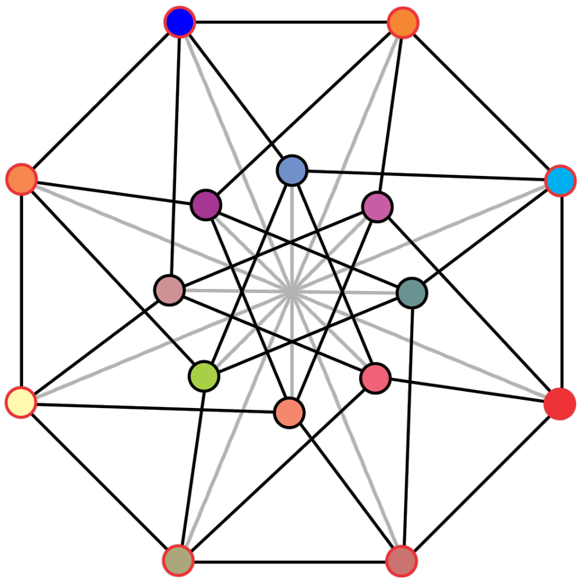
INTERNATIONAL CONFERENCE ON GRAPH THEORY AND ITS APPLICATIONS ICGTA2026

25^{th} - 27^{th} June 2026

Book of Abstracts



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DEPARTMENT OF MATHEMATICS

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PRESIDENCY UNIVERSITY - BENGALURU

Department of Mathematics

International Conference on Graph Theory and its Applications - ICGTA26

Conference Overview Schedule

Date & Time	Thursday, June 25, 2026	Friday, June 26, 2026	Saturday, June 27, 2026
9.30 - 10.30	**Registration & Inauguration**	Prof. Johannes Carmesin, TU Freiberg, Germany	Prof. Stephan Wagner, Graz University of Technology, Austria
10.30 - 11.00	**Tea Break**		
11.00 - 12.00	Prof . Arnfried Kemnitz, Technische Universität Braunschweig, Germany	Prof. Lavanya Selvaganesh, Indian Institute of Technology (BHU), Varanasi - India	Prof. Narayanan N, Indian Institute of Technology Madras, Chennai - India
12.00 - 1.00	Prof . Anand Louis, Indian Institute of Science, Bangalore - India	Prof. Karl Magnus Heuer, Technical University of Denmark, Denmark	Prof. Jing Huang, University of Victoria - Canada
1.00 - 2.00	**Lunch Break**		
2.00 - 3.00	Prof. Tomáš Kaiser, University of West Bohemia, Czech Republic	Prof. Atsuhiro Nakamoto, Yokohama National University – Japan	Prof. K. Somasundaram, Amrita Vishwa Vidyapeetham, Coimbatore – India
3.00 - 3.45	Prof. Shamik Ghosh, Jadavpur University, Kolkata, West Bengal, India	Prof. S. Francis Raj, Pondicherry University, Puducherry - India	Paper Presentation
3.45 - 4.15	**Tea Break**		
4.15 - 5.15	Paper Presentation		**Valedictory**
5.15 - 6.00	Open problem discussion		

International Conference on Graph Theory and its Applications - ICGTA26

List of Invited Speakers

S. No	Speakers	Title
1	**Prof. Anand Louis**, Indian Institute of Science, Bangalore - India	The planted clique problem
2	**Prof. Arnfried Kemnitz**, Technische Universität Braunschweig – Germany	On the Vertex Stability of Graphs
3	**Prof. Atsuhiro Nakamoto**, Yokohama National University – Japan	Coloring quadrangulations on surfaces and an extension to high dimensional spaces
4	**Prof. S. Francis Raj**, Pondicherry University, Puducherry - India	On Injective Coloring of Some Graphs
5	**Prof. Shamik Ghosh**, Jadavpur University, Kolkata, West Bengal, India	Near Goldback Graphs and their Applications to Hardy-Littlewood Conjecture
6	**Prof. Jing Huang**, University of Victoria - Canada	Graphs whose adjacency matrices avoid the Γ and/or the Slash matrix
7	**Prof. Johannes Carmesin**, TU Freiberg, Germany	The hidden two-dimensional structure of graph separations
8	**Prof. Karl Magnus Heuer**, Technical University of Denmark – Denmark	From finite graphs to infinite paradoxes
9	**Prof. Lavanya Selvaganesh**, Indian Institute of Technology (BHU), Varanasi - India	Spanners with spectral approach
10	**Prof. Narayanan N**, Indian Institute of Technology Madras, Chennai - India	Distinguishing trees using Chromatic Symmetric Functions
11	**Prof. Stephan Wagner**, Graz University of Technology, Austria	Subtrees of trees and graphs: recent developments and open problems
12	**Prof. K. Somasundaram**, Amrita Vishwa Vidyapeetham, Coimbatore – India	When is the product of claw-free perfect graphs elementary?
13	**Prof. Tomáš Kaiser**, University of West Bohemia - Czech Republic	Hamilton cycles in line graphs

International Conference on Graph Theory and its Applications - ICGTA26

Invited Speakers' Schedule

Day 1 – 25 June 2026 (Thursday)

S. No	Session Chair	Speaker	Title	Sessions	Location
9.30 - 10.30	**Registration & Inauguration**				F Block Seminar Hall 2
10.30 - 11.00	**Tea Break**				
11.00 -12.00	Prof. K. Somasundaram, Amrita Vishwa Vidyapeetham, Coimbatore - India	Prof . Arnfried Kemnitz, Technische Universität Braunschweig – Germany	On the Vertex Stability of Graphs	Session - 1	F Block Seminar Hall 2
12.00 - 1.00		Prof. Anand Louis, Indian Institute of Science, Bangalore - India	Spanners with spectral approach		
1.00 - 2.00	**Lunch Break**				
2.00 - 3.00	Prof. Atsuhiro Nakamoto, Yokohama National University, Japan	Prof. Tomáš Kaiser, University of West Bohemia, Czech Republic	Hamilton cycles in line graphs	Session - 2	F Block Seminar Hall 2
3.00 - 3.45		Prof. Shamik Ghosh, Jadavpur University, Kolkata, West Bengal, India	The planted clique problem		
3.45 - 4.15	**Tea Break**				
4.15 - 5.15	Paper Presentation				
5.15 - 6.00	Open problem discussion				

International Conference on Graph Theory and its Applications (ICGTA26)

Invited Speakers' Schedule

Day 2 – 26 June 2026 (Friday)

S. No	Session Chair	Speaker	Title	Sessions	Location
9.30 - 10.30	Prof . Arnfried Kemnitz, Technische Universität Braunschweig, Germany	Prof. Johannes Carmesin, TU Freiberg, Germany	Pebbling in Vertex-Transitive Graphs	Session - 1	F Block Seminar Hall 2
10.30 - 11.00	**Tea Break**				
11.00 -12.00	Prof. Narayanan N, Indian Institute of Technology Madras, Chennai - India	Prof. Lavanya Selvaganesh, Indian Institute of Technology (BHU), Varanasi - India	The hidden two-dimensional structure of graph separations	Session - 2	F Block Seminar Hall 2
12.00 - 1.00		Prof. Karl Magnus Heuer, Technical University of Denmark, Denmark	From finite graphs to infinite paradoxes		
1.00 - 2.00	**Lunch Break**				
2.00 - 3.00	Prof. Stephan Wagner, Graz University of Technology, Austria	Prof. Atsuhiro Nakamoto, Yokohama National University – Japan	Coloring quadrangulations on surfaces and an extension to high dimensional spaces	Session - 3	F Block Seminar Hall 2
3.00 - 3.45		Prof. S. Francis Raj, Pondicherry University, Puducherry - India	On Injective Coloring of Some Graphs		
3.45 - 4.15	**Tea Break**				
4.15 - 5.15	Paper Presentation				
5.15 - 6.00	Open problem discussion				

International Conference on Graph Theory and its Applications (ICGTA26)

Invited Speakers' Schedule

Day 3 – 27 June 2026 (Saturday)

