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THE ICFAI UNIVERSITY TRIPURA**



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This is the abstract volume of **Global Assembly for Mathematical Modeling and Analysis (GAMMA)-2025**

Vice-Chancellor's Message



Prof. (Dr.) Biplab Halder
Vice-Chancellor,
The ICFAI University Tripura

It gives me great pleasure to pen this note for the Book of Abstracts of the Global Assembly for Mathematical Modeling and Analysis (GAMMA)–2025, a premier conference where mathematical theory, innovation, and real-world application intersect. Mathematics, as both an ancient discipline and a modern imperative, remains at the heart of all scientific advancement. Its language is one of logic, yet its influence is boundless—from decoding genomic sequences to predicting global market behavior. This conference underscores the critical role of mathematical modeling and analysis in responding to contemporary global challenges with precision, insight, and resilience. As vice-chancellor, I take immense pride in our university's role in hosting such a prestigious gathering. This assembly is not just a confluence of research; it is a celebration of human curiosity and intellectual courage. The abstracts presented here capture a mosaic of ideas—diverse in scope, yet unified by a shared pursuit of truth and understanding. I extend my heartfelt gratitude to all contributors, keynote speakers, reviewers, and the organizing committee for their commitment to excellence. May this compendium serve as both a record of achievement and a seedbed for new collaborations that transcend borders and disciplines. I warmly welcome all delegates to GAMMA and wish you a stimulating and enriching experience.

Registrar's Message



Dr. A. Ranganath
Registrar,
The ICFAI University Tripura

It is a distinct honor to contribute this message to the Book of Abstracts for the Global Assembly for Mathematical Modeling and Analysis (GAMMA)-2025. Academic conferences such as GAMMA play a vital role in shaping institutional relevance in today's data-driven landscape. As Registrar, I have come to deeply appreciate the indispensable role that mathematical modeling plays—not only in academic research but also in educational planning, administrative systems, and strategic decision-making. This book represents more than a compilation of research summaries; it is a tangible manifestation of our collective commitment to scholarship, collaboration, and innovation. Each abstract is a window into the rigorous thinking and groundbreaking work being carried out across the globe. Together, they reflect the dynamism and diversity that make GAMMA a truly global assembly. I congratulate the editorial and organizing teams for their meticulous work in bringing this volume to fruition. To all contributors and participants, thank you for making this gathering intellectually rich and globally relevant. May your time at GAMMA be marked by meaningful exchanges and the forging of new academic frontiers.

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Topic: Equation-Free Multiscale Modelling: A Generalised Patch Dynamics Scheme
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Topic: On certain observations of characterized subgroups for arithmetic and related sequences
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Topic: Teaching Mathematical Modeling: A Personal Perspective
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Topic: The Grand and Mysterious History of Division by Zero
5. **Prof. Bipan Hazarika**, Professor, Department of Mathematics, Gauhati University, Assam, India
Topic: Henstock-Kurzweil integrals and Henstock-Orlicz space
6. **Prof. Shankhadeep Mondal**, Professor, Department of Mathematics, University of Central Florida, Orlando, Florida, USA
Topic: Optimization of Dual Frames for Error-Resilient Communication
7. **Prof. Anjan Mukherjee**, Rtd. Professor, Department of Mathematics, Tripura University, Tripura, India
Topic: Interval-Valued Neutrosophic Hesitant Fuzzy Rough Approximation Operators and Its Application in Medical Science
8. **Prof. Ljubisa Kocinac**, Professor Emeritus, Department of Mathematics, University of Nis, Serbia
Topic: On topologies on simple graphs
9. **Dr. B. Sagar** Professor, Department of Mathematics, University of Central Florida, Orlando, Florida, USA
Topic: Numerical Simulation of Fractional Keller-Segel System Modeling Chemotaxis
10. **Prof. F. Smarandache**, Emeritus Professor, Physical and Natural Sciences Division, University of New Mexico, USA
Topic: On overview of neutrosophic theories and applications

11. **Dr. Surapati Pramanik**, Assistant Professor, Nandalal Ghosh B.T.College, India, **Topic: Some properties of the interval quadripartitioned neutrosophic sets**
12. **Prof. Marcelo M. Cavalcanti**, Professor, Department of Mathematics, State University of Maringá, Brazil
Topic: Control and stabilization of distributed systems equations on manifolds.
13. **Prof. Binod Chandra Tripathy**, Professor, Department of Mathematics, Tripura University, Tripura, India
Topic: Weak Convergence of Sequences

Contents

Vice-Chancellor’s Message	iii
Registrar’s Message	iv
Organizing Committee	v
Invited Speaker	vii
Abstracts of Contributory Talks	1
1 UNSTEADY NATURE OF MIXED CONVECTION THREE-DIMENSIONAL HIEMENZ STAGNATION POINT FLOW (<i>Abdul Aziz, Tapas Ray Ma- hapatra</i>)	1
2 SPATIOTEMPORAL RAINFALL VARIABILITY AND TRENDS IN TRIPURA, INDIA: IMPLICATIONS FOR WATER RESOURCE MAN- AGEMENT (<i>Akash Sinha*, Prasenjit Sinha, Bimal Shil</i>)	2
3 TAYLOR DIFFUSION IN PLANE COUETTE FLOW (<i>Annesha Chowd- hury, Haradhan Maity*, Tapas Ray Mahapatra</i>)	3
4 ON MULTISSET AND INDEPENDENT MULTISSET DIMENSION OF EXTENDED KAYAK PADDLE GRAPH (<i>Archana Bengeri^{1*}, Venkatesh P.S¹, Prasanna Poojary¹, Sunny Kumar Sharma²</i>)	4
5 MODELLING FEAR AND ITS CARRY-OVER EFFECTS WITH BEVERTON- HOLT-LIKE SUPPLEMENTARY FOOD (<i>Deepabali Datta</i>)	5
6 HAMMING DISTANCE OF REPEATED ROOT CONSTACYCLIC CODES OVER A NON-CHAIN RING (<i>Divya Acharya*, Prasanna Poo- jary, Vadiraja Bhatta G R</i>)	6
7 OPTIMIZING A SUSTAINABLE EPQ MODEL THROUGH GREEN AND PRESERVATION TECHNOLOGY INVESTMENTS (<i>Haripriya Barman*, Magfura Pervin¹, Sankar Kumar Roy²</i>)	7
8 FAULT-TOLERANT LOCAL METRIC DIMENSION OF CERTAIN FAMILIES OF GRAPHS (<i>Geeta¹, Vidya S², Prasanna Poojary^{1*}, Sunny Kumar Sharma¹, Varalakshmi Manoharan¹</i>)	8
9 EFFECTS OF NECROTIC CORE AND PARTICLE SIZE ON TRANS- PORT MECHANISMS IN A HETEROGENEOUS TUMOR (<i>Gobinda Debnath, B. Vasu</i>)	9
10 IDENTIFICATION OF THE BEST INSURANCE PROVIDER USING MULTI-CRITERIA DECISION MAKING (MCDM) (<i>Harsangsuam Ha- lam, Prasenjit Sinha, Bimal Shil</i>)	10

11	WEAK CONVERGENCE OF DIFFERENCE SEQUENCES IN n -NORMED SPACE (<i>Abhijit Sarkar* and Binod Chandra Tripathy</i>)	10
12	NON-PARAMETRIC MACHINE LEARNING FOR PREDICTING SOIL CARBON STORAGE: A COMPARATIVE ANALYSIS OF ENSEMBLE METHODS (<i>Hitabrata Chakraborty*, Prasenjit Sinha, Bimal Shil</i>)	11
13	RELATIVE ALMOST UNIFORM CONVERGENT SEQUENCE OF FUNCTIONS AND ITS TOPOLOGICAL PROPERTIES (^{1*} <i>Kshetrimayum Renubebeta Devi and</i> ² <i>Pranab Jyoti Dowari</i>)	12
14	MATHEMATICAL MODELLING IN TUMOR GROWTH MECHAN-ICS (<i>Palas Mandal</i>)	13
15	EFFECTS OF NONSYMPLECTIC TRANSFORMATION ON INFOR-MATION GEOMETRY FOR GAUSSIAN DISTRIBUTIONS (<i>Shilpa Nandi, Pinaki Patra*</i>)	14
16	CONSTRUCTION OF BALANCED INCOMPLETE BLOCK DESIGNS (BIBDS) THROUGH VARIABLE CONSTRAINED NEIGHBOURHOOD SEARCH (VCNS) ALGORITHM (<i>Pratibha Karki, Samrat Hore *</i>)	15
17	TAUBERIAN THEOREMS FOR CESARO SUMMABILITY IN BI-COMPLEX NUMBER SPACES (^{1*} <i>Ruhit Bardhan, </i> ² <i>Binod Chandra Tri-pathy</i>)	16
18	DYNAMICS OF CARBON DIOXIDE GAS (CO ₂): EFFECTS OF VARY-ING CAPABILITY OF PLANTS TO ABSORB CO ₂ (<i>Sapna Devi</i>)	17
19	COMPLEX DYNAMICAL BEHAVIORS OF A PREDATOR-PREY SYSTEM WITH FEAR AND REFUGE IN A PARAMETER PLANE (<i>Shilpa Garai, N.C. Pati, Nikhil Pal*, and G.C. Layek</i>)	18
20	COMPUTATIONAL SIMULATION OF INTERNAL HYDRAULIC JUMP AND FLOODING IN STRATIFIED GAS-LIQUID TWO-PHASE FLOW (<i>Siddhartha Das* and Mrinmoy Dhar</i>)	19
21	COMPLEX SADIK INTEGRAL TRANSFORM OF LINEAR VOLTERRA INTEGRO-DIFFERENTIAL EQUATIONS OF SECOND KIND (<i>Sonia Sharma*, Harish Nagar</i>)	20
22	EXPONENTIAL STABILITY OF VISCOELASTIC MATERIALS COU-PLLED WITH A THERMAL EFFECT (<i>Srikanta Ram* and Ganesh C Gorain</i>)	21
23	AN INNOVATIVE PERSPECTIVE ON ROTATIONAL DYNAMICS IN FINANCIAL NETWORKS WITH INTERLINKED VOLATILITY AND ASSET FLUCTUATIONS (<i>Subhrajit Saha, Debashis Chatterjee*</i>)	22
24	APPROXIMATION SCHEME BASED ON ORTHONORMAL POLY-NOMIAL WAVELETS FOR SINGULAR INTEGRAL EQUATIONS WITH CAUCHY KERNEL (<i>Sudam Bin</i>)	23
25	EXPLORATION OF BUBBLING PHENOMENA IN AN ECOLOGI-CAL SYSTEM INFLUENCED BY DOUBLE ALLEE EFFECT (<i>Sukanya Das</i>)	24
26	UNSTEADY MIXED CONVECTION HOMANN NON-AXISYMMATRIC STAGNATION-POINT FLOW (<i>Supriya Malik, Tapas Ray Mahapatra*</i>)	25

27	A COMPARATIVE ANALYSIS OF SIMILARITY MEASURES ON NEUTROSOPHIC SETS: JACCARD, COSINE, AND EUCLIDEAN-BASED NORMALIZED APPROACHES (<i>Surath Roy^{1,2*} and Sharmistha Ghosh³</i>)	26
28	MATHEMATICAL MODELLING OF TRANSDERMAL DRUG DELIVERY USING A HOLLOW MICRONEEDLE (<i>Tanmoy Bhumali*, Prashanta Kumar Mandal</i>)	27
29	ON GENERALIZED η DUALS OF COMPLEX UNCERTAIN SEQUENCE SPACES (<i>Pranab Jyoti Dowari</i>)	28
30	ON s -VERTEX METRIC DIMENSION (<i>Venkatesh P.S^{1*}, Prasanna Poojary¹, Sunny Kumar Sharma²</i>)	28
31	FAULT-TOLERANT METRIC DIMENSION OF THE BARYCENTRIC SUBDIVISION OF ZERO-DIVISOR GRAPHS ASSOCIATED WITH A COMMUTATIVE RING (<i>Vidya S¹, Sunny Kumar Sharma², Prasanna Poojary^{1*}, Vadiraja Bhatta G R³</i>)	29
32	F -CONTRACTIONS ON ORTHOGONAL METRIC SPACES (<i>Vivek Mainali*, Bharti Joshi and Mahesh C. Joshi</i>)	30
33	PRICING OPTIMIZATION FOR SUSTAINABLE DUAL-CHANNEL SUPPLY CHAINS WITH VALUE-ADDED RETAIL SERVICES (<i>Amit Sarkar</i>)	31
34	A COMPARATIVE ANALYSIS OF DRINKING WATER QUALITY AT RAILWAY STATIONS IN TRIPURA USING TOPSIS, VIKOR, AND A PCA-BASED ROBUST RANKING METHOD (<i>Malabika Boruah¹, Saptarshi Mitra², Samrat Hore^{1,*}</i>)	32
35	A COMPARATIVE STUDY OF METAHEURISTICS ALGORITHMS THROUGH TYPE-1 TOURNAMENT IN BRIDGE DESIGN OPTIMIZATION PROBLEMS (<i>Goutam Mandal^{1*}, Nirmal Kumar² and Asoke Kumar Bhunia³</i>)	33
36	DEVELOPMENT OF AN EFFICIENT MACHINE LEARNING ALGORITHM TO DETECT BREAST CANCER (<i>Tansmaiha Reang, Samrat Hore</i>)	34
37	AN ECO-EPIDEMIOLOGICAL MODEL INCORPORATING MUTUAL INTERFERENCE AND NONLINEAR HARVESTING IN PREDATORS (<i>Raktim Kar^{1,2}, Santosh Biswas¹, A. K. Pal³, Pankaj Kumar Tiwari^{4,*}</i>)	35
38	ITERATIVE APPROACH TO CAYLEY VARIATIONAL INCLUSION WITH LOGICAL OPERATIONS (<i>Arifuzzaman and Syed Shakaib Irfan</i>)	36
39	UNIFORM CONVERGENCE OF DISTANCE FUNCTIONALS ON BORNOLGY UNDER REMETRIZATION (<i>Yogesh Agarwal</i>)	37
40	ON NEIGHBOURHOOD STATISTICAL CONVERGENCE FOR SEQUENCE OF FUNCTIONS IN TOPOLOGICAL SPACE (<i>Prasenjit Bal, Parthiba Das*</i>)	38
41	STATISTICAL CONVERGENCE FOR SEQUENCES OF SETS VIA TOPOLOGICAL NEIGHBOURHOODS (<i>Prasenjit Bal*, Tanmayee Datta</i>)	39
42	FOUNDATIONS AND FRAMEWORK OF SUPERHYPERSOFT SETS (<i>Himangshu Nath*, Mithun Datta</i>)	40
43	FIXED POINTS THEOREMS ON NEUTROSOPHIC FUZZY RECTANGULAR METRIC SPACES (<i>Krishna Bhattacharjee^{1,*}, Rakhal Das¹ and ²Amit Kumar Laha</i>)	41

