex Information Measure

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Abstract: Financial fraud detection basically relies on anomalous shifts in user spending patterns. Classical information measures have their limitations in terms of sensitivity and tunability while handling asymmetric behavioral shifts effectively. This paper effectively captures the uncertainty and deviations using a novel dual convex information measure (DCIM) with different versions of information functional. The reliability and existence of the measure is discussed using various properties of information measures. The proposed measure generalizes existing divergences as special cases and offers tunable sensitivity through parameterization, making it suitable for detecting both sudden anomalies and gradual behavioral shifts. The DCIM outperforms the conventional methods of anomaly detection in real world financial fraud problems.

Electroosmotic Flow in Rectangular Microchannels with Asymmetric Wall Zeta Potentials: Numerical Investigation Using Spectral Methods

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Abstract:

This work investigates the two-dimensional electroosmotic flow of a Newtonian fluid in a rectangular microchannel with asymmetric zeta potentials at the walls. The nonlinear Poisson–Boltzmann equation governing the electric potential distribution is solved numerically, and the resulting flow field is obtained using the Chebyshev spectral collocation method. Parametric analysis reveals that increasing the aspect ratio and the inverse Debye length leads to a more uniform velocity distribution and enhanced volumetric flow rate. Flow reversal is observed when the zeta potential asymmetry becomes significant, and the flow direction aligns with the sign of the Helmholtz–Smoluchowski velocity. These findings provide valuable insights for the optimal design of electroosmotic pumps and microfluidic devices operating under varying electrokinetic conditions.

Green Two-Warehouse Inventory Model with Deterioration, Multivariate Demand, and Trade Credit Policy

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Abstract: This paper presents a sustainable two-warehouse inventory model for deteriorating items considering multivariate demand and an allowable trade credit policy. The retailer employs both a primary (owned) warehouse and a secondary (rented) warehouse to handle capacity constraints and reduce the risk of shortages. Demand is characterized as a function of several determinants, including selling price, advertising efforts, and product freshness, capturing realistic market conditions. To mitigate losses from deterioration, discounting policies are applied to stimulate earlier customer purchases and support sustainability objectives. In addition, the supplier provides a fixed trade credit period, influencing the retailer's financial planning and replenishment schedule. The model seeks to identify the optimal replenishment interval, order size, warehouse utilization, and credit period that collectively minimize total inventory-related costs while encouraging eco-friendly practices. Numerical examples and sensitivity analyses validate the model's effectiveness and offer practical insights for sustainable decision-making in inventory management.

A Unified Framework for Fractional Derivatives of the Generalized Mittag–Leffler Function

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Abstract: This work explores a generalized approach for studying fractional derivatives of the four-parameter Mittag–Leffler (4P-ML) function under a variety of non-singular fractional operators. A unified representation is introduced, allowing different operators to be expressed within a common framework. The formulation highlights structural similarities as well as distinctions among the operators and provides a systematic basis for further analytical and computational investigations. Illustrative results demonstrate the versatility of the approach and indicate its potential applications in fractional models appearing in science and engineering.

Prospects and challenges of Molecular Dynamic Simulations for Advanced Materials

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Abstract:

Here we present a critical overview of computational molecular dynamic simulation (MDS) of deformation and fracture in advanced materials (AM) e.g., metals, metal based nanocomposites, polymers and polymer based nanocomposites. Failure of such materials imposes a global annual cost of about 300-500 Billion US dollars. Hence, the maximum importance is given to research on deformation science simply because the deformation at nano to sub nano scale evolve into full scale failure of structures, as a function of load, loading history, time, rate of loading etc. In this context the only plausible theoretical approach is computational molecular dynamic simulation (MDS) which can track the real-time motion of individual atoms by solving the classical equations of motion using appropriate interatomic potentials functions, thereby enabling visualization of atomic-scale deformation processes that occur during nano-indentation with sub-angstrom spatial precision. MDS is shown to capture dislocation nucleation and propagation in crystalline systems, shear transformation zone (STZ) activation in amorphous phases, and interface-controlled failure mechanisms. For instance, MDS of nanoindentation in Cu64Zr36 has been used to demonstrate the effects of pre-stress on mechanical performance, as well as the nucleation and spreading of shear band. Further, in Nickel-Graphene nanocomposite, MDS revealed how nacre-like architectures prevent catastrophic failure through layer-by-layer deformation. MDS is also utilized to study nanoindentations of PLA polymers as well as PLA-Graphene nanocomposites; wherein, the horizontal orientation provides much higher resistance than vertical orientation of graphene reinforcement. *Finally, this critical overview will not only illustrate the state-of-the-art knowledge base, but also the research gaps in MDS of the micro/nano/sub-nano scale mechanical behaviour of (AM). Further, the directions in which research needs to be undertaken for the futuristic applications for advanced materials will be hinted at. To the best of our knowledge, this work is the very first attempt to provide such a critical overview. (292 words)*