S. No	Session Chair	Speaker	Title	Sessions	Location
9.30 - 10.30	Prof. Tomáš Kaiser, University of West Bohemia, Czech Republic	Prof. Stephan Wagner, Graz University of Technology, Austria	Subtrees of trees and graphs: recent developments and open problems	Session - 1	F Block Seminar Hall 2
10.30 - 11.00	**Tea Break**				
11.00 -12.00	Prof . Anand Louis, Indian Institute of Science, Bangalore - India	Prof. Narayanan N, Indian Institute of Technology Madras, Chennai - India	Distinguishing trees using Chromatic Symmetric Functions	Session - 2	F Block Seminar Hall 2
12.00 - 1.00		Prof. Jing Huang, University of Victoria - Canada	Graphs whose adjacency matrices avoid the Γ and/or the Slash matrix		
1.00 - 2.00	**Lunch Break**				
2.00 - 3.00	Prof. Johannes Carmesin, TU Freiberg, Germany	Prof. K. Somasundaram, Amrita Vishwa Vidyapeetham, Coimbatore – India	When is the product of claw-free perfect graphs elementary?	Session - 3	F Block Seminar Hall 2
3.00 - 3.45	Paper Presentation				
3.45 - 4.15	**Tea Break**				
4.15 - 5. 15	**Valedictory**				

International Conference on Graph Theory and its Applications (ICGTA26)

Paper Presentation Schedule

Day 1 – 25 June 2026 (Thursday)

S. No	Session Chair	Author	Title	Sessions	Location
Day - 1 4.15 - 5.15	Prof . Arnfried Kemnitz Prof. S R Sudheendra Prof. S. Ganesamurthy	Usmanbasha	Radio Mean Labeling Of Mycielskian Graph of Certain Graphs	Session - 1	F Block Seminar Hall 01
		Yeva Fadhilah Ashari	On Super (a, d)-C_3-Antimagic Total Labeling of The Join Product of Tree and K_1		
		Kotala Shanmugam	Restricted super totient labeling of wheel related graphs		
		Avalakunta Nithish Durga	Gap-[k]-Edge Labeling on m-Split of Wheel Related Graphs		
		Sundar rajan R	Gap-k-vertex labelling of generalized Heawood, Franklin and Jahangir graphs		
	Prof . Anand Louis Prof. Athmakoori Prashant	Amitayu Banerjee	AVD Total Coloring of Central Graphs, Subdivision Graphs, And The Join of Graphs	Session - 2	F Block Seminar Hall 02
		Kyosuke Wakayama	Kempe equivalence of 5-colorings of 3-colorable graphs on the projective plane		
		Aiswarya. P. S	Total dominator coloring of some classes of perfect graphs		
		Saneesh Babu	Mutual-visibility coloring of graphs		
		Sneha R	Dominated coloring of some classes of graphs		
	Prof. Karl Magnus Heuer Prof. Kavita S Permi	Muthukani Vairavel T	Minimal Connected Majority Dominating Graph of a Graph	Session - 3	E Block Seminar Hall 03
		Bharadwaj	Efficient k-Limited Broadcast Domination in Graphs and Graph Products		
		Dr. M. Angala Eswari	On the Chromatic Total Domination Number of Zero Divisor Graphs of Z_n		
		J Saral	Distance - 2 Domination in Toeplitz Graphs and its Applications to Network Monitoring		
		Nayana R	Total Eccentricity Polynomial Of Corona Product Of Symmetric Regular Graph and Some Basic Graphs		
	Prof. Lavanya Selvaganesh Prof. T. Kavaskar	Deepa V. Kitturmath	An Approach to Anti-Parasitic Drug Optimization Based on Topological Indices and Decision-Making Methods	Session - 4	E Block Seminar Hall 04
		Seema Abasaheb Kadam	Basava Indices Of Graphs		
		Dr. G. Ramya	Computation Of Degree Based Topological Indices For The Product Maximal Grap		
		Kaveri Dharigon	Neighbourhood Degree Based Topological Indices Of Transformation Graphs		
		T.V. Asha	The Eccentricity - Temperature Indices Of A Graphs		

International Conference on Graph Theory and its Applications (ICGTA26)

Paper Presentation Schedule

Day 2 – 26 June 2026 (Friday)

S. No	Session Chair	Author	Title	Sessions	Location
Day - 2 4.15 - 5.15	Prof. Stephan Wagner Prof. Rajeshwari M	Dr. Preenu C.S.	Semigroup of Skeletal-Endomorphisms of Graphs	Session - 1	F Block Seminar Hall 01
		Suji G	On the structure of non-absorbing product graph of Rees matrix semigroup		
		Vasuki	On the Boxicity of Zero-Divisor Graph of Finite Commutative Ring with Unity and Power Graph of Finite Abelian Group		
		R S Indu	Universal Eigenvalues of Principal Ideal Graph of the Multiplicative Semigroup Z_n		
		Mikolaj Cuszynski-Kruka	Knödel Graphs: Dimensional Broadcast Schemes and Hamiltonian Decomposability		
	Prof. K. Somasundaram Prof. V. Ramalatha	Srinivasan K	A Hybrid Fuzzy Network–DEMATEL–Eigenvector Framework for Prioritizing Diagnostic Tests in Febrile Illness	Session - 2	F Block Seminar Hall 02
		Matheswaran M	Towards Intelligent Passenger Train Operations: A Probabilistic-Fuzzy-AI Multi-Criteria Decision-Making Approach		
		Kishor C	Quantifying uncertainty in assignment problem: An application of the Fuzzy Wiener index		
		Peruvemba Sundaram Ravi	On structural properties of some probable $R(3,10)$-critical graphs		
		Brian D'Souza	Additively Graceful Signed Graphs on Stars and Double Stars		
	Prof. Jing Huang Prof. Brian D'Souza Prof. Shilpa N	Santhosh Kumar N	Study of uniform cyclic Hyper bag graphs - Eigen Spectrum perspective	Session - 3	E Block Seminar Hall 03
		Debajit Kalita	On Nonsingular Unicyclic Graphs Without Unique Perfect Matchings and Their Inverses		
		Linet Dsouza	On Cycle-Open Distance Pattern Uniform Graphs		
		Radhamadhavi Duggaraju	Existence of Flow-up Basis for Generalized Spline Modules on Arbitrary Tree		
		Veena	A Novel Study of Spectral Properties and SK Energy of Graphs		
	Prof. Tomáš Kaiser Prof. J. Geetha	Ravi Kiran Kundet	On P vs NP: Revisiting Computational Complexity Through Structural and Algorithmic Perspectives	Session - 4	E Block Seminar Hall 04
		Jyothish S	The Steiner Comb Problem: Complexity Across Different Graph Classes		
		Abhishek Girish Ahe	Ramsey Sequences with Bounded Clique Number		
		"Praveen Jakkannavar	Matrix-Based Computation of Topological Descriptors of Graphs		
		Rajasekaran G	On Modular Chromatic Number of Generalized Mycielskian Graphs		

International Conference on Graph Theory and its Applications (ICGTA26)

Paper Presentation Schedule

Day 3 – 27 June 2026 (Saturday)

S. No	Session Chair	Author	Title	Sessions	Location
Day - 3 3.00 - 3.45	Prof. Atsuhiro Nakamoto Prof. O. Ramesh Dr. Rajeshwari Murugesan	Peruvemba Sundaram Ravi	On a conjecture of DeLaVi˜na and Waller	Session - 1	F Block Seminar Hall 01
		Priyanka Vishwakarma	On the Distinguishing and Frugal Distinguishing number of Certain Graph Classes		
		Dr. Clement Johnson R	Zagreb Indices and Zagreb Energy of Zero-Divisor Graphs of Commutative Rings and Their Applications		
	Prof. Francis Raj Prof. R. Vignesh	Swarna J B	On the Block Vertex Neighborhood Number of Connected Graphs	Session - 2	F Block Seminar Hall 02
		Rajeshwari Shibaraya	On the K-Metro Domination Number of Triangular Snake Graph		
		Sreelakshmi Sukumaran	On the Class 1 and Type 1 Properties of Generalized Mycielski Graphs		
	Prof. Johannes Carmesin Prof. K C Kavitha Prof. Suresh	Simran Kour	Fundamental Aspects of Skin Cancer Drugs via Degree-Based Topological Descriptors and Curvilinear Regression Models	Session - 3	E Block Seminar Hall 03
		S. Akansha	Graph Constructions and Operations Satisfying the ACK Conjecture		
		S Balaji	Some Results on Topological Indices of Generalized Join Graphs		
	Prof. Shamik Gosh Prof. Pradeep Kumar Prof. Rahul M P	S Krithi	Join Graphs	Session - 4	E Block Seminar Hall 04
		Madhavi Levaku	Some Properties of the Idempotent Cayley Graph of the Ring $(Z_n, \oplus, \odot)$		
		R Senthamizh Selvi	Decagonal Graceful Labeling of Toeplitz Graphs		