44	SHEAR-HORIZONTAL WAVE DYNAMICS IN SMART FIBER COM- POSITES WITH LAYERWISE INTERFACIAL IMPERFECTIONS (<i>Bikram Dholey</i>)	42
45	Different Types of Matrix on Neutrosophic Super Hyper Graphs (<i>Sabuj Das and Rakhal Das</i>)	43
46	τ_1, τ_2 -STAR-I-COMPACT SPACES (<i>Tarun Choudhury, Dr. Prasenjit Bal*</i>)	43
47	Multiscale Analysis of Pollutant Transport under Asymmetric Flow with Chemical Reactions (<i>Radha S and Swarup Barik*</i>)	44
48	Thermosolutal natural convection of ternary hybrid nanofluids in a baf- fled U-shaped porous enclosure with thermal radiation (<i>Samrat Hansda</i>) .	45
49	Studies on shifts and generalized differential operators of meromorphic functions under different sharing notions (<i>Arpita Roy*, Abhijit Banerjee</i>)	46
50	ANALYSIS OF LOVE WAVE PROPAGATION IN A PRE-STRESSD ORTHOTROPIC MEDIUM OVERLAYING A HETEROGENEOUS PRE- STRESSED HALF-SPACE (<i>Suparna Roychowdhury^{1,2,*}, Mostaid Ahmed³, Ayan Chatterjee¹, Abhijit Pramanik⁴</i>)	47
51	Mathematical Modeling of Chemotherapeutic Drug Delivery with the Application of Electroporation (<i>Monalisa Debbarma, Nilay Mondal*</i>) . . .	48
52	CONVECTIVE PERFORMANCE OF HYBRID NANOFLUID WITHIN AN IRREGULAR THERMAL SYSTEM IN PRESENCE OF MAGNETIC FIELD (<i>Krishno D. Goswami</i>)	49
53	ENSURING BALANCE WITH REGARD TO OPTIMALITY FOR KNOWN CATEGORICAL COVARIATES AND MULTIPLE TREATMENT GROUPS (<i>Parantap Nag, Samrat Hore*</i>)	50
54	A NEUTROSOPHIC APPROACH TO BRIDGING EDUCATIONAL MANAGEMENT AND PEDAGOGY FOR ENHANCING LEARNING OUTCOMES (<i>Suman Das¹, Sujoy Saha¹, Jay Raj Kumar^{1,*}, Ajoy Kanti Das², Rakhal Das³ and Kalyan Sinha⁴</i>)	51
55	RELIABILITY ANALYSIS OF LOAD-SHARING SYSTEMS USING A FLEXIBLE MODEL WITH PIECEWISE LINEAR FUNCTIONS (<i>Shilpi Biswas^{1,*}, Ayan Ganguly¹, Debanjan Mitra²</i>)	52
56	AN APPROXIMATION SCHEME BASED ON HERMITE INTERPO- LATION FOR SOLVING THIRD- AND HIGHER-ORDER NONLIN- EAR SINGULAR ORDINARY DIFFERENTIAL EQUATIONS (<i>Sharda Kumari</i>)	53
57	STATISTICAL CONVERGENCE OF MATRIX SEQUENCES AND EIGENVALUE INFLUENCES (<i>Prasenjit Bal* and Bikram Sutradhar and Gourab Paul</i>)	54
58	ON PAIRWISE δ -CLOSED SET AND PAIRWISE δ -CONTINUITY IN NEUTROSOPHIC BITOPOLOGICAL SPACE (<i>Bishnupada Debnath</i>) .	55
59	SPATIAL AUTOREGRESSIVE MODELING OF THE TIMING OF DIFFERENT IMMUNIZATION DOSES RECEIVED AMONG UNDER- FIVE CHILDREN IN INDIA (<i>Junaid Khan</i>)	56
60	SOME MORE RESULTS ON MENGER SPACE VIA IDEALS (<i>Susmita Sarkar*, Prasenjit Bal</i>)	57
	Conclusion	58

UNSTEADY NATURE OF MIXED CONVECTION THREE-DIMENSIONAL HIEMENZ STAGNATION POINT FLOW

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ABSTRACT

This study delves into the intricate analysis of the unsteady mixed convection three-dimensional Hiemenz stagnation-point flows over a vertical flat wall immersed in viscous and incompressible fluid. The analysis considers the derivation of a similarity solution, incorporating γ , indicative of the shear to strain rate ratio, ω denotes unsteady parameter and λ representing a mixed convection parameter. Numerical solutions are derived meticulously for typical values of ω , δ (which is function of λ) and λ with particular towards discerning critical values λ_c and ω_c especially concerning opposing flow. Asymptotic results are obtained for large values of ω , λ and δ . It is observed that dual solutions are present for opposing flows. It is noticed that the critical values λ_c of λ and ω_c of ω are found in opposing flow, which produce two solution branches by making saddle node bifurcation at λ_c and ω_c . A stability analysis of the steady flow solutions was carried out for different values of mixed convection parameter λ , the unsteady parameter ω and it reveals that, the lower solution branches are unstable while the upper solution branches are stable.

Keywords: Unsteady flow, Stagnation point flow, Hiemenz flow, Mixed convection.

MS Classification 2020: 76D05, 35Q30.

References:

1. P. D. Weidman, Non-axisymmetric Homann stagnation-point flows. *Journal of Fluid Mechanics* 702 (2012): 460-469.
 2. P. D. Weidman, Three-dimensional Hiemenz stagnation-point flows. *ZAMM-Journal of Applied Mathematics and Mechanics/Zeitschrift für Angewandte Mathematik und Mechanik* 101.2 (2021): e201900319.
 3. J. H. Merkin and T. Mahmood, Mixed convection boundary layer similarity solutions: prescribed wall heat flux. *Zeitschrift für angewandte Mathematik und Physik ZAMP* 40.1 (1989): 51-68.
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SPATIOTEMPORAL RAINFALL VARIABILITY AND TRENDS IN TRIPURA, INDIA: IMPLICATIONS FOR WATER RESOURCE MANAGEMENT

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ABSTRACT

Understanding how patterns of rainfall change over time and across different areas very important for managing water resources, especially for the regions that are influenced by the monsoon. This study explores the long-term trends and patterns of 23 weather stations across Tripura, India. To analyse these trends, we follow the Mann-Kendall test with Sen's slope estimator, both of which are well-used for environmental data analysis without assuming any specific distribution. The outcomes show noticeable differences in rainfall trends from one location to another. We also apply Principal Component Analysis (PCA) and K-means clustering for grouping the stations based on their monthly rainfall pattern behaviour. The analysis shows clear clusters and gives diverse rainfall regimes all over the state. These results are very useful for supporting agricultural decisions, infrastructure planning, and strategy development to adapt to changing climate conditions.

Keywords: Rainfall variability, Mann-Kendall test, Sen's slope, PCA, K- means Clustering,

MS Classification 2020: 62G10; 62H25; 62J02.

References:

1. Phukan, R., & Saha, D. (2022). Analysis of rainfall trends over Tripura. *MAUSAM*, 73(1), 27–36. <https://doi.org/10.54302/mausam.v73i1.5078>
2. Sangma, M. L. K., Reang, H., Patle, G. T., & Dabral, P. P. (2020). Variability and Trend Analysis of Rainfall Data of Shillong and Agartala Stations of North East India. *International Journal of Environment and Climate Change*, 10(11), 134–142. <https://doi.org/10.9734/ijecc/2020/v10i1130273>
3. Vivekanandan, N., Srishailam, C., & Patil, R. G. (2022). Analysis of Rainfall Data of Agartala Sadar, Tripura Using Statistical Approach. In A. K. Dikshit et al. (Eds.), *Innovative Trends in Hydrological and Environmental Systems* (pp. 17–32). Springer. https://doi.org/10.1007/978-981-19-0304-5_2
4. Ganchohdhuri, S., Sarmah, K., Roy, L., & Goswami, J. (2022). Rainfall Probability Analysis for Crop Planning of Unakoti and West Tripura District of Tripura, India. *International Journal of Environment and Climate Change*, 12(11), 2520–2529. <https://doi.org/10.9734/ijecc/2022/v12i1131245>

TAYLOR DIFFUSION IN PLANE COUETTE FLOW

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ABSTRACT

This study offers an analytical approach on the Taylor dispersion within the context of plane Couette flow. This technique avoids direct numerical calculations while effectively determining dispersion coefficients and the long-term asymptotic behavior of the solute. The main purpose of this study is to utilize Aris's higher order moment method to analytically evaluate the characteristics of solute transport. By analyzing the temporal evolution of concentration moments, this approach offers significant insights into the central tendency, distribution shape and size of the solute. Furthermore, the assessment of higher-order moments allows for the measurement of skewness and kurtosis, which indicate the asymmetry and peaked-ness of the solute concentration profile. The analytical results obtained from this study deepen the understanding of how shear flow influences solute dispersion, providing a comprehensive description of its statistical properties over time.

Keywords: Moment of solute concentration and solute dispersion, mean concentration distribution, geometrical analysis, physical interpretations.

MS Classification 2020: 35C05, 76M60.

References:

1. Taylor, G. I., 1953, "Dispersion of soluble matter in solvent flowing slowly through a tube," Proc. Roy. Soc. A, 219(1137), pp. 186-203.
 2. Aris, R., 1956, "On the dispersion of solute in a fluid flowing through a tube," Proc. Roy. Soc. A 235(1200), pp. 67-77.
 3. Andersson, B. and Berglin, T., 1981, "Dispersion in laminar flow through a circular tube," Proc. R. Soc. A, 377(1720), pp. 251-268.
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ON MULTISSET AND INDEPENDENT MULTISSET DIMENSION OF EXTENDED KAYAK PADDLE GRAPH

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ABSTRACT

A planar graph can be drawn in a plane without any edges intersecting each other except the vertices. These graphs have a wide range of applications, such as in game theory, robotics, chemistry, etc. In a connected graph G , a set of vertices W is called a multiresolving set if the multiset of distances from any vertex v in G to the vertices in W is unique for each vertex v . The multiset dimension, denoted by $\text{msdim}(G)$, is the size of the smallest multiresolving set. If no such set exists, $\text{msdim}(G)$ is infinite. In this article, we compute the multiset dimension and the independent multiset dimension of the extended kayak paddle graph.

Keywords: planar graph, multiresolving set, multiset dimension, kayak paddle graph

MS Classification 2020: 05C10, 05C12, 05C38.

References:

1. F. Harary and R. A. Melter, On the metric dimension of a graph, *Ars Combinatorial*, (1976), pp. 191-195.
2. J. B. Liu, S. K. Sharma, V. K. Bhat, and H. Raza, Multiset and mixed metric dimension for starphene and zigzag-edge coronoid, *Polycyclic Aromatic Compounds*, 43(1) (2023), pp. 190-204.
3. S. K. Sharma and V. K. Bhat, Independence in multiresolving sets of graphs, *International Journal of Computer Mathematics: Computer Systems Theory*, 8(2) (2023), pp. 99-107.
4. R. Simanjuntak, P. Siagian, and T. Vetrik, The multiset dimension of graphs, preprint (2017). Available at arXiv, arXiv:1711.00225.
5. P. J. Slater, Leaves of trees, *Congressus Numerantium*, 14 (1975), pp. 549-559.

MODELLING FEAR AND ITS CARRY-OVER EFFECTS WITH BEVERTON-HOLT-LIKE SUPPLEMENTARY FOOD

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ABSTRACT

The main objective of the present exploration is to examine the dynamic behaviour of an interacting species system with a hyperbolic functional response to fear and its carry-over effects. The primary focus of the present research is on comprehending how fear affects the system equilibria, stability, and diverse bifurcation structures through carry-over effects. The presence of diversified co-dimension one bifurcation has been established by incorporating Sotomayor's theory, and the direction of Hopf-bifurcation is identified using the normal form theorem. Parametric values have been selected for the intrinsic features of the proposed model with a Beverton-Holt-like food supplement to assess the sensitivity of the interacting species model. The coexistence of both interacting species has been found to be permanent, with certain parametric restrictions on selecting sensitive parameters. Numerical simulation and extensive dynamic results have been revealed by implementing both qualitative and quantitative analysis. Analytical results are validated by extensive numerical simulations, which provide a more comprehensive knowledge of ecological complexity. These simulations also improve perception by assessing parameter sensitivity and highlighting how fear influences long-term species relationships.

Keywords: Population dynamics, Nonlinear dynamics, Stability and bifurcation theory, Sensitivity analysis, Simulation.

MS Classification 2020: 34C60, 34D20, 37L10, 37N30

References:

1. J.D. Murray, *Mathematical Biology*, Vol. I & II, Springer Science & Business Media, New York, (2002).
 2. L. Perko, *Differential Equations and Dynamical Systems*, Springer, New York, (2013).
 3. D.R. Norris, Carry-over effects and habitat quality in migratory populations, *Oikos*, 109(1), 178-186, (2005).
 4. G. Mandal, S. Das, L.N. Guin and S. Chakravarty, Dynamic response of a system of interactive species influenced by fear and Allee consequences, *The European Physical Journal Plus*, 138(7), 1-36, (2023).
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HAMMING DISTANCE OF REPEATED ROOT CONSTACYCLIC CODES OVER A NON-CHAIN RING

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ABSTRACT

Let p be an odd prime, s be a positive integer and α be an arbitrary unit of the finite non-chain ring $R = \frac{F_{p^m}[u,v]}{\langle u^2, v^2, uv-vu \rangle}$. The structure of α -constacyclic codes of length $2p^s$ over R are classified into four distinct type of ideals of $\frac{R[x]}{\langle x^{2p^s}-\alpha \rangle}$. We determine, the Hamming distances of all such α -constacyclic codes.