An efficient analytical technique for solving Kaup-Kupershmidt equations of fractional order

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Abstract: In this article, we find the analytical approximate solutions of the non-linear time-fractional Kaup-Kupershmidt equations via Sumudu transform within the Caputo fractional derivative. The obtained solutions are in series form. To demonstrate the accuracy of the method solutions are shown graphically, and graphical comparison of the approximate and exact solutions shows a strong relationship between them.

Influence of Anisotropic Permeability on Brinkman–Darcy Flow through Curved Channels

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Abstract:

The study of fluid flow through curved channels embedded with porous materials plays a crucial role in improving the performance of systems encountered in industrial processes, biomedical devices, and environmental engineering. This work focuses on the steady, laminar flow of an incompressible fluid through a curved, impermeable channel filled with a porous medium exhibiting anisotropic permeability. The mathematical formulation is based on the Brinkman-extended Darcy model, which accounts for both Darcy resistance and viscous shear through the inclusion of a Brinkman drag term. A constant azimuthal pressure gradient is applied to induce the flow. The influence of anisotropy is modeled through a permeability tensor, yielding a symmetric positive semi-definite form in the momentum equations. Numerical solutions are obtained using the Spectral Quasilinearization Method (SQLM), which efficiently captures the impact of curvature and anisotropic resistance on the flow behavior. Results demonstrate that both channel curvature and directional permeability significantly affect the velocity distribution and pressure development. These observations are expected to assist in the design of porous flow systems in biomedical and microfluidic applications where controlled flow patterns are essential.

BIANCHI TYPE VIII BULK VISCOUS COSMOLOGICAL MODEL WITH BAROTROPIC EQUATION OF STATE AND DARK ENERGY

Abstract: Bianchi type VIII bulk viscous cosmological model with barotropic equation of state and dark energy is investigated. To achieve a deterministic solution, we have assumed that the coefficient of shear viscosity (σ) is proportional to expansion (θ), which leads to $A = B^n$, where A and B are metric potentials. Also coefficient of bulk viscosity ξ is assumed proportional to expansion, i.e. $\xi\theta = K$, where K is constant. Barotropic fluid equation $p = \gamma\rho$, where γ is a constant known as the barotropic index, p is pressure and ρ is energy density, is taken into consideration to determine cosmological constant (Λ). The behavior of the model from physical and geometrical aspects is discussed in detail.

A NOTE ON KATUGAMPOLA ELZAKI TRANSFORM

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Abstract : This work presents a new extension of the classical Elzaki Transform, referred to as the Katugampola Elzaki Transform. This formulation is based on the Katugampola fractional derivative, which preserves several key properties of classical derivatives. We explore essential properties of the proposed transform and also establish its relationship with the conventional Elzaki Transform.

Keywords : Katugampola derivative; Katugampola Elzaki transform

ON GENERALIZED q-SERIES AND SPLIT $(n + t)$-COLOR PARTITIONS

M. GOYAL

Abstract: In this paper, we study three generalized q-series combina- torially using split $(n + t)$-color partitions as a combinatorial tool. This work provides a generalized approach to unify the several combinatorial identities found in the literature. In this process, we obtain several new Rogers-Ramanujan-MacMahon type partition identities.