INVITED TALKS

On the Vertex Stability of Graphs

Arnfried Kemnitz
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We consider finite simple graphs $G = (V(G), E(G))$ and denote this class of graphs by $\mathcal{I}$. A graph is empty if $E(G) = \emptyset$. A (graph) invariant $\rho(G)$ is a function $\rho : \mathcal{I} \to \mathbb{R}_0^+ \cup \{\infty\}$. An invariant $\rho(G)$ is integer-valued if its image set consists of non-negative integers, i.e.,$\rho(\mathcal{I}) \subseteq \mathbb{N}_0$, and real-valued if $\rho(\mathcal{I}) \subseteq \mathbb{R}_0^+$.. An invariant $\rho(G)$ is monotone increasing if $H \subseteq G$ implies $\rho(H) \leq \rho(G)$, and monotone decreasing if $H \subseteq G$ implies $\rho(H) \geq \rho(G)$. The invariant $\rho(G)$ is called monotone if it is either monotone increasing or monotone decreasing. For an arbitrary invariant $\rho(G)$ of a graph G, the ρ-vertex stability number $vs_\rho(G)$ (respectively, ρ-edge stability number $es_\rho(G)$) is the minimum number of vertices (edges) whose removal results in a graph $H \subseteq G$ with $\rho(H) \neq \rho(G)$. If such a vertex set (edge set) does not exist, then we define $vs_\rho(G) = \infty$ ($es_\rho(G) = \infty$).

In the first part of the talk, we give general results for the ρ-vertex stability number. In particular, we prove a result implying the well-known theorem of Gallai: $\alpha(G) + \beta(G) = n(G)$, where $\alpha(G)$ is the independence number, $\beta(G)$ is the vertex covering number, and $n(G)$ is the order of the graph. Moreover, we present lower bounds for $vs_\rho(G)$ and prove that $vs_\rho(G) \leq es_\rho(G)$ for monotone invariants. In the second part, we focus on the chromatic number $\chi(G)$ and determine $vs_\chi(G)$ for several graph classes. We also study the relationship between $es_\chi(G)$ and $vs_\chi(G)$ and show that both their difference and ratio can become arbitrarily large.

Keywords: vertex stability number, edge stability number, graph invariant, chromatic number.

Mathematics Subject Classification: 05C15.

Coloring quadrangulations on surfaces and an extension to high dimensional spaces

Atsuhiro Nakamoto
Yokohama National University, Japan

The Four Color Theorem states that every graph embeddable in the plane is 4-colorable. The maximum number of colors needed for graphs on a non-planar surface $\mathbb{F}$ is given by Heawood in terms of the genus of $\mathbb{F}$, and many results are known on colorings of graphs on surfaces. In this talk, we consider an even-sided map on a surface $\mathbb{F}$, that is, a graph embedded in $\mathbb{F}$ each of whose faces is bounded by an even cycle. In particular, we focus on quadrangulations, that is, even-sided maps in which every face is a quadrilateral.

Every even-sided map on the plane is bipartite, whereas every non-planar surface admits a non-bipartite even-sided map. Heawood-type results have been established in this setting, but one can observe interesting phenomena in the colorings of even-sided maps on surfaces that depend on the orientability of the surface. We survey these results on quadrangulations on surfaces and then describe recent developments on colorings of high-dimensional quadrangulations of projective spaces due to Kaiser-Stehlćk and to the present authors.

Near Goldbach Graphs and their Application to Hardy-Littlewood Conjecture

Shamik Ghosh
Department of Mathematics, Faculty Council of Science
Jadavpur University, Kolkata- 700032, W.B., India.

In 2021, we introduced the concept of Goldbach graph and proved the equivalence of its connectedness with the famous Goldbach conjecture. In 2025, we introduced a modified form of this graph called near Goldbach graph and another concept, named prime multiple missing graphs. We observed that near Goldbach graphs are more compact and can be obtained from finite intersections of prime multiple missing graphs which have some rich properties like Hamiltonicity and bounded diameters.

A near Goldbach graph is a simple undirected graph whose vertex set consists of all positive even integers and there is an edge between two vertices a, b if and only if $\frac{a+b}{2}, \frac{|a-b|}{2}$ are either odd primes or 1. A finite near Goldbach graph $G(n)$ has the vertex set $\{x \in 2\mathbb{N} : x \leq 2n\}$ with the same adjacency rule. Interestingly, the degree of x in $G(x/2)$ measures the number of ways an even positive integer can be expressed as a sum of two odd primes.

We obtain two exact formulas for degrees of all even positive integers x in $G(x/2)$. We compute a function $\eta(x) = \prod_{p|x, p>2} \frac{p-1}{p-2} \frac{xe^{-0.183407}}{(\log x)^2}$ that approximates the degree of x in $G(x/2)$ for large even positive integer x using number theoretic tools. We show that $\eta(x)$ is near to a similar function conjectured by Hardy and Littlewood in 1923. Finally, we obtain two sufficient conditions that an even positive integer x can be expressed as the sum of two odd primes.

Graphs whose adjacency matrices avoid the Γ and/or the Slash matrix

Jing Huang
University of Victoria

The problem of deciding whether a given 0,1-matrix have orderings that avoid containing a fixed submatrix (or a fixed family of such submatrices) is fundamental and has been much studied in the literature. For certain submatrices, the matrices with the desired ordering properties have important applications in linear programs, graph colouring, and location theory. Most of research is concerned with whether or not these problems have polynomial-time solutions, but they often have interesting interpretations for graphs.

In this talk, we will focus primarily on two submatrices, namely, the Γ matrix (which has rows 11, 10) and the Slash matrix (which has rows 01, 10). In addition to addressing computational solutions to the above mentioned problems for these submatrices we will exhibit the classes of graphs whose adjacency matrices having the corresponding ordering properties. These include interval graphs, chordal graphs, chordal bigraphs, strongly chordal graphs, cocomparability graphs, cocomparability bigraphs, and strong cocomparability graphs. All these classes of graphs admit beautiful characterizations by vertex orderings and forbidden structures as well as polynomial-time certifying recognition algorithms.

The hidden two-dimensional structure of graph separations

Johannes Carmesin

TU Freiberg, Germany

Graph minor theory exhibits striking two-dimensional structure. Prominent examples include surface embeddings in the graph minor structure theorem and planar corner diagrammes used to analyse tree-decompositions.

We show that, in a precise sense, the crossing structure of separations is itself essentially two-dimensional. This may help explain why the corner diagramme method works so effectively. As an application, we obtain a refinement of the Robertson–Seymour tangle–tree theorem.

Distinguishing trees using Chromatic Symmetric Functions

Narayanan N

Indian Institute of Technology Madras, Chennai, India

We look at the tree isomorphism conjecture of Stanley and obtain results on distinguishing certain classes of trees using their chromatic symmetric functions.

Kernels: from finite graphs to infinite paradoxes

Karl Magnus Heuer

Technical University of Denmark, Denmark

Kernels are objects in directed graphs that were introduced by von Neumann and Morgenstern in a game theoretic context in 1944. They are independent vertex sets such that each vertex outside the kernel sends an edge directed towards a vertex inside the kernel. Relaxing the definition in the way that every vertex outside the fixed vertex set reaches a vertex in it via a directed path of length at most 2, yields the definition of a semi-kernel (also called quasi-kernel). Although not all directed graphs admit a kernel, as witnessed by odd directed cycles, all admit a semi-kernel. In total the existence of kernels is rather well understood for finite directed graphs. For infinite directed graphs, however, this is not the case.