Keywords: constacyclic codes; repeated-root codes; Hamming distance; symbol-pair distances.

MS Classification 2020: 94B15, 11T71.

References:

1. H. Q. Dinh, B. T. Nguyen, A. K. Singh, and S. Sriboonchitta, Hamming and Symbol-Pair Distances of Repeated-Root Constacyclic Codes of Prime Power Lengths Over $F_{p^m} + uF_{p^m}$, IEEE Communications Letters 22(12) (2018) 2400–2403.
 2. H. Q. Dinh, A. Gaur, I. Gupta, A. K. Singh, M. K. Singh, and R. Tansuchat, Hamming distance of repeated-root constacyclic codes of length $2p^s$ over $F_{p^m} + uF_{p^m}$, Applicable Algebra in Engineering, Communication and Computing 31(3-4) (2020) 291–305
 3. H. Q. Dinh, B. T. Nguyen, H. L. Thi, and W. Yamaka, On Hamming distance distributions of repeated-root constacyclic codes of length $3p^s$ over $F_{p^m} + uF_{p^m}$, Discrete Mathematics 346(12) (2023) 113593.
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OPTIMIZING A SUSTAINABLE EPQ MODEL THROUGH GREEN AND PRESERVATION TECHNOLOGY INVESTMENTS

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ABSTRACT

Critical causes of global warming and major hazards to human health are emissions of carbon dioxide and sulphur dioxide. Several nations have put emissions cap-and-trade programs in place as a main regulatory tool to help to reduce these environmental effects. With an eye toward sustainability, this paper suggests a multi-objective sustainable economic production quantity model including partially backordered shortages in response to these constraints. The model explains changing demand resulting from different urgency degrees during the epidemic. To address environmental concerns, investments in green technology and preservation efforts are implemented to decrease both greenhouse gas emissions and product deterioration. Maximizing manufacturer revenues and reducing greenhouse gas emissions in the manufacturing of ecologically friendly products constitute the main goals of the concept. The suggested multi-objective model is solved using fuzzy goal programming method. Four numerical examples help to show the relevance of the model. Key findings demonstrate that combining investments in both green and preservation technologies leads to a more sustainable production system, defined by lower emissions and better product greenness. Especially, under such investment approaches, the system becomes more profitable—by 16.1%. A sensitivity analysis is also undertaken, offering management insights for practical implementation. The report ends with an overview of the results and recommendations for next study paths.

Keywords: Preservation technology; Carbon cap- and-trade policy; Green technology; Sustainable EPQ model; Fuzzy Goal Programming.

FAULT-TOLERANT LOCAL METRIC DIMENSION OF CERTAIN FAMILIES OF GRAPHS

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ABSTRACT

Let $G = (V, E)$ be a nontrivial connected simple graph. A subset of the vertex set L is said to be a local resolving set, if $L \setminus \{a\}$ is still a resolving set for every $a \in L$. The minimum cardinality of the local resolving set is called the local metric dimension of G . A local resolving set L of G is fault-tolerant resolving set if $L \setminus \{g\}$ is still a local resolving set for each $g \in L$, and the fault-tolerant local metric dimension of G is the minimum cardinality of the fault-tolerant local resolving set of G . In this paper, we determine the fault-tolerant local metric dimension of the tadpole graph, necklace graph, and lollipop graph.

Keywords: Metric dimension, resolving set, local resolving set, local metric dimension, fault-tolerant metric dimension, fault-tolerant local metric dimension.

MS Classification 2020: 05C12.

References:

1. F. Harary and R. A. Melter, "On the metric dimension of a graph," *Ars Combinatorial*, vol. 2, no. 1, pp. 191–195, 1976.
2. F. Okamoto, B. Phinezy, and P. Zhang, "The local metric dimension of a graph," *Mathematica Bohemica*, vol. 135, no. 3, pp. 239–255, 2010.
3. Hernando, C., Mora, M., Slater, P. J., Wood, D. R. (2008). Fault-tolerant metric dimension of graphs. *Convexity in Discrete Structures*, 5, 81-85.

EFFECTS OF NECROTIC CORE AND PARTICLE SIZE ON TRANSPORT MECHANISMS IN A HETEROGENEOUS TUMOR

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ABSTRACT

Objective & Introduction: This study presents a finite element-based computational model to investigate interstitial fluid and nanoparticle transport in solid tumors, aiming to improve nanodrug delivery strategies in cancer therapy. Tumor heterogeneity, elevated interstitial fluid pressure (IFP), and abnormal vasculature pose major challenges to effective drug transport, making a detailed understanding of these dynamics essential.

Methodology: A three-region axisymmetric tumor model comprising a necrotic core, viable tissue, and surrounding healthy region is developed. The model couples steady-state interstitial fluid flow (Darcy's law) with time-dependent nanoparticle transport governed by convection–diffusion–reaction equations. Key physiological processes such as necrotic core size, transvascular exchange, and nanoparticle size are incorporated. Parametric studies explore the effects of two important physical parameter: necrotic core and nanoparticle size on nanodrug distribution.

Results: IFP peaks in the necrotic core and declines toward the healthy region, with a sharp drop at the viable healthy interface. A critical necrotic radius ($\tilde{0}.9$ cm) is identified, beyond which IFP and fluid flow profiles begin to stabilize. Smaller nanoparticles diffuse faster but are rapidly degraded, reducing their concentration in the viable region. Larger nanoparticles diffuse slowly and tend to accumulate near the injection site.

Clinical Importance & Conclusion: These findings highlight how tumor structure and nanoparticle properties affect drug delivery outcomes. The model provides a valuable tool for optimizing nanodrug design, dosage, and injection strategies. With further development such as integration of patient-specific data and hyperthermia dynamics it offers potential for personalized cancer treatment planning.

Keywords: Solid Tumor; Interstitial Fluid Flow; Solute Transport; Intratumoral Injection; Critical Necrotic Radius; Mathematical Modeling.

MS Classification 2020: Fluid Mechanics (76); PDEs in connection with fluid mechanics (35Q35); Transport equations (35Q49)

References:

1. Mahesh, N., Singh, N., & Talukdar, P. , "A mathematical model for understanding nanoparticle biodistribution after intratumoral injection in cancer tumors," Journal of Drug Delivery Science and Technology, vol. 68, p. 103048, (2022).

IDENTIFICATION OF THE BEST INSURANCE PROVIDER USING MULTI-CRITERIA DECISION MAKING (MCDM)

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ABSTRACT

In this paper, we introduce the notion of Modified Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method for identifying alternative possible insurance providers to solve the real-life insurance uncertainty. Hence, illustrate on a real-life data set of various insurance providers available in the market and the comparative analysis with existing TOPSIS methods.

Keywords: Decision making, TOPSIS, Entropy weights, Rank correlation, Motor insurance.

MS Classification 2020: 90B50, 94-10, 97K80

References:

1. V. Pandey, Komal and H. Dincer (2023) A review on TOPSIS method and its extensions for different applications with recent development. *Soft Computing In Decision Making and in Modeling in Economics*, 27:18011-18039
2. G. Odu (2019) Weighting Methods for Multi-Criteria Decision Making Technique. *J. Appl. Sci. Environ. Manage*, 23 (8):1449-1457
3. S. Chakraborty (2022) TOPSIS and Modified TOPSIS: A comparative analysis Elsevier: *Decision Analytics Journal*, 2:1-7.

WEAK CONVERGENCE OF DIFFERENCE SEQUENCES IN n -NORMED SPACE

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ABSTRACT

In this paper we explore the n -normed spaces defined by the difference sequences with respect of the sequence spaces c , c_0 and l_∞ . We have explained its different algebraic and topological properties, We have also proved the geometric properties of these sequence spaces. Some example will be discussed in this presentation.

NON-PARAMETRIC MACHINE LEARNING FOR PREDICTING SOIL CARBON STORAGE: A COMPARATIVE ANALYSIS OF ENSEMBLE METHODS

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ABSTRACT

Soil carbon storage is important factor to our environmental sustainability but estimating it correctly is a difficult task because there are intricate relationships between soil attributes, climate variables, urbanisation land uses and geospatial variables. This study examines the possibility of non-parametric machine learning models for the predication of Total Organic Carbon (TOC) in soil. We trained and compared four Machine Learning Models - Random Forest (RF) Model, Multilayer Perceptron (MLP) Model, K-Nearest Neighbours (KNN) and Gradient Boosting Machines (GBM) – on a dataset containing soil physicochemical characteristics, climate variables and urbanisation indicators. The performance of the four models was compared on the basis of Root Mean Square Error (RMSE). The finding indicates that GBM performed best, recording the minimum test RMSE of 1.190, whereas KNN records the maximum error 1.649. The results demonstrate the power of ensemble approaches to soil carbon predication, offering a strong, data driven tool for environment monitoring and land management. Further research will investigate Deep Learning methods and other Geospatial data to further improve predication accuracy.

Keywords: Random Forest, Multilayer Perceptron, K-Nearest Neighbours, Gradient Boosting Machines and Statistical Analysis.

MS Classification 2020: 62G05, 62J02, 62M45.

References:

1. Sakhaee, A., Gebauer, A., Ließ, M., & Don, A. (2022). Spatial prediction of organic carbon in German agricultural topsoil using machine learning algorithms. *Soil*, 8(2), 587-604.
2. Shi, Z., Crowell, S., Luo, Y., & Moore III, B. (2018). Model structures amplify uncertainty in predicted soil carbon responses to climate change. *Nature Communications*, 9(1), 2171.
3. Görgens, E. B., Montaghi, A., & Rodriguez, L. C. E. (2015). A performance comparison of machine learning methods to estimate the fast-growing forest plantation yield based on laser scanning metrics. *Computers and Electronics in Agriculture*, 116, 221-227.

RELATIVE ALMOST UNIFORM CONVERGENT SEQUENCE OF FUNCTIONS AND ITS TOPOLOGICAL PROPERTIES

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ABSTRACT

This paper introduces the concept of almost convergence for sequences of functions with respect to a scale function. We examine foundational properties such as linearity and completeness, and define the classes of relatively almost convergent, relatively null, and relatively bounded sequences of functions. In addition, we explore various topological aspects of the space, including convexity, local convexity, strict convexity, separability, and symmetry.

Keywords: convergence, relative, scale function, sequence.

MS Classification 2020:40A05; 54A20; 17C65; 46B10; 46B15

References:

1. B. Das, B. C. Tripathy, P. Debnath, B. Bhattacharya, Almost Convergence of Complex Uncertain Double Sequences, *Filomat* 35(1) (2021), 61–78.
<https://doi.org/10.2298/FIL2101061D>
 2. A. Esi and M. N. Catalbas, Almost convergence of triple sequences, *Global Journal of Mathematical Analysis* 2 (1) (2014), 6-10.
 3. S. Nanda, Some sequence spaces and almost convergence, *J. Austral. Math. Soc.* 22 (Series A) (1976), 446-455.
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MATHEMATICAL MODELLING IN TUMOR GROWTH MECHANICS

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ABSTRACT

The purpose of this proposed work is a coupled chemo-mechanical model of the invasion of the tumour cells to the host tissue to predict the generated stress field. In the invasion process, the growth of tumour cells, degradation of the extracellular matrix (host tissue), and production of degradation-enzyme are considered through well-established diffusion-type Partial Differential Equations (PDEs). A multiplicative decomposition-based framework is adopted to model the growth kinematics, and a Blatz-Ko-type nonlinear hyperelastic strain energy function is considered. The tumour generates mechanical stresses within itself and on the surroundings during the growth. A coupled Boundary Value Problem (BVP) is initiated by considering mechanical and chemical field equations to understand these bio-forces.

Keywords: Tumor growth, chemo-mechanical coupling, Blatz-Ko hyperelastic model, numerical simulation.

MS Classification 2020: 35, 74, 92

References:

1. B Addison-Smith, DLS McElwain, and PK Maini. A simple mechanistic model of sprout spacing in tumour-associated angiogenesis. *Journal of theoretical biology*, 250(1):1–15, 2008.
 2. Athar Ahmad, Andrew Hanby, Edwin Dublin, Richard Poulson, Paul Smith, Diana Barnes, Robert Rubens, Patrick Anglard, and Ian Hart. Stromelysin 3: an independent prognostic factor for relapse-free survival in node-positive breast cancer and demonstration of novel breast carcinoma cell expression. *The American journal of pathology*, 152(3):721, 1998.
 3. Martine Ben Amar and Alain Goriely. Growth and instability in elastic tissues. *Journal of the Mechanics and Physics of Solids*, 53(10):2284–2319, 2005.
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EFFECTS OF NONSYMPLECTIC TRANSFORMATION ON INFORMATION GEOMETRY FOR GAUSSIAN DISTRIBUTIONS

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ABSTRACT

In a practical scenario, the information in a mass of data is summarized by calculating the values of a relatively small number of parameters. In many cases, these parameters specify a probability density function (PDF) which is said to be a model for the data. Since the same PDF can be specified by many different sets of parameters, it is crucial to determine whether two given PDFs correspond to almost similar models for the data, or they are completely different. The comparison between two PDFs can be done with the help of the Fisher-Rao metric induced on the natural Riemannian manifold generated by the log-likelihood of the conditional PDF. We show that, although the Fisher-Rao distance for a Gaussian distribution remains invariant under any congruence transformation $GL(2n, \mathbb{R})$, the congruence transformation may affect the correlations between observables for a continuous variable system. As a model system, we restrict ourselves to the quantum system with a Gaussian distribution, and we take nonsymplectic transformation in phase-space of observables.

Keywords: Fisher-Rao metric; Information geometry; Isometry; Gaussian distribution; Quantum information geometry.