An Iterative Hybrid Procedure Based on Shehu Transform for Analysis of Space-Time Fractional Cahn-Hilliard Equation

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Abstract:

The Shehu homotopy transform method is applied to examine the space- time fractional phase separation Cahn-Hilliard model in the Caputo sense. The Shehu transform is used to resolve the time fractional operator, while homotopy perturbation method is employed to decompose the non-linear term. Results obtained through the Shehu homotopy perturbation method have been compared with existing schemes in the literature for specific cases. For time fractional equations, fractional homotopy trans- form method needs to determine the time fractional derivative for each successive component of the series solution. This constrains the applica- tion of fractional homotopy transform method for time fractional equations. The Shehu transform with homotopy transform method is an admirable attempt to get over the limitations of fractional homotopy transform method.

Squeezing flow analysis of micropolar fluid between parallel plates: A spectral approach

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Abstract: This study investigates the unsteady squeezing flow of a micropolar fluid between two symmetrically approaching or receding parallel plates. A similarity transformation is applied to the full Navier-Stokes and microrotation equations, along with the energy equation, to reduce the governing partial differential equations into a set of nonlinear ordinary differential equations. The quasi-linearization technique is employed to linearize these equations, which are then solved numerically using a spectral collocation method implemented in an in-house MATLAB code. The thermal behavior of the fluid is examined alongside the velocity and microrotation profiles, accounting for the influence of the micropolar parameters and thermal conductivity. The total resistance (or load capacity) acting on the upper plate due to the squeeze motion is evaluated, and the effects of key physical parameters such as the coupling number, spin-gradient viscosity, Prandtl number, and squeeze number are illustrated through comprehensive graphical representations. This study highlights the combined impact of microstructural and thermal effects on squeeze flow behavior.

LOGISTIC MODEL FOR HIV TRANSMISSION AND CONTROL IN MANIPUR

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Abstract: The logistic growth model is a mathematical model used to describe the growth of a population within limited resources or carrying capacity. This study employs a logistic model to analyze the transmission dynamics of HIV and the impact of control measures in Manipur, India, using the three-point method to estimate key epidemiological parameters. The model is formulated as $y_t = \frac{k}{1+b\exp(-at)}$, where y_t represents cumulative HIV cases at time t, k is the carrying capacity, a is the intrinsic growth rate, and b is the constant related to the initial conditions. Surveillance data of HIV cases from 1990 to 2024 were utilized to the logistic curve by selecting three equally spaced points corresponding to early, middle, and late phases to solve for k, a, and b, enabling predictions about future trends and potential impact of intervention strategies. The logistic fit shows the epidemic's progression phases of rapid growth, deceleration and stabilization. The model underscored the effectiveness of control measures, expanded testing, antiretroviral therapy programs, and targeted prevention campaigns taken up by Manipur State AIDS Control Society (MACS) and other Government/voluntary organizations in Manipur, which is correlated with the observed declines in new cases.

Keywords: Logistic growth model, transmission, three-point method, epidemiological parameters, surveillance data.

A Scheme For Gravitational Wave Detection With Modified Space-Hypertelescope

Rijuparna Chakraborty

Abstract:

Context: Hypertelescope is a promising astronomical multi-aperture telescope that can render very high resolution direct images of deep sky objects. A space version of this system can easily provide 0.1 microarcsecond resolution in visible wavelength range. *Aim*: To study the feasibility of using Space-based-Hypertelescope as Gravitational Wave detector. *Method*: The study was carried out by calculating the responsivities of the system along with its sensitivities over a broad frequency range. For sensitivity calculation we relied upon the available data of noise power spectral densities of other space-based systems. *Results*: It came out that some modification in the structure is necessary in order to reduce the radiation pressure noise on the mirrors as well as its spring constant. A detector with super-resolution capacity will be preferable for the suggested configuration. *Conclusion*: We present a modified Space-Hypertelescope system that can work as gravitational wave detector for frequencies more than Hz.