Beside a game theoretic meaning, kernels furthermore yield a connection to Logic, where, in a special case, kernels correspond to a valid truth value assignment on the vertices of a directed graph. In the logical setting these directed graphs are usually called dependency or reference graphs. Certain logical paradoxes (e.g. the Liar Paradox and Yablo's Paradox) can be understood via reference graphs where no valid truth value assignment is possible.

The presented results include, among others, the following new structural sufficient conditions for the existence of kernels in certain infinite directed graphs:

If G is a graph containing no subdivision of an infinite clique, then every acyclic orientation (respectively every orientation) of G contains a kernel (respectively semi-kernel).

Additionally, several open problems, also in connection to Logic, shall be discussed.

Spanners with spectral approach

Lavanya Selvaganesh

Indian Institute of Technology (BHU), Varanasi, India

A graph spanner is a sparse subgraph that approximately preserves the pairwise distances of the original graph. In this talk, we discuss sparse spanners from a spectral perspective rather than by directly applying local geometric rules. Our focus is on geometric graphs, where vertices are embedded as points in $\mathbb{R}^d$ and edge weights are induced by Euclidean distance. We investigate an approach to construct sparse graphs that still preserve distances well by using the low-rank approximation of the distance matrix via its spectral decomposition. We discuss the experiments and compare various metrics, including stretch ratios, average stretch ratios, theoretical bounds, and running times.

Subtrees of trees and graphs: recent developments and open problems

Stephan Wagner

Graz University of Technology, Austria

The study of random subtrees of a tree goes back to the work of Jamison in the 1980s, who in particular considered the mean subtree order (the average number of vertices in a subtree). This talk gives an overview of results on the mean subtree order and related graph invariants of trees and arbitrary graphs, with a focus on recent developments as well as some natural problems that still remain open.

Hamilton cycles in line graphs

Tomáš Kaiser
University of West Bohemia, Czech Republic

I will review the main problems and results regarding the existence of Hamilton cycles in line graphs of graphs and hypergraphs. The main motivating problem here is the conjecture of Thomassen (1986) that 4-connected line graphs (of graphs) admit a Hamilton cycle. Before discussing more recent developments, I will present an outline of the proof (TK, Vrana, 2012) of the special case where the connectivity is at least 5 and the minimum degree is at least 6 to highlight the role of disjoint connectivity structures akin to spanning trees. Another such structure, T-connectors, has been used to prove that highly connected line graphs of 3-hypergraphs are Hamiltonian (TK, Vrana, 2022), and I will discuss the question of the existence of T-connectors in graphs with a sufficiently edge-connected set of terminals. Joint work with Petr Vrana and with Atrayee Majumder.

Algorithms for graph partitioning problems

Anand Louis
Indian Institute of Science, Bangalore - India

Graph partitioning problems are a central topic of research in the study of algorithms and complexity theory. They are of interest to theoreticians with connections to error correcting codes, sampling algorithms, metric embeddings, among others, and to practitioners, as algorithms for graph partitioning can be used as fundamental building blocks in many applications. One of the central problems studied in this field is the sparsest cut problem, where we want to compute the cut which has the least ratio of the number of edges cut to the size of the smaller side of the cut. In this talk, I will survey some algorithms for various graph partitioning problems.

On Injective Coloring of Some Graphs

S. Francis Raj

Department of Mathematics, Pondicherry University, Puducherry-605014, India

An injective coloring of a graph G is a vertex coloring (not necessary proper) wherein no two vertices having a common neighbor receive the same color. The minimum number of colors required for an injective coloring of G is known as the injective chromatic number of G and it is denoted by $\chi_i(G)$. In [5], Hahn et al., introduced the concept of injective coloring of graphs. From the time of its introduction injective coloring of graphs have been extensively studied. Recently in [2], B. Brešar et al. studied injective coloring in terms of open packing sets. One can see that every color class of an injective coloring is an open packing. In this talk, we shall see a brief survey on the study of injective coloring of graphs.

References

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When is the product of claw-free perfect graphs elementary?

K. Somasundaram

Amrita Vishwa Vidyapeetham, Coimbatore – India

A graph G is said to be perfect if for every induced subgraph H of G, $\chi(H) = \omega(H)$, where $\chi(H)$ and $\omega(H)$ are the chromatic number and the clique number of H, respectively. A graph is said to be claw-free if it does not have the complete bipartite graph $K_{1,3}$ as an induced subgraph. The class of claw-free perfect graphs is an important subclass of perfect graphs.

A graph G is said to be an elementary graph if its edges can be colored with two colors such that every induced path of length two has its edges colored distinctly.

PAPER PRESENTATIONS

RADIO MEAN LABELING OF MYCIELSKIAN GRAPH OF CERTAIN GRAPHS

Vijayalaxmi S. Shigehalli [1], Usmanbasha [2,*]
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For a undirected finite connected graph G, $f : V(G) \to \mathbb{N}$ is an one-one function. Then f is called a radio mean labeling if for every distinct nodes p and q of G, $\left\lceil \frac{f(p)+f(q)}{2} \right\rceil + d(p,q) \geq 1 + diam(G)$. The greatest natural number assigned to any node of G is said to be radio mean number of f and is denoted by $rmn(f)$. The least natural number of $rmn(f)$ taken over all radio mean labeling f of G is said to be radio mean number of G and is symbolically denoted by $rmn(G)$. In this paper, we prove the radio mean number of Mycielskian graph of Path graph (P_n), Mycielskian graph of Cycle graph (C_n), and Mycielskian graph of Star graph ($K_{1,n}$).

Minimal Connected Majority Dominating Graph of a Graph

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This paper introduces the Minimal Connected Majority Dominating Graph (MCMDG), denoted by G_{CM}, as a novel intersection graph derived from all minimal connected majority dominating sets of a graph G. Each vertex in G_{CM} represents such a set, and edges are formed between vertices whose corresponding sets share at least one common element. The study systematically constructs and analyzes G_{CM} for various graph classes including paths, cycles, wheels, stars, complete graphs, bipartite graphs, and double stars revealing distinct structural patterns such as regularity, disconnectedness, and degree sequences. Theoretical results are supported by examples and propositions, offering new insights into domination theory and intersection graph behavior.

A Novel Study of Spectral Properties and SK Energy of Graphs

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Let G be a graph with vertex set $V = \{v_1, v_2, v_3, \ldots, v_n\}$ and d_i be the degree of v_i. Shigehalli Kanabur matrix of G is the square matrix of order n whose (i, j) entry is equal to $\frac{d_i+d_j}{2}$, if the vertices v_i and v_j are adjacent, otherwise zero. The Shigehalli Kanabur energy SK(G) of graph G is the sum of the absolute values of the eigenvalues of the SK matrix. In this paper we determine SK-energy for some classes of standard graphs, they are SK-Complete graph, SK-Star graph, SK-Path graph, SK-Complete Bipartite graph and SK-Cycle graphs.

Some Properties of the Idempotent Cayley Graph of the Ring $(Z_n, \oplus, \odot)$

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The idempotent Cayley graph of the ring $(Z_n, \oplus, \odot)$ is the Cayley graph associated with the symmetric set consisting of idempotent elements and their inverses in the group $(Z_n, \oplus)$. In this paper, we derive some basic properties of the idempotent elements and construct the idempotent Cayley graph. It is shown that this graph is connected and Hamiltonian. Further, if $n = 2^\alpha, \alpha > 1$, this graph is bipartite

Study of uniform cyclic Hyper bag graphs - Eigen Spectrum perspective

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Hypergraphs are generalization of graphs, introduced by Berge . In an ordinary graph, an edge connects exactly two vertices, where as in hyper graphs a hyperedge is a subset of the vertex set . Hypergraphs have applications in the field of Computer Science, Machine learning, Neural networks etc. Hyper bag graphs are hyper graphs in which hyper edges are multisets derived from the vertex set . In other words , vertices can be repeated in hyper edges. In this paper, we discuss different possibilities of cyclic and uniform hyper bag graphs and we derive expressions to find eigen spectrum of most common hyperbag graphs among them using the eigen spectrum of uniform cyclic hypergraphs and that of cyclic graphs.