MS Classification 2020: 53B12, 53B50

References:

1. D. Felice, M. H. Quang, and S. Mancini, "The volume of Gaussian states by information geometry", J. Math. Phys. 58, 012201 (2017).
 2. P. Sohr, V. Link, K. Luoma, and W. T. Strunz, "Typical Gaussian quantum information", J. Phys. A: Math. Theor. 52, 035301 (2019).
 3. S. Nandi, M. Rahaman, and P. Patra, "On the entanglement of co-ordinate and momentum degrees of freedom in noncommutative space", Modern Physics Letters A 39, 2450091 (2024).
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CONSTRUCTION OF BALANCED INCOMPLETE BLOCK DESIGNS (BIBDS) THROUGH VARIABLE CONSTRAINED NEIGHBOURHOOD SEARCH (VCNS) ALGORITHM

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ABSTRACT

The issue of comparing two or more treatments in the presence of single or multiple co-variates is a pivotal concern across various research domains. While various studies have explored optimal treatment allocation under completely randomized designs with regard to D- and A-optimality criteria but only few have addressed this challenge within a blocked framework. Addressing this problem, authors have developed an efficient, computationally tractable iterative search algorithm under the block design setup. This article extends the work by adapting the algorithm for the construction of Balanced Incomplete Block Designs (BIBDs). The primary objective of this study is to construct the Balanced Incomplete Block Designs (BIBDs) by the proposed Variable Constrained Neighborhood Search (VCNS) algorithm and assess the efficacy of the proposed VCNS algorithm with existing algorithms. The key contribution of this research lies in the extension of the previously developed VCNS algorithm to the domain of BIBD construction by offering a new computational tool that maintains competitive performance while reducing computational demands. This contribution adds value to the existing literature by bridging gaps in efficient design methodologies for treatment comparisons.

Keywords: Incomplete Block Design, Iterative Search, Near-optimal Allocation Design, Mathematical Programming, Computational Method.

TAUBERIAN THEOREMS FOR CESARÒ SUMMABILITY IN BI-COMPLEX NUMBER SPACES

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ABSTRACT

This paper extends the classical Tauberian theorems to the context of bi-complex number spaces. We establish new characterizations for Cesàro summable sequences in the bi-complex plane and derive corresponding Tauberian conditions that ensure the convergence of such sequences. Our approach utilizes the idempotent representation of bi-complex numbers and develops novel techniques to handle the specific algebraic structure of this hypercomplex number system. These results generalize the existing theory of Cesàro summability and open new avenues for applications in hypercomplex analysis and related fields.

Keywords: bi-complex number spaces, Cesàro summable sequences, hypercomplex analysis, Tauberian theorems.

MSC(AMS-2020): 40E05, 40G05, 40B05, 30G35

DYNAMICS OF CARBON DIOXIDE GAS (CO_2): EFFECTS OF VARYING CAPABILITY OF PLANTS TO ABSORB CO_2

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ABSTRACT

To explore the effects of variation in the capability of plants to absorb atmospheric carbon dioxide (CO_2), a nonlinear mathematical model is proposed here. The model is developed under the presumption that capability of plants to inhale/store CO_2 varies plantwise. Primarily, whole plant population is divided into two categories for the analysis. Qualitative analysis for boundedness of solutions, existence, and stability of equilibrium points, along with permanence of the model system is carried out. The model analysis reveals that increasing the growth rate of plants, whose capability to absorb atmospheric CO_2 is more, depleted CO_2 more rapidly as compared to other ones, and if we increase harvesting rate coefficient, the concentration of CO_2 increases accordingly. Numerical simulations are performed to support and interpret the analytical results. Finally, the plant population is categorized in n -parts and model is generalized to better understand the dynamics of the ecosystem.

Keywords: Plants Population, Absorption Capability, Carbon Dioxide, Logistic Growth, Persistence, Stability.

MS Classification 2020:34A34, 34D20, 34D23

References:

1. Misra, A. K., & Verma, M. (2013). A mathematical model to study the dynamics of carbon dioxide gas in the atmosphere. *Applied. Mathematics and Computation*, 219, 8595–8609.
 2. Agarwal, M., & Devi, S. (2010). The effect of environmental tax on the survival of biological species in a polluted environment: A mathematical model. *Nonlinear Analysis: Modelling and Control*, 15(3), 271–286.
 3. Tim, C., & Perrineville, N. J. (2016). Dear earth talk: Which trees are best to plant to help combat global warming? *Earth Talk*.
 4. Simmons, G. F. (1974). *Differential equations with applications and historical notes*. New Delhi: Tata McGraw-Hill.
 5. Lata, K., Dubey, B., & Misra, A. K. (2016). Modeling the effects of wood and non-wood based industries on forestry resources. *Natural Resource Modeling*, 29(4), 559–580.
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COMPLEX DYNAMICAL BEHAVIORS OF A PREDATOR-PREY SYSTEM WITH FEAR AND REFUGE IN A PARAMETER PLANE

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ABSTRACT

In this article, we report the existence of periodic structures viz., Arnold tongues, and shrimp-shaped structures within the irregular regimes of the parameter plane of a discrete-time predator-prey model. The model is constructed by taking into consideration of two biological phenomena: prey refuge and fear of predation risk. We analyze the system theoretically by performing stability analysis of the biologically feasible fixed points and studying some local bifurcations. The complex dynamical behaviors of the model are explored in the parameter planes with the help of largest Lyapunov exponent and isoperiodic diagrams. We see the presence of a completely new kind of U-shaped periodic structure in the parameter plane. Also, the transition to chaos occurs through the period-bubbling process. We identify the coexistence of triple heterogeneous attractors. The basins of attraction of these coexisting attractors are drawn, and we observe the presence of Wada basin boundary. Our study reveal that the oscillations of the predator-prey populations in certain control parameter regions are highly dependent upon the initial population densities of the interacting species.

Keywords: Fear effect, Prey refuge, Parameter plane, Arnold tongues, Multiple attractors, Wada basin.

MS Classification 2020: 92B05, 92B99.

References:

1. Lima Steven L, Dill Lawrence M. Behavioral decisions made under the risk of predation: A review and prospectus. *Can J Zool* 1990;68(4):619–40.
2. Wang Xiaoying, Zanette Liana, Zou Xingfu. Modelling the fear effect in predator–prey interactions. *J Math Biol* 2016;73(5):1179–204.
3. Pati NC, Layek GC, Pal Nikhil. Bifurcations and organized structures in a predator–prey model with hunting cooperation. *Chaos, Solitons & Fractals* 2020;140:110184.
4. Arnold Vladimir I. Small denominators. I: Mappings of the circumference onto itself. *AMS Transl Ser* 1965;46:213.
5. Pati NC, Garai Shilpa, Hossain Mainul, Layek GC, Pal Nikhil. Fear induced multistability in a predator–prey model. *Int J Bifurcation Chaos* 2021;31(10):2150150.

COMPUTATIONAL SIMULATION OF INTERNAL HYDRAULIC JUMP AND FLOODING IN STRATIFIED GAS-LIQUID TWO-PHASE FLOW

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ABSTRACT

The present work investigates the internal hydraulic jump in stratified gas-liquid two-phase flow where incoming liquid is in supercritical state (Froude number greater than unity). The flow is considered to occur in countercurrent configuration through closed channels where flooding phenomenon is prominent. High-fidelity numerical simulation based on computational fluid dynamics (CFD) algorithm, using freely available software GERRIS, is employed to analyze complex yet fascinating dynamics of multiphase flow in the vicinity of internal hydraulic jump, where analytical approaches encounter singularities. Computational simulations reveal that the formation of oscillatory jumps of high strength triggers flooding in countercurrent flow. The onset of flooding is computationally modeled by tracking the evolution of interfacial waves using volume of fluid method coupled with height function technique. The velocity distributions obtained from the simulation are analyzed which indicates flow reversal in the liquid phase near the interface. This work demonstrates the necessity of numerical simulations to capture the nonlinear mechanisms underpinning flooding in countercurrent flow.

Keywords: Computational fluid dynamics, internal hydraulic jump, flooding, gas-liquid flow.

MS Classification 2020:76T10, 76M12

References:

1. M. Dhar, S. Ray, G. Das, P. K. Das, Internal hydraulic jump in plane Poiseuille two-layer flow: Theoretical, numerical and experimental study, *J. Fluid Mech.* 2021, 912, A45.
 2. M. Dhar, G. Das, P. K. Das, Planar hydraulic jumps in thin film flow, *J. Fluid Mech.* 2020, 884, A11.
 3. M. Gargallo, T. Schulenberg, L. Meyer, E. Laurien, Counter-current flow limitations during hot leg injection in pressurized water reactors, *Nucl. Eng. Des.* 2005, 235, 785.
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COMPLEX SADIK INTEGRAL TRANSFORM OF LINEAR VOLTERRA INTEGRO-DIFFERENTIAL EQUATIONS OF SECOND KIND

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ABSTRACT

Abstract: When we transform an initial value problem into an integral equation, Volterra integral equations form. Compared to the starting value problem, the Volterra integral equation is much simpler to solve as a significant subclass of integral equations, numerous academics and mathematicians focus on Volterra integral equations to provide approximate or precise solutions. Recently, mathematics scientists have turned their attention to using the integral transform to solve issues in a variety of scientific domains, including engineering and mathematical sciences. The fundamental problem is reduced to a simpler algebraic equation using the complex transform. This paper utilizes the complex Sadik transform to track down the specific answer for the second kind of linear Volterra integrodifferential equation. After that, the solution to this fundamental problem can be found by solving this equation and using the complex Sadik transform's inverse. Through real-world examples, complex Sadik integral transform's effectiveness and capacity to deliver a precise solution with the least number of calculations are shown.

Keywords:Complex Sadik integral transform, inverse complex Sadik integral transform, volterra Integral equation of second kind.

EXPONENTIAL STABILITY OF VISCOELASTIC MATERIALS COUPLED WITH A THERMAL EFFECT

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ABSTRACT

We study the vibrations of an inhomogeneous viscoelastic materials of Kelvin-Voigt type coupled with a heat conduction governed by a simple modification of Cattaneo's law. The well-posedness of the system is shown using the semigroup theory. The uniform stabilization of the system is established by means of an explicit form of exponential energy decay estimate with the help of a suitable Lyapunov functional of the system.

Keywords: Cattaneo's law; Exponential stability; Lyapunov functional; Inhomogeneous flexible structure.

MS Classification 2020:35B40, 35L05, 74K10

References:

1. Alves, M. S, Gamboa, P, Gorain, G. C, Rambaud, A, Vera, O. Asymptotic behavior of a flexible structure with Cattaneo type of thermal effect. *Indagationes Mathematicae*, 27(3), pp. 821-834, (2016).
 2. Carlson, D. E. Linear thermoelasticity. In *Linear Theories of Elasticity and Thermoelasticity Linear and Nonlinear Theories of Rods, Plates, and Shells*. Berlin, Heidelberg: Springer Berlin Heidelberg pp. 297-345, (1973).
 3. Liu, K, Liu, Z. Exponential decay of energy of the Euler–Bernoulli beam with locally distributed Kelvin–Voigt damping. *SIAM journal on control and optimization*, 36(3), pp. 1086-1098, (1998).
 4. Pazy, A. Applications to partial differential equations—Linear equations. *Semigroups of Linear Operators and Applications to Partial Differential Equations*, pp. 206-229, (1983).
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AN INNOVATIVE PERSPECTIVE ON ROTATIONAL DYNAMICS IN FINANCIAL NETWORKS WITH INTERLINKED VOLATILITY AND ASSET FLUCTUATIONS

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ABSTRACT

This study introduces an innovative application of traditional directional statistics to capture the cross-correlation of asset volatility within financial networks. The newly developed Circular Volatility Model (CVM) serves as a comprehensive framework for analyzing the interdependencies among financial assets whose returns follow periodic patterns. By integrating classical volatility models into a circular paradigm, the study unveils fresh insights into the cyclical nature of market dynamics. Grounded in fundamental principles of directional statistics, the model employs von Mises distributions for parameter estimation and introduces novel circular covariance structures. The paper presents formal derivations, maximum likelihood estimation procedures, and a unique goodness-of-fit testing approach tailored for this circular model. The proposed methodologies are validated through extensive simulation studies.

Keywords: Circular Volatility Model, Von Mises distribution Financial networks, Volatility modeling, Maximum Likelihood Estimation (MLE).

MS Classification 2020: 62H11, 62P05.

References:

1. Fisher, N. I., & Lee, A. J. (1994). Time Series Analysis of Circular Data. *Journal of the Royal Statistical Society Series B: Statistical Methodology*, 56(2), 327-339.
 2. Mardia, K. V., & Voss, J. (2014). Some Fundamental Properties of a Multivariate von Mises Distribution. *Communications in Statistics - Theory and Methods*, 43(6), 1132-1144.
 3. Gai, P., & Kapadia, S. (2010). Contagion in Financial Networks. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 466(2120), 2401-2423.
 4. Haldane, A. G., & May, R. M. (2011). Systemic Risk in Banking Ecosystems. *Nature*, 469(7330), 351-355.
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APPROXIMATION SCHEME BASED ON ORTHONORMAL POLYNOMIAL WAVELETS FOR SINGULAR INTEGRAL EQUATIONS WITH CAUCHY KERNEL

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ABSTRACT

This paper presents an efficient approximation scheme utilizing orthonormal polynomial wavelets for solving singular integral equations with Cauchy kernels over a finite interval. By employing the Galerkin method, the proposed approach transforms the original singular integral equation into a system of algebraic equations involving the unknown coefficients of the wavelet basis functions. The orthonormal polynomial wavelets offer excellent localization properties, improving computational efficiency and solution accuracy. The performance and convergence of the method are demonstrated through numerical examples, highlighting its capability to effectively handle singularities inherent in Cauchy kernel-based equations.

Keywords: Tumor growth, chemo-mechanical coupling, Blatz-Ko hyperelastic model, numerical simulation.