SOME APPLICATIONS OF FRACTIONAL CALCULUS OPERATORS CONNECTED WITH MITTAG-LEFFLER FUNCTIONS

Dinesh Kumar

Abstract: This study establishes novel connections between fractional calculus and Mittag-Leffler functions, emphasizing their significance in mathematical modeling and real-world applications. We investigate the fundamental properties and extensions of Mittag-Leffler functions, particularly in the framework of fractional differential equations. These functions provide a powerful mechanism for analyzing complex dynamical systems, effectively capturing memory effects and anomalous diffusion. Our findings contribute to the ongoing development of fractional calculus as a powerful tool for solving problems in applied mathematics and theoretical physics, paving the way for further advancements in these fields. Also discuss the significance and various applications of Mittag-Leffler functions, highlighting the potential of our results in simplifying the analysis of certain types of experimental data.

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An Empirical Comparison of Ensemble Learning Techniques in Healthcare Applications

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Abstract:

This study compares three popular machine learning models LogiBoost, Bagging and AdaBoost to find the best method for disease prediction. The researchers used a medical dataset of 17,985 records. They cleaned the data by removing duplicates and randomizing the records. The dataset was then split: 70% for training the models and 30% for testing. Each model was evaluated using accuracy, recall, F1-score and ROC (Receiver Operating Characteristic) -AUC (Area Under the Curve) on training data, test data and through 10-fold cross-validation. Bagging performed the best, achieving the highest accuracy of 77.40% on the test set. It also scored highest in recall, F1-score and ROC-AUC. This means Bagging was effective at correctly identifying disease cases and minimizing false alarms. However, its training accuracy was noticeably higher than its test accuracy, indicating slight overfitting. LogiBoost and AdaBoost showed similar results but slightly lower performance on the test data. LogiBoost performed slightly better than Bagging during cross-validation, suggesting it might be more stable across different datasets. AdaBoost had the lowest recall, missing more actual disease cases compared to the other models. Overall Bagging was found to be the most suitable model for real-world medical applications, where missing a diagnosis can be risky. Despite minor overfitting, its strong performance on test data makes it reliable for disease prediction.

Simulation and Analytical Study of Chromosome Organization in Vibrio cholerae: A Random Walk Polymer Physics Approach

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Abstract:

Understanding the spatial organization of chromosomes within bacterial cells is imperative for elucidating the fundamental physical mechanisms that govern DNA replication, segregation, and gene regulation. In this investigation, we examine the dynamics of chromosome positioning and confinement in Vibrio cholerae, by employing stochastic polymer simulations with analytical solutions based on random walk polymer physics. Our methodology conceptualizes the confined chromosome as a tethered random walk polymer, influenced by the geometric constraints and boundary conditions of the cellular environment. We utilize both Monte Carlo rejection sampling and direct inversion sampling from the analytical end-point distribution P(x;N), to obtain position distributions corresponding to various polymer contour lengths.

Our simulation and analytical outcomes, validated across polymer contour lengths Na=0.5, 2, and 10 μm, respectively, demonstrate quantitative concordance (reduced chi-squared <0.02) and effectively replicate characteristic non-Gaussian position distributions observed via fluorescence in situ hybridization (FISH). Particularly, our framework accurately captures the transition from unconfined (Gaussian) distributions to strongly confined (skewed or plateau-like) distributions as a function of polymer length and the extent of confinement. Direct cumulative distribution function (CDF) inversion sampling has proven to be both efficient, thereby mitigating computational inefficiencies associated with strong confinement in conventional rejection sampling methodologies.

Our results indicate that, even in the presence of significant crowding and confinement, random walk polymer models can reliably forecast chromosome spatial distributions in bacterial systems. The methodologies developed herein establish a robust and extensible computational framework for investigating chromosome positioning and territory formation

Some Inaccuracy Fuzzy Measure for Noiseless Coding Theorems and Best 1:1 Codes

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Abstract:

Coding theory plays a significant role in in data transmission, error detection and correction techniques. It provides data representation in more efficient and reliable form. Incorporating the concepts of coding information theory with the fuzzy measures gives us some important measures that reduces uncertainty and give precise results. This work focuses mainly on noiseless coding theorem and fuzzy inaccuracy measures. Established some inequalities for fuzzy code length based on the general statement of Shannon's source coding theorems. Further, obtained some bounds for fuzzy code length for optimal (1:1) codes. The approach discussed here, proves to be reliable and efficient in noisy environments, support flexible code design and leads to more intelligent communication systems.