Graph Constructions and Operations Satisfying the ACK Conjecture

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The Akbari-Cameron-Khosrovshahi (ACK) conjecture, which appears to be un resolved, states that for any simple graph G with at least one edge, there exists a nonzero $(0,1)$-vector in the row space of its adjacency matrix that is not a row of the matrix itself. In this talk, we present a unified framework that includes several families and operations of graphs that satisfy the ACK conjecture. Using these fundamental results, we introduce new graph constructions and demonstrate, through graph structural and linear algebraic arguments, that these constructions adhere to the conjecture. Further, we show that certain graph operations preserve the ACK property. These results collectively expand the known classes of graphs satisfying the conjecture and provide insight into its structural invariance under composition and extension.

AVD Total Coloring of Central Graphs, Subdivision Graphs, and the Join of Graphs

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An adjacent vertex distinguishing (AVD) total coloring of a graph $G = (V(G), E(G))$ is a proper total coloring f such that for every edge $uv \in E(G)$, we have $C_G(u) \neq C_G(v)$, where $C_G(u) = \{f(u)\} \cup \{f(uv) : uv \in E(G)\}$ is the color set of u. The AVD-total chromatic number $\chi''_a(G)$ of G is the minimum integer k such that there exists an AVD-total coloring of G using k colors. The AVD-total coloring conjecture (AVD-TCC) asserts that $\chi''_a(G) \leq \Delta(G) + 3$ for every graph G, where $\Delta(G)$ is the maximum degree of G. The central graph $C(G)$ of G is obtained from the subdivision graph $S(G)$ by joining all pairs of non-adjacent vertices of G. In this paper:

1. We determine the AVD-total chromatic number of $S(G)$.

2. We verify the AVD-TCC for central graphs of regular graphs, complete bipartite graphs, and graphs that can be expressed as the join of two graphs of the same order, providing partial progress towards an open problem of Panda, Verma, and Keerti.

3. For odd m, we show that if G_1 and G_2 are graphs with $|V(G_1)| = n$ and $|V(G_2)| = m > n$, and $\Delta(G_2) \leq \Delta(G_1)$, then the join $G_1 \vee G_2$ satisfies the AVD-TCC. Moreover, when $|V(G_1)| = |V(G2)| = m$, the join $G_1 \vee G_2$ satisfies the AVD-TCC whenever G_1 is Type 1.

On Nonsingular Unicyclic Graphs Without Unique Perfect Matchings and Their Inverses

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In this article, we characterize nonsingular unicyclic graphs that either have no perfect matching or possess more than one perfect matching. Among these graphs, we identify those whose adjacency matrices have inverses with zero diagonal entries; such graphs are said to admit an inverse. Furthermore, we prove that if a unicyclic graph of order n admits an inverse, then its inverse graph necessarily contains at least $n + 3$ edges.

Kempe equivalence of 5-colorings of 3-colorable graphs on the projective plane

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Let G be a graph and let ϕ_1 and ϕ_2 be two k-colorings of G. We say that ϕ_1 and ϕ_2 are Kempe equivalent if ϕ_1 can be obtained from ϕ_2 by a repeated application of a "Kempe change", i.e., switching two colors i, j in a component of the subgraph of G induced by the vertices colored by i, j.

It is known that two 4-colorings of a planar graph are not necessarily Kempe equivalent, but Fisk proved that any two 4-colorings of a 3-colorable plane triangulation are Kempe equivalent, and then Mohar extended this result to 3-colorable planar graphs. For other surfaces, Matsumoto proved that any two 4-colorings of a 3-colorable triangulation on the projective plane are Kempe equivalent, while such a result does not hold for 3-colorable graphs on the projective plane.

In this talk, we show that any two 5-colorings of a 3-colorable triangula tion on the projective plane are Kempe equivalent, and then verify the same holds for 3-colorable graphs on the projective plane. By these results, we con sequently have a result that any two k-colorings of a 3-colorable triangulation on the projective plane are Kempe equivalent, for any $k \geq 3$.

Semigroup of Skeletal-Endomorphisms of Graphs

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In this paper, we introduce the concept of skeletal-endomorphisms of graphs and investigate their algebraic structure. A map between the vertices of two graphs is called a skeletal-morphism when two vertices in the first graph are adjacent if and only if their images are the same or adjacent in the second graph. A skeletal morphism from a graph to it self is called a skeletal-endomorphism. We explore the properties of the semigroup formed by these skeletal-endomorphisms under composition and provide characterizations of its elements. We describe the Green's relations in this semigroup and identify the idempotent and regular el ements.

On the structure of non-absorbing product graph of Rees matrix semigroup

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We define the non-absorbing product graph of a semigroup S, as an undirected graph whose vertices are the elements of S and two distinct vertices are adjacent precisely when their product differs from both factors. We study these graphs for Rees matrix semigroups over a group, establishing their structural decomposition based on idempotents and non-idempotents. This natural partition of the vertex set into idempotents and non-idempotents reflects the core algebraic structure in a purely graphical way. A key result is that the isomorphism type of the graph depends only on the cardinalities of the index sets and the order of the underlying group, independent of the specific sandwich matrix. We also investigate the absorbing product graph of S and some fundamental graph invariants, including connectivity, clique number, degree distribution, Hamiltonicity and planarity of this graph.

On Cycle-Open Distance Pattern Uniform Graphs

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Let $G = (V, E)$ be a connected simple (p, q)-graph, $\phi \neq M \subseteq V(G)$ and $u \in V(G)$. Associate with each vertex u of a graph $G = (V, E)$, its open M distance pattern (or, 'ODP' in short), is defined as the set $f^o_M(u) = \{d(u, v) : v \in M, u \neq v\}$. If every vertex $u \in V(G)$ has the same open distance pattern with respect to M, if it exists, then G is called an Open M- Distance Pattern Uniform (ODPU) graph. The ODPU set M is called a Cycle-Open Distance Pattern Uniform (Cycle-ODPU) set if $f^o_M(u)$ is independent of the choice of $u \in V(G)$ and $\langle V \rangle$ is a cycle. A graph G has such a Cycle-ODPU set, then G is called a Cycle-ODPU graph. The Cycle-ODPU number of a graph G, denoted by $\zeta_c(G)$, is the minimum cardinality of a Cycle-ODPU set in G, if it exists. In this paper, we establish the existence of Cycle-ODPU sets in various graph structures with their Cycle-ODPU number. It is proved that the Cycle ODPU number of the shadow graph is $2n$. It is also proved that there exists infinitely many classes of Cycle-ODPU graphs G_i, with their Cycle-ODPU number $i + 3$.

On the Class 1 and Type 1 Properties of Generalized Mycielski Graphs

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The Mycielski construction is a classical method for generating triangle free graphs with high chromatic numbers. Our work explores the coloring properties of the generalized Mycielskian $_m(G)$, specifically focusing on its classification in terms of edge and total chromatic numbers. The first investigation addresses the Total Coloring Conjecture (TCC) [1], which posits that every graph G satisfies $\Delta(G) + 1 \leq \chi''(G) \leq \Delta(G) + 2$. While Meirun Chen et al. [2] proved the validity of the TCC for generalized Mycielski graphs, it remains interesting to investigate their speci c total coloring classifications - namely, Type 1 (where $\chi''(G) = \Delta(G) + 1$) or Type 2 (where $\chi''(G) = \Delta(G) + 2$). In this direction, we have obtained several partial results. We demonstrate that the Type 1 property is hereditary under the Mycielskian operator for several important classes, including:

1. Type 1 regular graphs;
2. Graphs containing universal vertices;
3. Bipartite graphs where the maximum degree is attained in only one partite set;
4. Bipartite graphs where both partition sets have a size equal to the maximum degree;
5. Complete bipartite graphs.

These findings support a broader conjecture that for any graph $G \neq K_2$, $_m(G)$ is Type 1. The second investigation focuses on Edge Coloring and Vizing's Theorem [6]. Vizing classifies graphs into Class 1 ($\chi'(G) = \Delta(G)$) and Class 2 ($\chi'(G) = \Delta(G) + 1$). We show that the Mycielskian construction inherently favors Class 1 structures. Young Soo Kwon et al. [5] previously proved that the first Mycielski graph, $\mu_{(}G)$, is Class 1 for any graph G other than K_2. By applying Galvin's Theorem [4] on list edge coloring and Fournier's Theorem [3], we provide a more concise proof of this result. Furthermore, we prove that for any graph $G \neq K_2$, the generalized Mycielskian $\mu_m(G)$ is Class 1 for every positive integer m. Together, these results suggest that the structural layers and bipartite connections inherent in the generalized Mycielski graph provide suffcient flexibility to meet the lower theoretical bounds for both edge and total colorings.