MS Classification 2020:35, 74, 92

References:

1. Nikola Muskhelishvili. Singular integral equations: boundary problems of function theory and their application to mathematical physics.
 2. Ivan Kuzmich Lifanov. Singular integral equations and discrete vortices. Walter de Gruyter GmbH & Co KG, 2018.
 3. C Corduneanu. Integral equations and applications, 1991.
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EXPLORATION OF BUBBLING PHENOMENA IN AN ECOLOGICAL SYSTEM INFLUENCED BY DOUBLE ALLEE EFFECT

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ABSTRACT

The present research work investigates a two-dimensional continuous-time predator-prey model that includes a density-dependent predator mortality factor influenced by a double Allee effect. The model is analyzed both analytically and numerically, with emphasis on how the Allee effect and density-dependent mortality influence the system dynamics. The findings indicate the potential for bi-stability, where two stable states coexist, and even tri-stability, marked by two stable coexistence equilibria and a stable predator-free state. The study also delves into ecological phenomena such as bubbling and hydra effects, which emerge due to the double Allee effect. Bubbling cycles, showing alternating amplitude growth and decline, are explored in detail. Local bifurcations are systematically identified through one- and two-parameter bifurcation diagrams. A sensitivity analysis assesses the impact of key parameters on species biomass balance. Numerical simulations also reveal a variety of bifurcation structures. In the growth of predators, the Allee effect parameter functions as a control parameter that may induce or suppress oscillations. Ultimately, this work introduces a novel temporal framework capturing both bubbling and hydra effects, offering new insights into the dynamics of ecological systems influenced by double Allee effect.

Keywords: Computational biology, Stability and bifurcation, Hydra effect, Sensitivity analysis.

MS Classification 2020: 34A34, 34C60, 37G35, 37N25

References:

1. W. C. Allee; *Animal Aggregations, A Study in General Sociology*, University of Chicago Press, Chicago (1931).
2. N. Chitnis, J. M. Hyman, J. M. Cushing; Determining important parameters in the spread of malaria through the sensitivity analysis of a mathematical model, *Bulletin of Mathematical Biology*, Vol.70, 1272-1296 (2008).
3. L. Perko; *Differential Equations and Dynamical Systems*, Springer (2013).
4. G. Mandal, Sukanya Das, L.N. Guin, S. Chakravarty; Dynamic response of a system of interactive species influenced by fear and Allee consequences, *The European Physical Journal Plus*, Vol. 138(7), 1-36 (2023).
5. Sukanya Das, G. Mandal, L.N. Guin, S. Chakravarty; Diverse Bifurcation Structures and Multi-Stability in Interacting Species Dynamics, *International Journal of Biomathematics* (2025) ISSN 1793-5245 (print); ISSN 1793-7159 (online) [<https://doi.org/10.1142/S1793524525500226>]

UNSTEADY MIXED CONVECTION HOMANN NON-AXISYMMETRIC STAGNATION-POINT FLOW

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ABSTRACT

This research explores the unsteady mixed convection of non-axisymmetric Homann stagnation point flow and its heat transfer characteristics for an incompressible viscous fluid over a rigid plate, while accounting for a time-varying free stream. By employing an appropriate similarity transformation, the governing partial differential equations are converted into a system of nonlinear ordinary differential equations with defined boundary conditions. The fourth-order Runge-Kutta method is utilized to numerically solve these equations via a shooting technique. The similarity solution contains the important physical dimensionless parameters like the shear to strain rate parameter $\gamma(\gamma = \frac{b}{a})$, where a and b are the strain rate and shear rate of the stagnation point flow respectively), mixed convection parameter λ and the unsteady parameter ω . First, we have investigated the case for forced convection ($\lambda = 0$), which emerges from the singularity at $\gamma = \pm 1$ and in that case, we can say that the unsteady parameter ω affects the behavior of the solution. The investigation focuses on the numerical and asymptotic solutions for large γ , λ and ω . We found that, in the case of large γ and large λ , the leading term of the solutions remain unaffected by the unsteady parameter ω .

Keywords: Mixed convection, Stagnation point flow, Buoyancy forces, forced convection

MS Classification 2020:76D05, 35Q30.

References:

1. Weidman, P. D. (2012). Non-axisymmetric Homann stagnation-point flows. *Journal of Fluid Mechanics*, 702, 460-469.
2. Lok, Y. Y., Merkin, J. H., & Pop, I. (2017). Mixed convection non-axisymmetric Homann stagnation-point flow. *Journal of Fluid Mechanics*, 812, 418-434.
3. Mahapatra, T. R., & Sidui, S. (2017). Unsteady heat transfer in non-axisymmetric Homann stagnation-point flows. *Zeitschrift für angewandte Mathematik und Physik*, 68(2), 32.

A COMPARATIVE ANALYSIS OF SIMILARITY MEASURES ON NEUTROSOPHIC SETS: JACCARD, COSINE, AND EUCLIDEAN-BASED NORMALIZED APPROACHES

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ABSTRACT

The article deals with similarity measures on single-valued neutrosophic sets (SVNS), which are generalizations of fuzzy and intuitionistic fuzzy sets having three components of membership: truth (T), indeterminacy (I), and falsity (F). Three measures were considered in this article viz - Jaccard, Cosine and Euclidean-Based Normalized, satisfying circumstances under uncertainty, inconsistency, and indecision, where neutrosophic sets can be very much suitable for real-world scenarios like medical diagnosis and multi-criteria decision-making. The article discusses about the major drawbacks of classical indices such as Jaccard and cosine similarity, which overlook finer differences especially in indeterminacy and falsity components. By focusing on all three components equally, one achieves a very balanced, interpretable evaluation of similarity. The measure was applied to synthetic diagnostic data on 20 Type 2 diabetic patients to prove its efficiency. The results state that the traditional measures, in fact, render high similarity scores almost all the time, irrespective of significant level changes. On the other side, the Euclidean-Based Normalized measurement, in this paper captures subtle differences that mostly come into play with minute shifts in indeterminacy ignored by other forms discussed in this article. The study indeed highlights the necessity to look into better similarity measures in neutrosophic scenarios and offers a solid and applicable approach for researchers and practitioners. Future work will explore extending this approach to interval and multi-valued neutrosophic sets and embedding it in an intelligent decision-support system.

Keywords: Neutrosophic Sets, Similarity Measure, Uncertainty Modeling, Medical Diagnosis, Decision-Making Systems.

MATHEMATICAL MODELLING OF TRANSDERMAL DRUG DELIVERY USING A HOLLOW MICRONEEDLE

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ABSTRACT

This study uses a microneedle (MN) array to conduct a detailed analytical analysis of transdermal medication administration. Prior to being absorbed in the blood compartment, the medication released from the MN tip diffuses throughout the viable skin. The reversible specific drug binding with its receptors in the tissue compartment as well as the reversible uptake kinetics between the blood and tissue compartments have been considered. Analytical solutions are found for the governing equations. Simulations demonstrate that selective binding, irreversible absorption, and metabolism in live skin stabilise the concentrations of both free and bound verapamil. The effect of metabolism on viable skin cannot be ruled out in the current study. Optimising the design of the MN array requires precise determination of the effects of numerous aspects, such as the length of the MN, the area of the skin-blood interface, and the different transport characteristics of drug-using MNs. Our results are in good agreement with recent findings reported in the literature.

Keywords: hollow microneedle, drug binding, metabolism, computer simulation.
MS Classification 2020: 34,35.

ON GENERALIZED η DUALS OF COMPLEX UNCERTAIN SEQUENCE SPACES

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ABSTRACT

In this paper, we develop the concept of the generalized η -dual within the framework of uncertainty normed spaces. Using an uncertainty measure in the sense of Liu, we extend classical duality notions to spaces of uncertain functions. The uncertain η -dual is defined via an integral-based norm, generalizing the L^p -norm structure. We establish key properties such as linearity, boundedness, and dual inclusion, and illustrate these with examples. This study contributes to the foundational theory of duals in uncertainty theory and opens avenues for further applications in complex uncertain sequence spaces.

ON s -VERTEX METRIC DIMENSION

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ABSTRACT

Let $G = (V, E)$ be a connected graph, a resolving set $S \subseteq V$, such that for every pair of distinct vertices $x, y \in V$, there exists at least a vertex $w \in S$ such that $d(x, w) \neq d(y, w)$. A metric basis is a minimum cardinality of a resolving set. The cardinality of the metric basis is called the metric dimension, denoted by $dim(G)$. In this article, we have introduced a new variant of metric dimension known as the s -vertex metric dimension and studied their properties for basic graph families.

Keywords: Resolving set; metric dimension; metric basis; s -vertex metric dimension.

MS Classification 2020:05C10, 05C12, 05C38

References:

1. Slater, P.J., 1975. Leaves of trees, *Congressus Numerantium*.
 2. Khuller, S., Raghavachari, B. and Rosenfeld, A., 1996. Landmarks in graphs. *Discrete applied mathematics*, 70(3), pp.217-229.
 3. Melter, R.A. and Tomescu, I., 1984. Metric bases in digital geometry. *Computer vision, graphics, and image Processing*, 25(1), pp.113-121.
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FAULT-TOLERANT METRIC DIMENSION OF THE BARYCENTRIC SUBDIVISION OF ZERO-DIVISOR GRAPHS ASSOCIATED WITH A COMMUTATIVE RING

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ABSTRACT

Let R be a commutative ring with unity 1, and let $G(V, E)$ be a simple, connected, nontrivial graph. The zero-divisor graph of a ring R is denoted by $\Gamma(R) = (V(\Gamma(R)), E(\Gamma(R)))$, where the vertex set $V(\Gamma(R))$ consists of all the non-zero zero-divisors of R , and the edge set $E(\Gamma(R))$, is defined as follows: $E(\Gamma(R)) = \{ @ = p_1 p_2 p_1 p_2 | p_1 \cdot p_2 = 0 \} \text{ and } p_1, p_2 \in V(\Gamma(R)) \}$. The barycentric subdivision of a graph Γ is the process of subdividing each edge by inserting a new vertex in the graph Γ . We are interested in finding the fault-tolerant metric dimension of the barycentric Subdivision of the zero-divisor graph $\Gamma(z_n)$ for $q > 2p - 1$, which is denoted by $fdim(BS(\Gamma(Z_n)))$. Additionally, we aim to prove that $fdim(BS(\Gamma(Z_n))) \geq q - 1$ for every $n = pq$, where p and q are distinct primes and $q > p$.

Keywords: Zero divisor graph; barycentric subdivision; resolving set; metric basis; fault-tolerant metric dimension.

MS Classification 2020: 05C12; 05C25

References:

1. Anderson, D. F., Axtell, M. C., & Stickles, J. A. (2011). Zero-divisor graphs in commutative rings. *Commutative Algebra: Noetherian and non-Noetherian perspectives*, 23-45.
2. Beck, I. (1988). Coloring of commutative rings. *Journal of Algebra*, 116(1), 208-226.
3. Hernando, C., Mora, M., Slater, P. J., & Wood, D. R. (2008). Fault-tolerant metric dimension of graphs. *Convexity in Discrete Structures*, 5, 81-85.

***F*-CONTRACTIONS ON ORTHOGONAL METRIC SPACES**

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ABSTRACT

In this paper, we derive fixed point results in orthogonal metric spaces based on the concept of an almost generalized *F*-contraction on the orthogonal sets. Our results extend numerous recent findings. Additionally, we provide an application related to second order differential equations to analyze the dynamics of a spring.

Keywords: Fixed point, *F*-Contraction, orthogonal metric space, Cauchy sequence.

MS Classification 2020: 47H10, 54H25.

References:

1. M. Eshaghi Gordji, M. Ramezani, M. De La Sen and Y. J. Cho, On orthogonal sets and Banach fixed point theorem, *Fixed Point Theory*, 18(2017), 569-578.
 2. K. Sawangsup, W. Sintunavarat and Y. J. Cho, Fixed point theorems for orthogonal *F*-contraction mappings on *O*-complete metric spaces, *J. Fixed Point Theory Appl.*, 22:10(2020), 1-14.
 3. D. Wardowski, Fixed point of a new type of contractive mappings in complete metric spaces, *Fixed point Theory Appl.*, 94 (2012), 1-6.
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PRICING OPTIMIZATION FOR SUSTAINABLE DUAL-CHANNEL SUPPLY CHAINS WITH VALUE-ADDED RETAIL SERVICES

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ABSTRACT

In today's digital age, the widespread use of electronic devices has significantly shifted consumer behaviour toward online shopping. Consequently, manufacturers are increasingly considering the integration of online platforms alongside their traditional retail channels. Retailers now offer services to compete with customers' growing preference for online markets. Demand rates are modelled as linear functions of selling prices (both retail and online), green level and the level of retail service. This study investigates a centralized model and decentralized models using both analytical and numerical approaches to determine optimal outcomes. Additionally, a sensitivity analysis examines the impact of essential parameters. The insights gained from this research are valuable for supply chain members. For instance, if the cost coefficient of retail service can be reduced, it leads to an increase in the optimal level of service and the overall profits for all members.

Keywords:Dual channel; Supply chain; Retail service; Green innovation.

MS Classification 2020: 90B05; 90B06; 91A06.

References:

1. Pal, B., & Sarkar, A. (2022). Effects of green improvement and pricing policies in a double dual-channel competitive supply chain under decision-making power strategies. *RAIRO: Operations Research*, 56(2), 931–953.
 2. Rofin, T. M., & Mahanty, B. (2018). Optimal dual-channel supply chain configuration for product categories with different customer preference of online channels. *Electronic Commerce Research*, 18(3), 507–536.
 3. Tsay, A., Agrawal, N., (2004). Channel conflict and coordination in the e-commerce age. *Production and Operations Management* 13 (1), 93–110.
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A COMPARATIVE ANALYSIS OF DRINKING WATER QUALITY AT RAILWAY STATIONS IN TRIPURA USING TOPSIS, VIKOR, AND A PCA-BASED ROBUST RANKING METHOD

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ABSTRACT

Effective ranking of alternatives in multi-criteria decision-making (MCDM) problems is vital across disciplines such as engineering, economics, and the social sciences. This study employs two well-established MCDM techniques—TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) and VIKOR (VlseKriterijumska Optimizacija I Kompromisno Resenje)—to assess the drinking water quality at 27 railway stations in Tripura, India. A total of 13 water quality parameters were initially considered; however, Principal Component Analysis (PCA) revealed that only 5 parameters, were statistically significant. These 5 key parameters were subsequently used for ranking the railway stations through both TOPSIS and VIKOR methods. To evaluate the consistency between the two ranking methods, Spearman's rank correlation coefficient was calculated and found to be close to zero, indicating a lack of correlation. In response to this discrepancy, a new approach—Robust Ranking Method (RRM)—is proposed. RRM integrates the 5 significant parameters using a linear combination, with PCA-derived eigenvalues as weights, to provide a more stable and interpretable ranking of drinking water quality across the stations. The proposed methodology offers a novel and reliable framework for environmental quality assessment in multi-criteria contexts.