Advanced numerical techniques for solving groundwater flow equations

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Abstract:

The paper explores advanced numerical methods to solve groundwater flow equations, with a particular emphasis on the variational iteration method. Groundwater flow modeling is crucial for understanding and managing water resources, but the complex nature of these systems often leads to equations that are challenging to solve analytically. We demonstrate the application of the variational iteration method to a specific groundwater flow equation, comparing its performance and accuracy to traditional numerical methods. Our results show that the variational iteration method offers significant advantages in terms of computational efficiency and solution accuracy, particularly for non linear groundwater flow problems. This study helps to develop the growing field of research on innovative numerical methods in hydrogeology and provides information on the potential of the variational iteration method for broader applications in environmental modeling.

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Gesture Controlled Virtual Mouse

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Abstract: This thesis explores the technique of sensor fusion as a solution to the challenges of optimizing decision-making within multi-sensor environments. Recent advancements in sensor fusion have shown promise in enhancing intrusion detection capabilities, particularly for identifying rare and previously unseen attacks. The study provides an in-depth analysis of this premise through both theoretical exploration and experimental validation.

An initial model is developed to represent the relationship between attacks and detection mechanisms, which is then validated to better understand the detection context. Various performance metrics commonly used to evaluate intrusion detection systems (IDS) are introduced, and the relevance and effectiveness of the dataset employed for experimental purposes are demonstrated.

The research further examines the limitations of current IDS approaches, emphasizing the necessity of integrating multiple detectors and fusing their outputs. Sensor fusion is shown to offer significant benefits in terms of reliability, completeness, and the production of coherent and interpretable outcomes.

The core aim of this work is to investigate how data from diverse IDS sources can be effectively combined to enhance detection accuracy and minimize false alarm rates. Ultimately, the thesis seeks to establish both a theoretical and practical framework for improving IDS performance through sensor fusion, leveraging readily available detection systems. To support this, the study also introduces the mathematical foundations of sensor fusion, reinforcing its potential as a viable enhancement strategy for intrusion detection systems.

Ionic Transport in Glasses: From Structural Disorder to Solid-State Energy Devices

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Abstract:

Ion-conducting glasses have emerged as a versatile class of materials owing to their structural flexibility, wide compositional tunability, and ability to host highly mobile ions. Their inherent structural disorder provides large free volumes and a wide distribution of hopping sites, enabling efficient ionic transport compared to crystalline counterparts. Such properties make these materials highly relevant for applications in solid-state batteries, fuel cells, electrochemical sensors, and next-generation energy storage devices. This review highlights the fundamental aspects of ionic conductivity in glasses, including structural origins, conduction mechanisms, and the influence of mixed alkali and mixed glass former effects. Special emphasis is given to silver-ion conducting glasses, which have demonstrated fast ion transport and strong correlations between local structure and dielectric response. Various experimental techniques used to probe ionic conduction, such as impedance spectroscopy and temperature-dependent conductivity measurements, are discussed in detail. Recent advances in glass–ceramic composites, glass–polymer hybrids, and nanostructured electrolytes are also summarized. Finally, challenges and future research directions are outlined, with a focus on composition design, nanoscale engineering, and device integration strategies. Overall, ion-conducting glasses hold significant promise as next-generation solid electrolytes combining high ionic conductivity, stability, and scalability.

Investigating the use of special functions in solving Fractional Differential Equations

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Abstract:

Fractional differential equations are generalized forms of classical differential equations that incorporate non-locality and memory effects. They can be derived in both space and time using power-law kernels, which account for hereditary and memory-dependent behaviours of various substances and processes. As powerful mathematical tools, fractional differential equations provide a rigorous framework for modelling complex dynamical systems where traditional approaches are insufficient. Their well-established physical foundation has opened avenues for new scientific investigations, including theoretical analysis, numerical methods, and applications across diverse fields such as physics, engineering, and applied mathematics

The use of special functions has recently expanded to include the solution of stochastic, integro-differential, and fractional differential equations that arise in the mathematical modelling of real-world problems in science and engineering. These functions are particularly valuable in solving partial differential equations, where variable separation often reduces them to systems of ordinary differential equations. Among the most widely used special functions are hypergeometric functions, Hermite polynomials, Zeta functions, Bessel functions, Legendre polynomials, Laguerre polynomials, and Chebyshev polynomials. The theory of orthogonal polynomials plays a central role in obtaining precise and accurate solutions to differential equations. Their orthogonality with respect to specific weight functions and parameter choices is essential for investigating accuracy, stability, and approximate solutions to time-dependent PDEs.