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On Super (a, d)-C_3-Antimagic Total Labeling of The Join Product of Tree and K_1

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Let $G = (V(G), E(G))$ be a simple and finite graph. A graph G admits an H-covering if each edge in $E(G)$ belongs to a subgraph of G isomorphic to a given graph H. Then, G is called (a, d)-H-antimagic if there exists a bijection $f : V(G) \cup E(G) \to \{1, 2, ..., |V(G)| + |E(G)|\}$ such that the set of subgraph-weight $\{ \sum_{v \in V(H')} f(v) + \sum_{e \in E(H')} \mid$ for all subgraph H' of G that is isomorphic to $H\}$ constitutes the set of arithmetic progression $\{a, a + d, ..., a + (t - 1)d\}$, where $a > 0$ and $d \geq 0$ are integers and t is the number of all subgraphs of G isomorphic to H. Moreover, G is called super (a, d)-antimagic if $f(V(G)) = \{1, 2, ..., |V(G)|\}$. In this case, the bijection f is said to be super (a, d)-H-antimagic labeling of G. In this talk, we present the construction of super (a, d)-C_3-antimagic labelings of a graph obtained from the join product of a tree and K_1 for various values of d.

Restricted Super Totient Labeling of Wheel Related Graphs

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A positive integer n is a super totient number if the set of positive integers less than n and relatively prime to n can be partitioned into two subsets of equal sum. For every injective vertex labeling $f : V \to \mathbb{N}$, define $f^* : E(G) \to \mathbb{N}$ such that $f^*(xy) = f(x)f(y)$. We say f is a super totient labeling if $f^*(xy)$ is a super totient number for every $xy \in E$. If the range of a super totient labeling f is $\{1, 2, 3, ..., |V|\}$, then f is said to be restricted super totient labeling. We have investigated the restricted super totient labeling for Helm graph, Prism graph, Stacked prism graph and Web graph.

Gap-$[k]$-Edge Labeling on m-Split of Wheel Related Graphs

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Proper coloring on the vertices of a graph G is obtained from labeling of either the vertices (or) edges (or) both of the graph G. Gap-$[k]$-edge labeling is one of the technique to obtain the proper vertex coloring of G by labeling their edges from the set $\{1, 2, ..., k\}$ such that k is minimum. The color of its vertices is defined as the range of their incident edge labels. In this paper the Gap-$[k]$-edge labeling is obtained for m-split of wheel related graphs. More precisely we studied the minimum possible value of k for the m-split of Wheel graph, Crown graph and Generalized Heawood graph.

Additively Graceful Signed Graphs on Stars and Double Stars

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We study additively graceful labelings of signed graphs on stars and double stars. While a characterization of additively graceful signed stars is straightforward, the problem becomes significantly more intricate for signed double stars. We obtain characterizations of additively graceful signed double stars S with n negative edges in all cases except when $n = 2$ with the unique non-pendant edge being positive. For several sub-cases of this exceptional case, we establish existence, uniqueness and non-existence results.

On the Distinguishing and Frugal Distinguishing number of Certain Graph Classes

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The distinguishing number of a graph G, denoted by $D(G)$, is the minimum number of colors required to color the vertices of G so that the identity automorphism is the only automorphism preserving all color classes. In other words, a distinguishing coloring breaks all non-trivial symmetries of the graph. Another important symmetry-related parameter is the determining number. A subset $S \subset V(G)$ is called a determining set of G if every automorphism of the graph is completely determined by its action on S. The minimum cardinality of such a set is called the determining number of G, and is denoted by $Det(G)$. Further the frugal distinguishing number of a graph G, denoted by $Fdist(G)$, is defined as the smallest integer d for which the size of minimum complement of a color class is same as the determining number of graph. These parameters are closely related, and it is known that $D(G) \leq Fdist(G) \leq Det(G) + 1$. In 2021, D. L. Boutin raised the problem of classifying graphs G satisfying $D(G) = Fdist(G)$. Answering this question helps in understanding which structural properties of a graph reduce the number of colors required in a $D(G)$-distinguishing coloring compared to the trivial $Det(G) + 1$-distinguishing coloring of the graph. As a first step toward solving this problem, we study the gap $Fdist(G) - D(G)$ for graph families with relatively simple structures, and then gradually increase the symmetry and structural complexity of the graphs to observe how these changes affect the gap.

In this work, we begin with a graph family having a simple structure, namely windmill graphs, and determine their distinguishing number and frugal distinguishing number. We then gradually increase the structural complexity and symmetry (that is, the size of the automorphism group) by enlarging the shared clique structure, and investigate how the quantity $Fdist(G) - D(G)$ changes with the underlying graph structure. In particular, we determine the automorphism group $Aut(G)$, distinguishing number $D(G)$, determining number $Det(G)$, and frugal distinguishing number $Fdist(G)$ for four families of graphs. Further, we compare the behavior of the difference $Fdist(G) - D(G)$ across these graph families and analyze how the structural properties of the graphs influence this gap.

Knödel Graphs: Dimensional Broadcast Schemes and Hamiltonian Decomposability

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Knödel graphs are equipped with the notion of dimensions, similar to hypercubes. They also exhibit useful properties in broadcasting and gossiping problems. The dimensionality allows for nice representations of the solutions to the minimum broadcast time problem. The solutions are given as sequences of dimensions and are called dimensional broadcast schemes.

In this manuscript, all dimensional broadcast schemes are given for Knödel graphs of order 2^k and $2^{k+2} - 4$, there are 2^{k-1} and $4(k + 1)\phi(k)$ such schemes, respectively. These results extend the already known case of $2^{k+1} - 2$ and the classification of all sequential dimensional broadcast schemes.

In addition Knödel graphs of order $4n+2$ are shown to be Hamiltonian decomposable. Extending the already known cases of Knödel graphs of order 2^k and $2^{k+1} - 2$.

An Approach to Anti-Parasitic Drug Optimization Based on Topological Indices and Decision-Making Methods

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Anti-parasitic infections constitute a major global health burden, and the struc tural diversity of imidazole and benzimidazole based therapeutic agents has made these scaffolds the focus of sustained medicinal research. The present study em ploys chemical graph theory to quantitatively characterise a dataset of 20 clinically relevant anti-parasitic compounds through four degree-based topological indices. Physicochemical properties were adopted as response variables. Quadratic regression models were fitted for each index-property pair, yielding R^2 values as high as 0.9644. Indices exhibiting Pearson correlation coefficients exceeding 0.80 were retained for the decision-making stage. Three Multi-Criteria Decision Making frameworks are then applied under equal weighting and the drugs are ranked from most effective to the least.

Gap-k-vertex labelling of generalized Heawood, Franklin and Jahangir graphs

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A gap-$[k]$-vertex labelling of a graph G is a pair (f, C_f), where $f : V(G) \rightarrow 1, 2, ..., k$ assigns labels to the vertices of G, and this induces a mapping $C_f : V(G) \rightarrow 0, 1, ..., k$ which is a proper vertex colouring of G. For any vertex v with degree $d(v) \geq 2$, the colour of v is defined as the maximum difference between labels of its neighbours:$C_f(v) = \max\{|f(u) - f(w)| : u, w \in N(v)\}$. If v is a vertex of degree one, then its colour is the label assigned to its unique neighbour. gap-$[k]$-vertex labelling was introduced by Ali Dehghan in 2013. Here, k is the minimum number required for the graph G to induce proper vertex colouring. Weffort Santos et al stated that the vertex gap number of cubic bipartite Hamiltonian graph is 2 whenever the graph is non-isomorphic to the Heawood graph. In this study, we determine the vertex gap number of the generalised Heawood graph, the generalised Franklin graph and generalized Jahangir graph.