Keywords: Spatial Statistics, Transport Problems, Sustainable Development Goal (SDG)s, Multi-Criteria-Decision-Making Problems.

MS Classification 2020: 62-11, 90-08.

References:

1. Amudha, M., Ramachandran, M., Saravanan, V., Anusuya, P., & Gayathri, R. (2021). A study on TOPSIS MCDM techniques and its application. *Data Analytics and Artificial Intelligence*, 1(1), 09-14.
2. Opricovic, S. (1998). Multicriteria optimization of civil engineering systems. *Faculty of civil engineering, Belgrade*, 2(1), 5-21.
3. Roy, S., Singh, W. S., Manna, K., Maiti, D., Majumder, D., Modak, S., ... & Mitra, S. (2023). Assessing and modelling drinking water quality at the railway stations of Tripura, India, with a possible strategic solution. *Arabian Journal of Geosciences*, 16(2), 98.

A COMPARATIVE STUDY OF METAHEURISTICS ALGORITHMS THROUGH TYPE-1 TOURNAMENT IN BRIDGE DESIGN OPTIMIZATION PROBLEMS

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ABSTRACT

The tournamenting process has emerged as an effective strategy for developing hybrid metaheuristic algorithms in recent years. In this study, four novel hybrid algorithms are formulated using a tournament-based approach, integrating four well-established metaheuristics: Teaching-Learning-Based Optimization (TLBO), Embedded Cuckoo Search (ECS), Social Group Optimization (SGO), and Honey Badger Algorithm (HBA). The resulting algorithms **T1-TLBO**, **T1-ECS**, **T1-SGO**, and **T1-HBA** are applied to solve structural optimization problems. The performance of the proposed methods is evaluated through numerical comparisons against several state-of-the-art metaheuristic algorithms. Additionally, to assess the statistical significance of the results, two nonparametric statistical tests (e.g., Wilcoxon rank-sum and Friedman tests) are conducted. The findings demonstrate the efficacy of the tournament-based hybridization approach, providing valuable insights into algorithm selection for structural optimization problems.

Keywords: Spatial Statistics, Transport Problems, Sustainable Development Goal (SDG)s, Multi-Criteria-Decision-Making Problems.

MS Classification 2020: 62-11, 90-08.

References:

1. Amudha, M., Ramachandran, M., Saravanan, V., Anusuya, P., & Gayathri, R. (2021). A study on TOPSIS MCDM techniques and its application. *Data Analytics and Artificial Intelligence*, 1(1), 09-14.
2. Opricovic, S. (1998). Multicriteria optimization of civil engineering systems. *Faculty of civil engineering, Belgrade*, 2(1), 5-21.
3. Roy, S., Singh, W. S., Manna, K., Maiti, D., Majumder, D., Modak, S., ... & Mitra, S. (2023). Assessing and modelling drinking water quality at the railway stations of Tripura, India, with a possible strategic solution. *Arabian Journal of Geosciences*, 16(2), 98.

DEVELOPMENT OF AN EFFICIENT MACHINE LEARNING ALGORITHM TO DETECT BREAST CANCER

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ABSTRACT

Breast Cancer is one of the most common forms of cancer in women. According to the World Cancer Report breast cancer accounts for about 22.9% of diagnosed cancers and 13.7% of cancer related deaths. Presently screening mammogram is the most frequently used non-invasive imaging technique for early detection of cancerous lumps. The lumps present in the breast can be broadly divided into two kinds-one which is cancerous (malignant) and the other which is non-cancerous (benign). To address this public health issue, the study examines the performance of different machine learning algorithms for data classification. The purpose of this study is to discuss the accuracy and efficiency of predicting the occurrence of breast cancer in individuals based on input variables which can be used as a diagnostic aid by the medical community.

Keywords: Optimization Techniques, Sensitivity, Specificity, Accuracy, Clinical Trials.

MS Classification 2020: 62P10, 90-08.

References:

1. A. Jemal, R. Siegel, E. Ward, Y. Hao, J. Xu, T. Murray, and M. J. Thun, "Cancer statistics, 2008," *CA: a cancer journal for clinicians*, vol. 58, no. 2, pp. 71–96, 2008.
 2. S. B. Faisal, S. A. Mustafa, I. K. Mohammed, and M. A. Maha, "Breast cancer decisive parameters for Iraqi women via data mining techniques," *Journal of Contemporary Medical Sciences*, vol. 5, pp. 260–264, 2019.
 3. S. F. Khorshid, A. M. Abdulazeez, and A. B. Sallow, "A comparative analysis and predicting for breast cancer detection based on data mining models," *Asian Journal of Research in Computer Science*, vol. 8, no. 4, pp. 45–59, 2021.
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AN ECO-EPIDEMIOLOGICAL MODEL INCORPORATING MUTUAL INTERFERENCE AND NONLINEAR HARVESTING IN PREDATORS

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ABSTRACT

This study presents a mathematical model of a prey-predator system in which a contagious disease affects only the prey population. The predator-prey interaction is described using a generalized Holling type II functional response that incorporates mutual interference among predators. The model also includes a nonlinear harvesting term applied to the predator population. We perform a comprehensive analytical investigation, establishing the positivity and boundedness of solutions, and explore both local and global stability of the system's equilibria. Numerical simulations are conducted to support the analytical results, revealing the presence of Hopf bifurcation. The analysis highlights the significant influence of mutual interference and harvesting strategies on the system's dynamic behavior and the transmission of disease within the prey population.

Keywords: Eco-epidemic model, Mutual interference, Harvesting, Stability analysis, Hopf-bifurcation.

MS Classification 2020: 92Bxx, 92D30.

References:

1. Anderson, R.M., May, R.M.: Regulation and stability of host-parasitic population interactions: I. Regulatory process. *J. Animal Ecol.* 47, 219–247 (1978)
2. Hader, K.P., Freedman, H.I.: Predator-prey populations with parasitic infection. *J. Math. Bio.* 27(6), 609–631 (1989).
3. Chattopadhyay, J., Srinivasu, P.D.N., Bairagi, N.: Pelican at risk in Salton sea—an eco-epidemiological model-II. *Ecol. Model.* 167, 199–211 (2003).

ITERATIVE APPROACH TO CAYLEY VARIATIONAL INCLUSION WITH LOGICAL OPERATIONS

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ABSTRACT

In this article, we introduce and study a generalized Cayley variational inclusion problem incorporating XOR and XNOR operations. We establish an equivalent fixed-point formulation and demonstrate the Lipschitz continuity of the generalized Cayley approximation operator. Furthermore, we analyze the existence and convergence of the proposed problem using an implicit iterative algorithm. The iterative algorithm and numerical results presented in this study significantly enhance previously known findings in this domain. Finally, a numerical result is provided to support our main result and validate the proposed algorithm using MATLAB programming.

Keywords: Algorithm; Numerical result; Resolvent operator; XOR and XNOR operations; Cayley approximation operator.

MS Classification 2020: 47H05; 49H10; 47J25.

References:

1. Hassouni, A.; Moudafi, A. A perturbed algorithm for variational inclusions. *J. Math. Anal. Appl.* 1994, 185, 706–712.
 2. Noor, M.A. Generalized set-valued variational inclusions and resolvent equations. *J. Math. Anal. Appl.* 1998, 228, 206–220.
 3. Ahmad, I.; Irfan, S.S.; Farid, M.; Shukla, P. Nonlinear ordered variational inclusion problem involving XOR operation with fuzzy mappings. *J. Inequal. Appl.* 2020, 36.
 4. Ahmad, I.; Pang, C.T.; Ahmad, R.; Ishtyak, M. System of Yosida inclusions involving XOR-operation. *J. Nonlinear Convex Anal.* 2017, 18, 831–845.
 5. Iqbal, J.; Rajpoot, A.K.; Islam, M.; Ahmad, R.; Wang, Y. System of Generalized Variational Inclusions Involving Cayley Operators and XOR-Operation in q -Uniformly Smooth Banach Spaces. *Mathematics* 2022, 10, 2837.
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UNIFORM CONVERGENCE OF DISTANCE FUNCTIONALS ON BORNOLGY UNDER REMETRIZATION

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ABSTRACT

Let (X, d) be a metric space and $CL(X)$ be the collection of all nonempty closed subsets of X . Then $\{(d, A : A \in CL(X))\}$ denotes the collection of all distance functionals on (X, d) . We equipped the collection $\{(d, A : A \in CL(X))\}$ with the topology of uniform convergence on the member of a bornology S on (X, d) . Since $CL(X)$ have a natural embedding with $\{(d, A : A \in CL(X))\}$, we get a new hyperspace topology, denoted by $\tau_{S,d}$ on $CL(X)$. In particular cases, it reduces to some popular hyperspace topologies such as Wijsamn, Attouch-Wets, and Hausdorff metric topologies. As customary to hyperspaces, $\tau_{S,d}$ can be decomposed into upper and lower topologies. For more on $\tau_{S,d}$, refer [1,2,3]. In this talk, our main aim is to look for the conditions under which the upper topology $\tau_{S,d}^+$ becomes invariant under a remetrization of the underlying space. To see this, we first talk of some existing results. Following, we introduce a new covering property of bornology S which characterizes the invariance of topology $\tau_{S,d}^+$ under a remetrization.

Keywords: Wijsman topology, Attouch-Wets topology, Hausdorff metric topology, Bornology.

MS Classification 2020: 54B20, 54A10, 54E35, 46A17.

References:

1. Agarwal Y, Jindal V. Set Convergences via bornology. Set-Valued and Variational Analysis. 2025 Mar;33(1):1.
 2. Agarwal Y, Jindal V. Set convergences and uniform convergence of distance functionals on a bornology. Rocky Mountain Journal of Mathematics. 2025, to appear.
 3. Beer G, Naimpally S, Rodríguez-López J. S-topologies and bounded convergences. Journal of Mathematical Analysis and Applications. 2008 Mar 1;339(1):542-52.
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ON NEIGHBOURHOOD STATISTICAL CONVERGENCE FOR SEQUENCE OF FUNCTIONS IN TOPOLOGICAL SPACE

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ABSTRACT

This study generalizes a novel concept of convergence for sequences of functions derived under the context of topological spaces. The investigation begins with the introduction of two new operators, $\diamond_{f(x)}^-$ and $\diamond_{f(x)}^+$, which are designed to analyse the local behaviour of a sequence of function $\langle f_n(x) \rangle$ that converges around a point $f(x)$ within a neighbourhood structure. Several key properties of these operators are discovered. Using these properties, the study introduces a new way to define statistical convergence for sequences of functions in topological spaces included with some new definition, theorems and counterexamples.

Keywords: Sequence of function, Statistical convergence, Statistical limit of sequence of function, Pointwise convergence.

MS Classification 2020: 40A30, 54A20.

References:

1. H. Fast, Sur la convergence statistique, In Colloquium mathematicae, 2(3-4), 241-244, (1951).
 2. B. Inan, M. Küçükaslan, Ideal convergence of sequence of sets, Contem. Anal. Appl. Math., 3(2), 184-212, (2015).
 3. S. Yegul, E. Dundar, On statistical convergence of sequence of functions in 2-normed spaces, Journal of Classical Analysis, 10(1), 49-57, (2017).
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STATISTICAL CONVERGENCE FOR SEQUENCES OF SETS VIA TOPOLOGICAL NEIGHBOURHOODS

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ABSTRACT

This paper explores the concept of statistical convergence with respect to topological neighbourhoods for sequences of subsets in a topological space (X, τ) . We investigate various properties related to this notion, establishing several theorems and providing counterexamples to illustrate the limitations of the theory. Furthermore, we apply the δ_0 -intersection property of statistically compact spaces to these sequences of subsets, demonstrating its relevance and implications within this framework.

Keywords: Statistical convergence, sequence of sets, Neighbourhood convergence.

MS Classification 2020: 40A30, 54A20.

References:

1. R. Engelking, General Topology, Sigma Series in Pure Mathematics, Revised and complete ed. Berlin: Heldermann. (1989).
 2. B. Inan, M. Küçükaslan, Ideal convergence of sequence of sets, Contem. Anal. Appl. Math., 3(2), 184-212, (2015).
 3. G. D. Maio, L. D. R. Kočinac, Statistical Convergence in Topology, Topology and its applications, 156, 28-45, (2008).
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FOUNDATIONS AND FRAMEWORK OF SUPERHYPERSOFT SETS

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ABSTRACT

Superhypersoft sets (SHSS) represent an advanced extension of soft sets and hypersoft sets, designed to address complex multi-parameterized decision-making problems in uncertain environments. This study explores the foundational theories of soft set and hypersoft set models, leading to the formulation of SHSS as a more generalized and flexible framework for managing intricate data structures. We define key operations and properties of SHSS and establish their basic algebraic laws. The findings show that SHSS improves the mathematical abilities of existing soft set models by adding more structural complexity, which makes them suitable for complicated classification and decision-support systems. Even with such potential, SHSS is still a relatively new field with many undiscovered research possibilities, such as formalization of basic operations, discussion of basic algebraic laws, algorithmic implementations and real-world applications in different fields. This study inspires more developments in soft set theory and uncertainty modeling by establishing the foundation for future research into the theoretical and applied aspects of SHSS.

Keywords: Soft set, Hypersoft set, Superhypersoft set.

MS Classification 2020: 03E72, 03B52, 06D72, 68T37.

References:

1. Molodtsov, D. (1999). Soft set theory—First results. *Computers & Mathematics with Applications*, 37(4-5), 19–31. [https://doi.org/10.1016/S0898-1221\(99\)00056-5](https://doi.org/10.1016/S0898-1221(99)00056-5)
 2. Saeed, M., Ahsan, M., Siddique, M. K., & Ahmad, M. R. (2020). A study of the fundamentals of hypersoft set theory. *Infinite Study*.
 3. Smarandache, F. (2024). Foundation of superhyperstructure & neutrosophic superhyperstructure. *Neutrosophic Sets and Systems*, 63, 367-381.
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FIXED POINTS THEOREMS ON NEUTROSOPHIC FUZZY RECTANGULAR METRIC SPACES

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ABSTRACT

This research introduces an innovative concept known as “neutrosophic fuzzy rectangular metric space,” which enhances the conventional metric space framework by integrating the idea of neutrosophic fuzzy sets. A comprehensive study has been carried out on various structural and topological characteristics within this newly formulated generalization of metric space. We propose fixed point theorems related to nonlinear contractions, located within the intricate framework of neutrosophic fuzzy neutrosophic metric spaces. Additionally, we demonstrate several fixed point results that are relevant to this particular context.