Some Properties on New Form of Hurwitz Lerch Zeta function

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Abstract:

In this paper, we define the function Φ_(δ,ς;γ)^(α,β) (ξ,s; z) which is a combination of Mittag-Leffler and Hurwitz Lerch Zeta function and obtain its properties including analytic properties (like type and order),contiguous relations also several classical features are obtained, such as a differential formula, different integral representations,.We further consider an application to probability distributions and also point out some important special cases of the main results.

Keywords: Hurwitz-Lerch Zeta function, Mittag-Leffler function, Probability density function, Entire function

Unsteady MHD Squeezing Flow of Nanofluid Between parallel plates with Chemical Reaction, Viscous Dissipation and Joule Heating

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Abstract:

This research investigates the unsteady magnetohydrodynamic (MHD) squeezing flow of a viscous incompressible nanofluid confined between two parallel plates, influenced by an inclined magnetic field. The flow is driven by the motion of the lower plate translating in its own plane, while the upper plate moves perpendicularly. Key physical effects such as Brownian motion, thermophoresis, viscous dissipation, Joule heating, and a first-order chemical reaction are incorporated to capture the complex heat and mass transfer characteristics. Suction/injection at the lower plate is also considered to enhance control over the flow. The governing partial differential equations are reduced to a set of coupled, nonlinear ordinary differential equations through similarity transformations. These equations are then numerically solved using the robust *bvp4c* method, known for its accuracy in handling boundary value problems. Validation is achieved through comparison with existing literature. The study presents comprehensive parametric analyses of velocity, temperature, and concentration profiles through their graphical representations under varying parameter conditions. Furthermore, detailed analyses of skin friction, Nusselt number, and Sherwood number are provided at both plates to offer deeper insights into the physical phenomena, with potential implications for applications in microfluidic systems, cooling technologies, and industrial fluid processes.

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A Comprehensive Study of Computational Techniques for Structural Optimization

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Abstract:

The abstract highlights the significance of structural optimization in the field of civil engineering. Structural optimization is a methodological approach to structural design that aims to maximize and minimize specific variables in order to reduce material consumption while maintaining structure performance. Structural optimization influences architectural aesthetics through cross-section sizing and structural member arrangement. This is a modern, cost-effective technique that uses less material and increases strength. In this study, several structural optimization strategies have been incorporated. Optimization algorithms are defined as mathematical methodologies employed to ascertain the most effective solution to a given problem, frequently involving the maximization or minimization of a designated objective function. In this paper, a comprehensive overview of each algorithmic category related to structural challenges is presented alongside a diverse literature review. This review paper examines techniques such as size, shape, and topology optimization, as well as multi-objective optimization, to better understand the underlying challenges. Metaheuristics, genetic algorithms, particle swarm optimization, ant colony optimization, and harmony search algorithms are presented in depth, along with examples of how they are applied to different kinds of structures. Genetic algorithms (GAs) are reliable tools for structural design optimization that are especially effective at navigating multimodal, complex, and nonlinear design environments. This paper functions as a scholarly resource to comprehend the recent investigations conducted in this field and also delineates prospective avenues for future research in structural optimization, providing an in-depth analysis of optimization objectives, methodologies, and techniques relevant to applications in civil engineering.