A Hybrid Fuzzy Network–DEMATEL–Eigenvector Framework for Prioritizing Diagnostic Tests in Febrile Illness

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This study proposes a hybrid fuzzy network integrated with DEMATEL[1] and eigenvalue analysis to model uncertainty in symptom–test relationships for febrile illness diagnosis. Aggregated hospital data involving five symptoms and five diagnostic tests were transformed into a fuzzy relation matrix. DEMATEL[2] identified causal relationships among symptoms, while eigenvector centrality revealed dominant tests. A novel Symptom-Test Influence Index (STII) and Test Influence Index (TII) are introduced to integrate centrality, prominence, and causality into a unified score. Results show that severe body pain is the strongest causal symptom, and Complete Blood Count (CBC) is the most influential diagnostic test. This framework supports cost-efficient, data-driven diagnostic protocols for febrile illness management.

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Basava Indices of Graphs

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Topological indices are extremely important when it comes to mathematical chemistry, especially for analyses concerning QSPR/QSAR, where these indices help to describe molecular structures and forecast physicochemical characteristics. Many degree-based indices have a relatively high mean isomer degeneracy. This reflects even lower isomer discriminating power. This paper tries to create more sensitive and discriminative descriptors. Here, we introduce a new subclass of neighbourhood degree-based topological indices called Basava indices (BG indices). Further, We obtain closed formulae for Basava indices of some graph families and establish the relations connecting these new indices with other well-known degree-based topological indices which are already in the literature. In addition, the Basava indices of some transformation graphs are obtained. We extend our study to the chemical relevance of the first and second Basava indices and octane isomer datasets. We find that these indices have a high degree of correlation with the entropy and enthalpy of the octane isomer dataset, and they also have a mean isomer degeneracy ($d = 1$), which demonstrates high isomer discrimination.

On the Boxicity of Zero-Divisor Graph of Finite Commutative Ring with Unity and Power Graph of Finite Abelian Group

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Boxicity is a structural graph parameter that measures how complex a graph is by attempting to represent it as the intersection of axis-parallel rectangles. It was first introduced by Fred S. Roberts [3] in 1969. The boxicity of an undirected graph Γ is defined as the smallest non- negative integer k such that Γ can be represented as an intersection of axis-parallel rectangular boxes in $\mathbb{R}^k$. This paper investigates boxicity of two significant algebraic structures: zero- divisor graphs of finite commutative rings with unity and power graphs of finite abelian groups.

The study of boxicity for zero-divisor graphs was initiated by the work of T. Kavaskar, who established an upper bound for the zero-divisor graph of the ring of integers modulo N. For $N = \prod_{i=1}^{a} p_i^{2n_i} \prod_{j=1}^{b} q_j^{2m_j+1}$, it is proved in [2] that:

$$box(\Gamma(\mathbb{Z}_N)) \leq \left(\prod_{i=1}^{a}(2n_i+1)\prod_{j=1}^{b}(2m_j+2)\right)! - \left(\prod_{i=1}^{a}(n_i+1)\prod_{j=1}^{b}(m_j+1)\right)! - 1$$

Subsequently, in [1] L. Sunil Chandran and S. K. Sahoo showed that if $N \equiv 2 \pmod 4$ and N is not divisible by p^3 for any prime p, then $\text{box}(\Gamma(\mathbb{Z}_N)) = a - 1$; otherwise, the boxicity is exactly a, where a is the number of distinct prime factors of N. By the fundamental structure theorem for finite commutative rings, any such ring R with unity is isomorphic to a finite direct product of finite commutative local rings. Consequently, to investigate the boxicity of zero-divisor graphs, it is sufficient to examine the direct product of local rings. In this paper, we extend these existing results by obtaining an upper bound for $\text{box}(\Gamma(R))$ in terms of threshold dimension when R is a product of finite local principal ideal rings. We establish bounds for the boxicity and threshold dimension of the zero-divisor graph $\Gamma(R)$ for a finite commutative ring R decomposed as a product of local principal ideal rings. Specifically, we consider $R \cong \prod_{i=1}^{m+n} R_i$, where the first m R_i's are isomorphic to $\mathbb{Z}_2$ and the next n components are not. Then, we show that the boxicity of zero divisor graph $\Gamma(R)$ is bounded below by $\lfloor \frac{m}{2} \rfloor + n$ and above by the threshold dimension, which is at most $m + n$. Specifically, if we can guarantee the existence of an $R_i \cong \mathbb{Z}_2$ among the m components then the above bound can be further reduced as,

$$box(\Gamma(R)) \leq \dim_{TH}(\Gamma(R)) \leq m + n - 1.$$

Also, we provide a characterization of rings whose zero-divisor graphs have boxicity equal to 1 as follows: For a commutative ring $R \cong R_1 \times \cdots \times R_n$ with $n \geq 2$, where each R_i is a local ring, we prove that $\text{box}(\Gamma(R)) = 1$ if and only if $n = 2$, where $R_1 \cong \mathbb{Z}_2$ and R_2 is a local ring such that $\Gamma(R_2)$ is complete.

The second part of the paper focuses on the power graphs of finite abelian groups. The concept of a power graph is a relatively modern and rapidly evolving area of algebraic graph theory. The power graph of a group G, denoted by $pow(G)$, is an undirected graph with vertex set same as that of G, and two distinct vertices x and y are adjacent in $pow(G)$ if $x = y^m$ or $y = x^m$ for some positive integer m. The concept of power graph is defined by Chakrabarty et al. [4]. In [5], L. S. Chandran and J. Ghosh established that when $G \cong \mathbb{Z}_n$ be a cyclic group where the prime factorization of n is given by $n = p_1^{a_1} p_2^{a_2} \cdots p_k^{a_k}$ with $p_1 < p_2 < \cdots < p_k$, then $box(pow(G)) \leq \sum_{i=1}^{k-1} a_i$. By the fundamental theorem of finite abelian groups, every finite abelian group is isomorphic to a direct product of cyclic groups of prime power order. We first prove that if G is a p-group of the form $\mathbb{Z}_{p^{\alpha_1}} \times \cdots \times \mathbb{Z}_{p^{\alpha_n}}$ with $n \geq 2$, then $pow(G)$ is an interval graph (i.e., $box(pow(G)) = 1$). For a general finite abelian group $G \cong \mathbb{Z}_{p_1^{\alpha_{11}}} \times \cdots \times \mathbb{Z}_{p_1^{\alpha_{1n_1}}} \times \cdots \times \mathbb{Z}_{p_k^{\alpha_{k1}}} \times \cdots \times \mathbb{Z}_{p_k^{\alpha_{kn_k}}}$ and $A = \{n_i \mid n_i \geq 2, 1 \leq i \leq k\}$, then

$$box(pow(G)) \leq |A| + \sum_{i,j} \alpha_{ij} - \max_{i,j}\{\alpha_{ij}\}.$$

This result generalizes a result in [5].

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Computation of Degree Based Topological Indices For The Product Maximal Graph

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Let $M_1, M_2, ..., M_r$ represent the maximal ideals of R, a finite commutative ring with unity (CRU). The elements of R are used as vertices to form the product maximal graph, $\Gamma_{pm}(R)$, where two unique vertices are joined if their product is in at least one maximal ideal of R.

This work focuses on the analysis of degree-oriented topological invariants of $\Gamma_{pm}(R)$. General expressions for several classes of such indices, including additive, multiplicative, and eccentricity-based variants, are established in terms of fundamental parameters of the ring. The results provide a concise structural characterization of the graph and offer insight into how algebraic features of the underlying ring influence associated graph invariants. This study further strengthens the connection between algebraic structures and graph-theoretic descriptors.

Non-inclusion Principal Ideal Graphs of Transformation Monoids

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Let S be a semigroup. We define the non-inclusion principal left ideal graph of S as a simple, undirected graph with the nonzero elements of S as vertices and two distinct elements $a, b \in S$ are adjacent if and only if $a \notin S^1b$ and $b \notin S^1a$, where S^1a and S^1b are principal left ideals generated by a and b respectively. The non-inclusion principal right ideal graph is defined similarly. In this paper, we study these graphs for the full transformation semigroup T_n, the order-preserving transformation semigroup O_n, and the Catalan monoid C_n. We describe their structural properties and compare their behaviors. In particular, we show that the graph corresponding to O_n is an induced subgraph of that of T_n, while such a relation does not hold for C_n, even though $C_n \subset O_n \subset T_n$. This demonstrates that inclusion of semigroups does not necessarily preserve inclusion of the associated graphs.