Keywords: Fixed point, Neutrosophic fuzzy metric space, Nonlinear contractions, Neutrosophic fuzzy rectangular metric space.

MS Classification 2020: 47H10, 54H25, 30G35, 47J25.

References:

1. Kirişci, M., & Şimşek, N. (2020). Neutrosophic metric spaces. *Mathematical Sciences*, 14(3), 241-248.
 2. Ghosh, S., Sonam, Bhardwaj, R., & Narayan, S. (2024). On neutrosophic fuzzy metric space and its topological properties. *Symmetry*, 16(5), 613.
 3. Kannan, R. (1969). Some results on fixed points—II. *The American Mathematical Monthly*, 76(4), 405-408.
 4. Banach, S. (1922). Sur les operations dans les ensembles abstraits et leur applications aux equations integrals. *Fundamenta mathematicae*, 3(1), 133-181.
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SHEAR-HORIZONTAL WAVE DYNAMICS IN SMART FIBER COMPOSITES WITH LAYERWISE INTERFACIAL IMPERFECTIONS

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ABSTRACT

In this study, the propagation behavior of shear-horizontal (SH) waves in a tri-layered smart composite structure including a piezoelectric fiber-reinforced composite (PFRC) core, flanked by a fiber-reinforced composite (FRC) layer and a piezoelectric layer is investigated. A major development of this study is the addition of imperfect interfacial effects, providing a more realistic model of multilayered composite systems. Analytically generated and numerically investigated, the dispersion relation for SH waves is obtained by stating the governing equations and using suitable boundary conditions. The impacts of interfacial bonding parameters and layer thickness ratios on SH wave phase velocity are investigated in depth parametrically. Results show that wave propagation is highly influenced by interfacial properties and geometric configurations, therefore stressing important design issues for uses in structural health monitoring, energy harvesting, and non-destructive evaluation. For advanced multilayer composite systems, our study offers a unique analytical structure and insightful design ideas.

Keywords: SH-wave propagation, Fiber-reinforced composite (FRC), Piezoelectric fiber-reinforced composite (PFRC), Piezoelectric layer, Wave speed.

MS Classification 2020: 35A18, 35L05, 74J05.

References:

1. Abhishek Kumar Singh, Pragati Rajput, Sayantan Guha, and Sonam Singh (2022). Propagation characteristics of love-type wave at the electro-mechanical imperfect interface of a piezoelectric fiber-reinforced composite layer overlying a piezoelectric half-space. *European Journal of Mechanics-A/Solids*, 93:104527.
2. Sayantan Guha and Abhishek Kumar Singh (2021) Plane wave reflection/transmission in imperfectly bonded initially stressed rotating piezothermoelastic fiber-reinforced composite half-spaces. *European Journal of Mechanics-A/Solids* 88:104242.
3. Sharmistha Rakshit, Amrita Das, Kshitish Ch, Mistri and Anirban Lakshman, (2022) Effect of interfacial imperfections on sh-wave propagation in a porous piezoelectric composite. *Mechanics of Advanced Materials and Structures* 29(25):4008–4018.
4. Das Amrita, Singh Abhishek Kumar, Patel Prajnaya Parimita, Kshitish Ch, Mistri, and Amares Chattopadhyay, (2019) Reflection and refraction of plane waves at the loosely bonded common interface of piezoelectric fibre-reinforced and fibre-reinforced composite media. *Ultrasonics* 94:131–144.

Different Types of Matrix on Neutrosophic Super Hyper Graphs

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ABSTRACT

In this article, we have studied the Super Hyper Graphs and extended the existing results by incorporating various Operations, Axioms, and functions in Super Hyper Graphs. We also define different types of matrix on neutrosophic Super Hyper Connected Graphs. We also explain the Super Hyper Graph theory by various examples. It explores extensions like Single-Valued Neutrosophic and Plithogenic Quasi Super Hyper Graphs and their relationships with other graph classes. Furthermore, we discuss the existing results with some suitable examples.

Keywords: Graphs; Neutrosophic Graph; Super Hyper Graph; Connected Graphs; Path Matrix.

MS Classification 2020: 05C05, 03E72.

References:

1. Smarandache, F. (2019). n-SuperHyperGraph and Plithogenic n-SuperHyperGraph. *Nidus Idearum*, 7, 107-113.
2. Smarandache, F. (2020). Extension of HyperGraph to n-SuperHyperGraph and to Plithogenic n-SuperHyperGraph, and Extension of HyperAlgebra to n-ary (Classical-/Neutro-/Anti-) HyperAlgebra. *Infinite Study*.

τ_1, τ_2 -STAR-I-COMPACT SPACES

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ABSTRACT

In this paper, we introduce the concept of τ_1, τ_2 , n-star-I-compact space in an ideal bispaces and study some of its topological properties. A countably I-compact space is of τ_1, τ_2 , 2-star-I-compact. Real valued continuous mapping on τ_1, τ_2 n-star- I_{fin} -compact is bounded. Finally, we establish relation between weakly τ_1, τ_2 -star-compact space and τ_1, τ_2 -star-I-compact space.

Keywords: Ideal space, Star compact space, weakly star compact.

MS Classification 2020: 54D20, 54D30, 54D35.

References:

- Sarkar, Susmita, Prasenjit Bal, and Mithun Datta. "On star Rothberger spaces modulo an ideal." *Applied General Topology* 25.2 (2024): 407-414.

Multiscale Analysis of Pollutant Transport under Asymmetric Flow with Chemical Reactions

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ABSTRACT

This study presents an analytical solution for the two-dimensional concentration distribution of a pollutant in a channel with prismatic cross-section and an asymmetric velocity profile. The transport process is influenced by reversible adsorption-desorption, irreversible inhomogeneous reactions at the channel boundaries, and homogeneous reaction within the fluid. Using Mei's homogenization technique, the transverse concentration distribution is derived up to the second-order approximation. The effects of velocity distribution parameters (α and β), adsorption, desorption, inhomogeneous, and homogeneous reaction rate on both mean and transverse concentrations are analyzed. Results show that increasing α and β intensifies the velocity profile producing a sharper profile when $\alpha = \beta$ and a more skewed one when $\alpha \neq \beta$ leading to increased shear and dispersion. The dispersion coefficient DT exhibits non-monotonic behaviour with respect to these parameters, while mean concentration consistently declines. Higher inhomogeneous and inhomogeneous reaction rates significantly suppress transverse concentration, whereas greater adsorption or desorption increase it. Increased adsorption-desorption intensifies transverse concentration variation in both symmetric and asymmetric cases; however, persistent non-uniformity arises when $\alpha \neq \beta$, whereas symmetry ($\alpha = \beta$) promotes uniform concentration distribution over time. These findings are essential for pollution mitigation and improving water quality in natural channels.

Thermosolutal natural convection of ternary hybrid nanofluids in a baffled U-shaped porous enclosure with thermal radiation

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ABSTRACT

This study presents a numerical investigation of thermosolutal convection in a baffled U-shaped porous enclosure filled with a ternary hybrid nanofluid under the influence of thermal radiation. The ternary hybrid nanofluid, composed of three distinct nanoparticles (Al_2O_3 , CuO , Ag) suspended in a base fluid, is employed to enhance both heat and mass transfer characteristics. The influence of thermal radiation is incorporated using the Rosseland approximation, capturing radiative heat flux contributions at elevated temperatures. The bottom wall is maintained at a high temperature and high concentration, while the vertical walls are kept at a low temperature and low concentration. The remaining walls are impermeable and adiabatic. Additionally, two cooled baffles are installed at the bottom corners of the groove in the U-shaped porous enclosure. The governing Navier-Stokes equations, along with temperature and concentration equations are solved by using a Higher Order Compact (HOC) scheme. This work delves into the effects of several key parameters, including the Lewis number, aspect ratio, buoyancy ratio, Darcy number, Rayleigh number, radiation parameter, and solid particle concentration of the trihybrid nanofluid. The findings emphasize the superior efficacy of uniform heating over non-uniform heating concerning double diffusion.

Keywords: U-shaped cavity, Baffle, Ternary hybrid nanofluid, Heat and mass transfer, Thermal radiation, Uniform and non-uniform heating.

MS Classification 2020:35C05, 76M60.

References:

1. Y. Ma, R. Mohebbi, M.M. Rashidi, O. Manca, Z. Yang, Numerical investigation of MHD effects on nanofluid heat transfer in a baffled U-shaped enclosure using lattice Boltzmann method, *Journal of thermal analysis and Calorimetry* 135 (2019) 3197-3213
2. S.K. Pandit, A. Chattopadhyay, A robust higher order compact scheme for solving general second order partial differential equation with derivative source terms on nonuniform curvilinear meshes, *Computers & Mathematics with Applications* 74(6) (2017) 1414-34.
3. S.K. Lele, Compact finite difference schemes with spectral like resolution, *J. Comput. Phys.* 103 (1992) 16-42.

Studies on shifts and generalized differential operators of meromorphic functions under different sharing notions

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ABSTRACT

To begin with, we assume that the reader is already familiar with the standard definitions and terminology of value distribution theory. For some $a \in \mathbb{C}$, we denote by $E(a; f)$ the collection of the zeros of $f - a$, where a zero is counted according to its multiplicity. In addition to this, when $a = \infty$, the above definition implies that we are considering the poles. In the same manner, by $\bar{E}(a; f)$, we denote the collection of the distinct zeros or poles of $f - a$ according as $a \in \mathbb{C}$ or $a = \infty$, respectively. For any two non-constant meromorphic functions f and g , if $E(a; f) = E(a; g)$ (resp. $\bar{E}(a; f) = \bar{E}(a; g)$), we say that f and g share the value a CM (IM). If $a = a(z)$ is a small function, we define that f and g share a CM or a IM according as $f - a$ and $g - a$ share 0 CM or 0 IM, respectively. For $a \in \mathbb{C} \cup \{\infty\}$, if $E(a; f) \subseteq E(a; g)$ then we say that f and g *partially share* the value a CM. For two distinct complex numbers a_1, a_2 , if $f - a_1$ and $g - a_2$ have the same zeros with same multiplicities (or ignoring multiplicities), we say that f and g share a pair (a_1, a_2) CM (IM).

In this paper, we establish a number of uniqueness results in the context of entire and meromorphic functions, their shifts, and derivatives that share two small functions under various sharing notions. Our results relax the sharing conditions from a recent work by Huang and Fang [?], thereby extending and refining their findings. Notably, one of our results introduces the concept of *partial sharing of paired small functions*, a completely new notion that has not been previously used, making our result unique in this regard.

References:

1. Huang, X. and Fang, M.: Unicity of entire functions concerning their shifts and derivatives, *Comput. Methods Funct. Theo.*, 21(3)(2021), 523-532.
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ANALYSIS OF LOVE WAVE PROPAGATION IN A PRE-STRESSD ORTHOTROPIC MEDIUM OVERLAYING A HETEROGENEOUS PRE-STRESSED HALF-SPACE

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ABSTRACT

This paper investigates the propagation of Love waves in an orthotropic elastic medium under initial stress, situated over an initially stressed heterogeneous half-space. The study focuses on the effects of both material anisotropy and pre-existing stresses on wave behavior. A dispersion equation for the Love wave is analytically derived, taking into account the influence of initial stress and inhomogeneity in the half-space. The velocity of Love waves is computed numerically as a function of the non-dimensional parameter kH , where k is the wave number and H is the thickness of the upper layer. The results are illustrated through multiple graphs to visualize how wave velocity varies with respect to kH . To further examine the influence of inhomogeneity and initial stress, additional figures depict the variation in SH-wave velocity for different parameter values. The numerical analysis reveals that the Love wave velocity generally decreases as the non-dimensional wave number increases. This indicates that both the initial stress and the degree of heterogeneity in the medium significantly affect wave propagation characteristics. These findings provide insights into the dynamic behavior of layered stressed media and may be useful in geophysical and engineering applications involving seismic wave analysis.

Keywords: Love waves, initial stress, orthotropic medium, heterogeneous half-space, dispersion equation, phase velocity.

MS Classification 2020: Mathematical modeling, Mathematical Physics, Mathematical Analysis .

References:

1. Belfield, A.J., T.G. Rogers, and A.J.M. Spencer (1983), Stress in elastic plates rein forced by fibres lying in concentric circles, J. Mech. Phys. Solids 31, 1, 25 54, DOI: 10.1016/0022-5096(83)90018-2.

Mathematical Modeling of Chemotherapeutic Drug Delivery with the Application of Electroporation

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ABSTRACT

In this work, a mathematical model of drug delivery into tumour tissues along with the application of electroporation is presented. It is an application of an electric field, where drug particles enter from the exterior cell into the interior compartment of the cell through the permeabilized cell membrane. For the treatment of tumour tissues, some chemotherapeutic drugs (fluorouracil, carmustine, cisplatin, methotrexate, doxorubicin, and Paclitaxel) are analyzed. A set of differential equations are taken to represent the physical environment of the model. A mass transport coefficient (MTC) as a function of pore density is proposed to describe mass flow in the tissue domain. The governing equations are solved numerically using the finite difference method (FDM). By the numerical solution, we have recognized the electroporation parameters in such a way that there is no unwanted cell damage and we can find the appropriate drug among the six chemotherapeutic drugs taken for the treatment of brain tumour. The numerical results are analyzed through a graphical representation. It is observed that the fluorouracil is the appropriate choice of drug for the treatment of brain tumour.

Keywords: Mathematical Modelling; Drug Delivery; Numerical Simulation; Brain Tumour; Chemotherapeutic Drugs; Electroporation.

MS Classification 2020:9210, 80A19.