Keywords—Structural Optimization, Genetic Algorithm, Particle Swarm Algorithm, Topology Optimization

A Radiative Jeffrey Tetra Hybrid Nanofluid Flow over an Angled Stretched Cylinder using the Cattaneo–Christov Heat Flux Theory

Abstract:

Determining the wire coating and coper thinning quality requires an understanding of heat, mass, and fluid flow across a stretching cylinder. This study looks the influence of the thermal radiation of Jeffrey tetra hybrid nanofluid flow over a inclined stretching cylinder in the presence of the Cattaneo-Christov heat flux model. Nanoparticles are used in a lot of industrial operations to enhance the physical systems' thermal performance. The application of nanoparticles and the phenomenon of thermal transfer in a stretched cylinder are covered in this study. With the Cattaneo-Christov heat flux, convective boundary limitations and thermal radiation are taken into account in equations modeling heat transport. By using boundary layer theory, the set of nonlinear-coupled PDEs (partial differential equations) for the model under consideration is derived in a simplified form. After that, using similarity transformation, a collection of ODEs (ordinary differential equations) was produced. The BVP4C solver and MATLAB software is used to solve the modeled equations numerically. A graphic representation of the answer is shown in relation to various emergent parameters.

Lie Algebraic Modeling of Vibrational Frequencies in Hexachlorobenzene: A Symmetry-Adapted Approach for the D_{6h} Point Group

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Abstract:

This study presents a detailed analysis of the vibrational frequencies of hexachlorobenzene (C_6Cl_6) within the framework of symmetry-adapted Lie algebraic modeling. Recognizing the molecule's high D_{6h} point group symmetry, a vibrational Hamiltonian based on U(2) Lie algebra generators is constructed to accurately describe the fundamental vibrational modes. The methodology systematically incorporates molecular symmetry and anharmonic effects, providing a compact and algebraically efficient formulation of the vibrational spectrum. The computed fundamental frequencies exhibit good agreement with available experimental data, validating the effectiveness of the Lie algebraic approach for highly symmetric polyatomic molecules. This work provides a foundational basis for further investigations into overtone and combination bands of hexachlorobenzene.

Mellin Transform and Fractional Operators: A New Analytical Framework

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Abstract:

This paper presents a unified analytical study of the Mellin transform in conjunction with fractional calculus. Several theoretical results are established, including a generalized composition identity, an extended fractional Parseval-type identity, and a duality relation between fractional integrals and derivatives within the Mellin transform framework. These findings extend classical integral transform methods and provide efficient tools for solving fractional differential and integral equations. Illustrative examples support the theoretical results, and practical applications in viscoelastic modeling, anomalous diffusion processes, fractional control systems, and multiplicative signal analysis are explored. The study aims to enhance both the theoretical understanding and practical application of fractional operators in mathematical modelin and engineering sciences.

A Bioinspired Pneumatic Soft Robot Navigating Confined Spaces Through Tip Eversion

Dr. Anubhab Sinha, Dr. Tamonash Jana, Avik Panja, Dipta Sasmal, Samay Saha, Sarbeswar Roy

Abstract: This paper presents the design and development of a bioinspired soft growing robot tailored for navigation in confined, cluttered, and hard-to-reach environments. Drawing inspiration from the tip-growth of climbing vines, the robot advances through pneumatic eversion (i.e. growing from the tip while the base remains anchored) thus eliminating the need for pushing, pulling, or crawling mechanisms. Unlike traditional robots, it does not move in the conventional sense; it grows, minimizing sliding friction and enabling safe interaction with delicate surroundings.

The robot's body is constructed from heat-sealed thermoplastics such as TPU or LDPE, forming an airtight, flexible tube. Internal air pressure drives controlled eversion, while pressure-modulated self-steering allows the robot to adaptively follow curved, obstacle-rich paths. Its inherently compliant structure makes it highly flexible, adaptive to environmental geometry, and safe for interaction with sensitive materials or biological tissue.

A compact camera integrated at the everting tip (despite constant shape change) enables real-time vision, when the system will be evaluated in controlled environments mimicking irregular terrains and narrow spaces.

With its lightweight, low-cost, and electronics-minimal architecture, this platform holds promise for infrastructure inspection, medical intubation, and future extraterrestrial missions requiring safe, adaptable traversal through constrained environments.