CONVECTIVE PERFORMANCE OF HYBRID NANOFUID WITHIN AN IRREGULAR THERMAL SYSTEM IN PRESENCE OF MAGNETIC FIELD

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ABSTRACT

The onset of convection in a trapezoidal thermal system saturated with a H₂O-based Ag-MgO (50%–50%) binary hybrid nanofluid is investigated via streamfunction–vorticity (ψ – ζ) analysis and numerical simulation. A uniformly heated block is positioned in the middle of the trapezoidal system. The block is considered in three different sizes, measured by aspect ratios of 25%, 50%, and 75% of the trapezium height. The flow transport in the domain is magnetically controlled. The governing equations are solved using a fourth-order accurate compact finite difference scheme, which captures flow physics on low computational grids with high spatial resolution.

The novelty of this work lies in five key areas: the role of hybrid nanofluids, the geometrical effects of the trapezoidal cavity, the influence of heated block aspect ratios ($0.25 \leq AS \leq 0.75$), the interaction with applied magnetic fields, and the implementation of higher-order compact computational techniques over a wide range of parameters. Quantitatively, the maximum heat transfer enhancement is achieved at $AS = 0.75$ and $\gamma = 750$, with corresponding increases in average Nusselt number (\overline{Nu}) ranging from 9.5% to 34.12% at $Ra = 10^4$, 8.43% to 29.78% at $Ra = 10^5$, and 7.27% to 35.21% at $Ra = 10^6$. The results reveal that the heated block significantly alters the thermal and flow structure, especially under higher Rayleigh numbers and inclined boundary configurations. These outcomes offer promising implications for real-world applications requiring efficient thermal management within confined enclosures.

Keywords: Heated block; Hybrid nanoliquid; Convection; Trapezium cavity; Compact scheme.

MS Classification 2020: 76D05, 76D55, 80A19

References:

1. R. ul-Haq, S. Aman, Water functionalized CuO nanoparticles filled in a partially heated trapezoidal cavity with inner heated obstacle: FEM approach, *Int. J. Heat Mass Transf.* 128 (2019) 401–417.
2. S. Guo, K.X. Cheng, P.S. Lee, Numerical study of the cold finned-tube bundle heat exchanger under natural convection for a novel passive displacement cooling system, *Build. Environ.* 233 (2023) 110083.

ENSURING BALANCE WITH REGARD TO OPTIMALITY FOR KNOWN CATEGORICAL COVARIATES AND MULTIPLE TREATMENT GROUPS

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ABSTRACT

Ensuring balanced allocation by achieving optimality for known categorical covariates into two treatment groups has been analytically established with regard to D-, A-, D_s -, and As-optimality in Hore et al. (2020), and for E- and E_s -optimality by the authors. However, the mathematical complexity of the respective optimality function expressions and computations increases with the number of treatments.

In this work, the relationship between D-optimality and balancing criteria for known categorical covariates across three treatment groups is established through analytical derivation and simulation studies. It has been shown that D-optimality ensures a balanced allocation design, at least as a local optimal solution. Furthermore, simulation studies demonstrate that the balanced allocation design performs uniformly better than random allocation designs.

Keywords: Covariate Balanced, Optimal Allocation Design, Clinical Trials, Local Optimality, Randomization.

MS Classification 2020: 62K05, 62P10

References:

1. Hore, S., Dewanji, A., Chatterjee, A. (2020): Ensuring balance through optimal allocation of experimental units with known categorical covariates into two treatments. *Statistics*, 54 (3), 559-576.
2. Morgan, K. L. and Rubin, D. B. (2012) : Rerandomization to improve covariate balance in experiments. *The Annals of Statistics*, 40 (2), 1263-1282.
3. Shah, K. R and Sinha, B. K. (1989) : *Theory of Optimal Designs*. Springer-Verlag, New York.

A NEUTROSOPHIC APPROACH TO BRIDGING EDUCATIONAL MANAGEMENT AND PEDAGOGY FOR ENHANCING LEARNING OUTCOMES

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ABSTRACT

The effective integration of Educational Management (EM) and Pedagogy is paramount for fostering optimal learning environments and achieving desired educational outcomes. However, Decision-Making (DM) processes in this complex interplay often grapple with uncertainty, vagueness, and conflicting information. This article proposes a novel framework leveraging Neutrosophic Set (NS) theory to address these challenges. By representing the degrees of truth-membership, indeterminacy-membership and falsity-membership associated with various factors influencing the management-pedagogy nexus, this study develops a Multi-Criteria Decision-Making (MCDM) model in the context of NS, which enables a more nuanced and robust evaluation of strategies aimed at bridging the gap between administrative functions and instructional practices, ultimately contributing to improved educational quality. A hypothetical case study is also presented to illustrate the applicability and effectiveness of the proposed MCDM framework.

Keywords: Educational Management; Pedagogy; Neutrosophic Set; Indeterminacy; Learning Outcomes.

MS Classification 2020: 62K05, 62P10

References:

1. Atanassov, K.T. (1986). Intuitionistic fuzzy sets. *Fuzzy Sets and Systems*, 20(1), 87-96.
2. Bush, T. (2011). *Theories of educational leadership and management*. Sage.
3. Chen, C.T., Huang, S.F., & Yeh, C.H. (2011). A novel hybrid MCDM model for evaluating university website quality. *Applied Soft Computing*, 11(2), 1975-1985.

RELIABILITY ANALYSIS OF LOAD-SHARING SYSTEMS USING A FLEXIBLE MODEL WITH PIECEWISE LINEAR FUNCTIONS

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ABSTRACT

A flexible model for analysing load-sharing data is developed by approximating the cumulative hazard functions of component lifetimes by piecewise linear functions. The proposed model is data-driven and does not depend on restrictive parametric assumptions on underlying component lifetimes. Maximum likelihood estimation and construction of confidence intervals for model parameters are discussed. Estimates of reliability characteristics such as reliability at a mission time, quantile function, mean time to failure and mean residual time for load-sharing systems are developed in this setting. As the proposed model is capable of providing a good fit for load-sharing data, it also results in a better estimation of these important reliability characteristics. The performance of the proposed model is observed to be quite satisfactory through a detailed Monte Carlo simulation study. The analyses of two load-sharing datasets, one pertaining to the lives of two-motor load-sharing systems and another related to basketball games, are provided as illustrative examples. In summary, this article presents a comprehensive discussion on a flexible model that can be used for load-sharing systems efficiently.

Keywords: Load-sharing systems; Component lifetime; Baseline hazard; Piecewise linear approximation; Bootstrap; Confidence interval.

MS Classification 2020: 62F40, 62P10

AN APPROXIMATION SCHEME BASED ON HERMITE INTERPOLATION FOR SOLVING THIRD- AND HIGHER-ORDER NONLINEAR SINGULAR ORDINARY DIFFERENTIAL EQUATIONS

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ABSTRACT

This article presents an efficient approximation scheme based on Hermite interpolation for obtaining highly accurate solutions to third- and higher-order nonlinear singular ordinary differential equations. A two-point Hermite interpolant approximates the unknown solution of a general form of third- and higher-order singular boundary value problems. The necessary data for the approximation are derived from the given boundary conditions and the intrinsic structure of the differential equation. The convergence and efficiency of the method are validated through several illustrative examples involving different nonlinearities and boundary conditions.

References:

1. N. Karamollahia, M. Heydaria, G. B. Loghmania. A computational method to find dual solutions of the one-dimensional Bratu problem. *Journal of Computational and Applied Mathematics* 388 (2021) 113309.
2. K. Parand, M. Delkhosh. An effective numerical method for solving the nonlinear singular Lane-Emden type equations of various orders. *Jurnal Teknologi* 79:1 (2017) 25-36.

STATISTICAL CONVERGENCE OF MATRIX SEQUENCES AND EIGENVALUE INFLUENCES

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ABSTRACT

This paper delves into the statistical convergence of sequences of square matrices with entries in the real or complex domain. Matrix sequence convergence is traditionally examined through two distinct lenses: element-wise convergence and norm convergence. We explore both paradigms, unraveling their interconnections through illustrative examples. Furthermore, we shed light on the intrinsic nature of matrix sequence convergence, emphasizing its intricate dependence on the eigenvalues of the matrices involved.

Keywords: Matrix sequence, Statistical convergence, eigenvalue.

References:

1. P. Bal, P. Das, Bi statistical γ -covers controled by a pair of weight functions in topology, *Pan-American Journal of Mathematics*, 4 (2025), Art. No. 3, 7 pages..
 2. P. Bal, D. Rakshit, S. Sarkar, On star statistical compactness, *Afrika Matematika*, 36(1) (2025), 1–7.
 3. E. N. Yildirim, Statistical Convergence of Matrix sequences, *Konuralp Journal of Mathematics*, 12(1): 74-79, 2024.
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ON PAIRWISE δ -CLOSED SET AND PAIRWISE δ -CONTINUITY IN NEUTROSOPHIC BITOPOLOGICAL SPACE

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ABSTRACT

In fuzzy topology, the notion of δ -closure operator was explored in the light of quasi-coincidence (q-coincidence) due to Pu and Liu (1980). In this paper, we generalize the concept of δ -closure operator in neutrosophic bitopological spaces (NBTS). Some characterizations of neutrosophic pairwise regular open (closed) and δ -open (closed) sets have been presented. Moreover, the notion of neutrosophic pairwise δ -continuous map has been introduced and some of its characterizations are also studied in terms of q-coincidence.

Relationship between neutrosophic pairwise δ -continuity and neutrosophic pairwise almost-continuity has been established. Finally, the characterizations and preservation aspects of neutrosophic pairwise regular (resp. semi-regular) and neutrosophic pairwise almost regular spaces are also investigated.

Keywords: Neutrosophic q-coincidence, Neutrosophic δ (resp. θ)-cluster point, Neutrosophic pairwise δ (resp. θ)-closed set, Neutrosophic pairwise δ -continuity, Neutrosophic pairwise regular (resp. semi-regular, almost regular) spaces.

MS Classification 2020: 54A40,54A05, 03A05, 03E72

References:

1. F. Smarandache, *Neutrosophic set, a generalization of the intuitionistic fuzzy sets*, Int. J. Pure Appl. Math. **24** (2005), 287–297.
2. J. C. Kelly, *Bitopological spaces*, Proc. London Math. Soc. **313** (1963), 71–89.
3. A. A. Salama, S. A. Al-Blawi, *Neutrosophic set and Neutrosophic topological spaces*, IOSR Journal of Mathematics **3** (2012), 31–35.
4. D. D. Mwchahary, B. Basumatary, *A Note on Neutrosophic Bitopological Spaces*, Neutrosophic Sets and Systems **33** (2020), 134–144.
5. B. Debnath, F. Smarandache, *Introduction to Multi Intuitionistic Fuzzy Lie Algebras*, Palestine Journal of Mathematics (Accepted, 2024).

SPATIAL AUTOREGRESSIVE MODELING OF THE TIMING OF DIFFERENT IMMUNIZATION DOSES RECEIVED AMONG UNDER-FIVE CHILDREN IN INDIA

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ABSTRACT

Child immunization is a critical public health intervention aimed at reducing infant and child mortality. In India, the uptake of different immunization doses varies significantly across regions, influenced by socio-economic, demographic, and healthcare accessibility factors. Understanding these spatial patterns is essential for targeted policy interventions. This study employs spatially autoregressive modelling to analyse the geographic variation and interdependencies in the administration of various child immunization doses across Indian districts, offering insights for improving immunization coverage.

Results: Univariate Moran's I analysis shows significant spatial autocorrelation in the timing of Hepatitis-B, BCG, and Polio birth dose immunizations across India. Higher Moran's I indicates stronger spatial clustering. Bivariate Moran's I analysis checks the influence of various socio-demographic and healthcare-related predictors on the receipt of Hepatitis-B and BCG vaccines at the first week and first month after birth in India. Positive index values with high z-scores (e.g., full ANC/PNC coverage, institutional delivery, maternal education) are associated with timely immunization, especially in the first week. In contrast, negative associations at the first month often reflect delayed immunization, particularly among disadvantaged groups like rural children and those from lower economic quintiles. As examined, the classical linear regression model confirms a statistically significant spatial autocorrelation in the model residuals for all the outcome variables under the study and thus the spatial lag model was introduced to examine the underlying associations between the outcome and the set of predictor variables. **Data & Methods:** This study utilised the National Family Health Survey, 2019-21 data to collect the pertinent information on birth doses of hepatitis-B, BCG and Polio Vaccination among children aged under-five years. Univariate and Multivariate Spatial statistical analyses were carried out at the district level.

Conclusion: This study highlights significant spatial clustering in the timing of child immunizations across Indian districts, influenced by key socio-demographic and healthcare factors. Timely vaccine uptake is positively associated with better maternal healthcare and education. Spatial modelling underscores the need for geographically targeted strategies to address disparities and improve immunization coverage.

SOME MORE RESULTS ON MENGER SPACE VIA IDEALS

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ABSTRACT

By fusing the idea of an ideal Menger space with the star operator, this article introduces the concept of the star-Menger property modulo an ideal. A topological examination of various features of this property is then carried out. We bolster the fundamental idea by connecting a number of topological features that show patterns similar to the star-Menger space. We also present numerous counterexamples to illustrate the differences between different interrelated topological properties. Numerous aspects of preservation within subspace and functions are examined in this paper. Lastly, we suggest utilizing specific modifications to the SSI^I feature to depict the optimum star-Menger space using families of closed sets.

Conclusion

The Book of Abstracts for the Global Assembly for Mathematical Modeling and Analysis (GAMMA)- 2025 encapsulates the scholarly spirit and interdisciplinary breadth of this international forum. Featuring **60 abstracts** contributed by researchers, the volume reflects a wide spectrum of contemporary research in mathematical modeling and analysis, spanning theoretical advancements, applied methodologies, and cross-disciplinary innovations.

With the participation of more than **110** participants, including prominent scholars, early career researchers, and graduate students, GAMMA 2025 has served as a fertile ground for intellectual exchange, collaboration, and exploration. The diverse contributions presented here are a testament to the global relevance and transformative potential of mathematical inquiry.

We hope that this compilation will serve as both a lasting scholarly record and a source of future inspiration for all members of the mathematical and scientific community.

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