A Simplified Quantum Circuit for Addition Using the Lilavati–Bhashkaracharya Method

Rijuparna Chakraborty[1], Mili Sarkar[1], Debabrata Dutta[2]

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Abstract:

Quantum computing promises exponential speedups for many classical problems, especially for arithmetic operations. In quantum arithmetic circuits, the adder is the principal operational unit. For executing this addition operation on numbers, we normally start summing from right most digits and gradually shift left with carry. And this method is followed in electronic and quantum circuitry too. Therefore for n-digit operation we need (n-1) full-adders and one half adder, and these n-parts of the total circuit operates one by one taking n-units of time.

Here we present a simplified quantum circuit using Lilavati – Bhashkaracharya Method, which performs the total addition operation of any number of digits using 3-units of time and it requires only half adders. The proposed Lilavati-method based quantum adder offers a blend of historical insight and modern computational efficiency, bridging classical mathematical heritage with cutting-edge quantum technology.

Keywords: Quantum Computing, Half Adder, Full Adder

Solutions of Fractional Bagley-Torvik Equations with Certain External Forces

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Abstract:

The Bagley-Torvik equation is a quintessential fractional differential equation that captures the essence of viscoelastic damping in materials and structures, bridging the gap between classical and fractional calculus theories. In this study, we have considered the fractional Bagley-Torvik equation with three special forms of the external forces: constant force, linearly increasing force, and piecewise-defined external force. We employ an innovative approach for solving the fractional Bagley-Torvik equation, the Laplace Adomian Decomposition Method (LADM), taking the Caputo-type fractional order derivative. To confirm the validity of the results, we compare them with the other results available in the literature.

Keywords: Caputo Fractional Derivative, Bagley-Torvik Equation, Fractional Calculus, Fractional Differential Equation, Laplace Adomian Decomposition Method

Mathematical Analysis of Internal Blood Pressure Pertaining to the Incomplete Y-Functions

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Abstract: In our research, we created a model that uses a special function called the incomplete Y-functions to track how glucose, which is an important energy source, moves and spreads in the blood of humans. Our study shows how mathematical modelling can connect math with life sciences, offering a useful way to better understand medical and biological processes. After that, while studying the limitations of the incomplete Y-functions, we provide some specific examples of our model and also refer to some established findings.

Optimization of Inventory Policies for Deteriorating Items with Ramp-Type Demand, Carbon Emission, and Inflationary Impact

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Abstract:

This research paper develops an Economic Order Quantity (EOQ) model that incorporates the influence of multiple demand parameters to achieve optimal outcomes. The model considers factors such as advertisement, selling price, and demand for green products. Since deterioration negatively affects profitability, preservation technology is integrated into the framework. The study also accounts for partial backlogging of shortages. Recent trends highlight the growing importance of product sustainability and carbon tax policies in supply chain optimization, which are now essential for organizational decision-making. Numerical examples and sensitivity analysis demonstrate how firms can achieve optimal performance while ensuring environmental sustainability.

Predicting Alpha Decay Half-Lives Using Neural Networks

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2 Department of Physics, Amity School of Applied Sciences, Amity University Maharashtra, Panvel, Navi Mumbai, India - 410206

Abstract: This study uses neural network regression to predict alpha decay half- lives for 854 nuclei. The models use atomic number (Z), mass number (A), and alpha decay energy (Qα) as features to predict half-life in seconds [1, 2]. Two models were built: a 4-layer and a 5-layer network, each with 50 neurons per layer. Features were scaled using a Standard Scaler. The models were trained for 100, 200, and 300 epochs, with 25 independent runs each. To prevent overfitting, an early stopping mechanism was used, halting training when validation loss increased. Performance was evaluated using metrics like Mean Squared Error (MSE), Mean Absolute Error (MAE), and R2/Adjusted R2 scores on both training and test sets. The mean and standard deviation of these metrics were calculated across all runs. The model's predictive ability was demonstrated by comparing predictions for six specific nuclei 254Fm, 212Po, 180W, 168Pt, 144Nd, and 106Te with experimental half-lives. This research establishes a framework for future studies to enhance prediction accuracy by incorporating new physical parameters and alternative techniques [3, 4].

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