Fundamental Aspects of Skin Cancer Drugs via Degree-Based Topological Descriptors and Curvilinear Regression Models

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In this study, a quantitative structure–property relationship analysis of skin cancer drugs have been conducted. Topological indices have been used to predict physicochemical properties. The curvilinear regression was to capture both linear and non-linear relationships. For volumetric and electronic properties, strong correlations were shown. However, surface based properties showed weak performance. The models were evaluated using statistical parameters, along with external validation like Q^2. Overall, the finding indicates that the combination of topological indices and curvilinear regression, gave an optimal framework for predicting properties.

On structural properties of some probable $R(3,10)$-critical graphs

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The Ramsey number $R(s,t)$ is the smallest positive integer n such that every graph on n vertices contains either a clique of size s or an independent set of size t. An $R(s,t)$-critical graph is a graph on $R(s,t)-1$ vertices that contains neither a clique of size s nor an in dependent set of size t. It is known that $40 \leq R(3,10) \leq 42$. We study the structure of a $R(3,10)$-critical graphs by assuming $R(3,10) = 42$. We show that if such a graph exists then its minimum degree and vertex connectivity are the same and is 6,7 or 8. Then we find all the possible degree sequences of such graphs. Further, we show that if such a graph exists, then its diameter is either 2 or 3, and if it has diameter 2 and minimum degree 6, then it has only 21 choices for its degree sequence.

Universal Eigenvalues Of Principal Ideal Graph Of The Multiplicative Semigroup Z_n

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We investigate the principal ideal graph of the semigroup $(Zn, \cdot)$ under multiplication modulo n. In this graph, vertices correspond to non-zero elements of Z_n, with adjacency defined by the non-trivial intersection of their generated principal ideals. By leveraging the divisor structure of (n), we partition the vertex set according to the greatest common divisor with n, revealing that the graph decomposes into an H-join of complete subgraphs indexed by these divisors. The auxiliary graph H encodes adjacency between divisors based on the least common multiple condition. Utilizing this decomposition, we derive an explicit formula for the universal adjacency spectrum of the principal ideal graph in terms of the spectra of the components and the structure of H. This framework provides a comprehensive spectral characterization of the graph associated with $(Z_n, \cdot)$.

On the Block Vertex Neighborhood Number of Connected Graphs

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The open neighborhood $N(w)$ of a vertex $w \in V$ consists of all vertices adjacent to w in an undirected graph. The closed neighborhood $N[w]$, includes w and all vertices reachable from it. The fragments of subgraphs held together by its cut-vertices are its blocks. Let $B(G)$ denote the set of all blocks in G. A block $b \in B(G)$ bv-covers a vertex v if $v \in \langle N[b] \rangle$, where $\langle N[b] \rangle$ is the subgraph induced by the closed neighborhood of b. A set $S \in B(G)$ is a bv-neighborhood set if every vertex v is bv-covered by some $b \in S$, that is, $G = \bigcup_{b \in B(G)} \langle N[b] \rangle$. The minimum cardinality of bv-neighborhood set is $b \in B(G)$ called a block vertex neighborhood number $n_{bv}(G)$. In this work, we establish upper and lower bounds for $n_{bv}(G)$, characterize extremal graph classes attaining these bounds and compute exact values of $n_{bv}(G)$ for graphs associated with block-related parameters.

Neighbourhood Degree Based Topological Indices Of Transformation Graphs

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Topological indices play a significant role in graph theory, mathematical chemistry, and network analysis as they provide numerical characterizations of graph structures and are useful in studying physicochemical properties of molecular graphs. Motivated by the growing importance of neighbourhood degree concepts in enhancing the discriminating ability of classical degree-based descriptors, we derive exact expressions for first and fifth M-Zagreb indices corresponding to selected graph transformations viz., splitting graph, shadow graph and Mycielskian graph of a graph in this research work. The obtained results are presented in closed forms. The derived formulations enrich the existing literature on graph invariants and may find potential applications in chemical graph theory, quantitative structure–property relationship(QSPR) studies, and complex network analysis.

Towards Intelligent Passenger Train Operations: A Probabilistic-Fuzzy-AI Multi-Criteria Decision-Making Approach

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Strong decision-making is necessary for passenger train operations in dynamic, uncertain environments where numerous interdependent criteria are at play. The necessity for adaptive learning, stochastic unpredictability in operational data and the ambiguity of expert judgements are all challenges that traditional optimisation techniques find difficult to properly manage. This paper suggests a unified hybrid Multi-Criteria Decision-Making (MCDM) framework that combines reinforcement learning for adaptive refinement, probabilistic entropy for stochastic uncertainty and fuzzy logic for linguistic ambiguity. The method uses an upgraded Fuzzy TOPSIS for initial ranking after first generating subjective weights from expert knowledge using a Fuzzy Delphi Analytic Hierarchy Process (AHP). These are then combined with entropy-based objective weights in a hybrid scheme. Real-time feedback is then used by a reinforcement learning model to iteratively improve decisions. The framework shows excellent flexibility, ranking stability and decision transparency when implemented in a case study in passenger rail scheduling and operations. Measurable improvements in efficiency, service quality and punctuality are demonstrated by experimental outcomes utilising real-world datasets. These results offer useful recommendations as well as methodological improvements for intelligent railway decision support systems.

On a conjecture of DeLaViña and Waller

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The Wiener index of a connected graph is defined as the sum of distances between all its unordered pairs of vertices. Characterizing graphs on n vertices with a fixed diameter that maximize the Wiener index is a long-standing open problem. This problem has been resolved fully for trees on n vertices with diameter $d \in \{1, 2, 3, 4, n-3, n-2, n-1\}$ while partial results are available for $d = 5$ and 6. In this context, a conjecture proposed by DeLaViña and Waller has remained open for the last 18 years. In this paper, we establish a necessary condition for a tree to attain the maximum Wiener index among all trees on n vertices with a given diameter. Using this condition, we characterize the maximal trees for diameter $n-4$ and $n-5$. Furthermore, we prove the DeLaViña Waller conjecture for the classes of graphs having 0,1,2,3 or $n-4$ cut vertices.

On P vs NP: Revisiting Computational Complexity Through Structural and Algorithmic Perspectives

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Most of the research in computer science for the last 50 years is centered around the P vs NP problem. In this paper we present an approach which is strongly polynomial for the max cycle in a un-directed graph which can be extended to a TSP problem. As a part of our work we came across a graph decomposition theorem which separates a given undirected graph into a polynomial number of components. We developed a Java Implementation of the same & a set of comparison graphs in terms of performance.There are at least 3600 problems and we have a polynomial time algorithm solution if the above algorithm is correct.

On the K-Metro Domination Number of Triangular Snake Graph

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A dominating set D of a graph $G = (V, E)$ is called a metro dominating set of G if for every pair of vertices $u, v \in V$, there exists a vertex $w \in D$ such that $d(u, w) \neq d(v, w)$.

The k-metro domination number of a triangular snake graph $\gamma^k_\beta(T_n)$ is the order of the smallest k-dominating set of T_n which serves as a metric set.

In this paper, we calculate the k-metro domination number of the triangular snake graph $\gamma^k_\beta(T_n)$.

Total dominator coloring of some classes of perfect graphs

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Given a graph G with no isolated vertex, total dominator coloring is a proper coloring in which every vertex properly dominates at least one color class. The total dominator chromatic number is the minimum number of color classes in a total dominator coloring and is denoted by χ^t_d. A graph G is a perfect graph if for every induced subgraph H, the chromatic number of H is equal to the size of the maximum clique in H. In this paper, we study the total dominator coloring for some classes of perfect graphs. Bounds for the total dominator chromatic number are obtained for some classes of perfect graphs, and the sharpness of some of these bounds is also established.

The Eccentricity-Temperature Indices Of Graphs

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Topological indices in graph theory are numerical parameters associated with a graph that capture structural information about it. These indices play an important role in chemical graph theory, network analysis, and mathematics for comparing graphs and predicting their properties.

In this paper, we introduce the eccentricity temperature–based indices of a graph G, namely the Sum eccentricity–temperature index $SET(G)$, Product eccentricity–temperature index $PET(G)$, and Difference eccentricity–temperature index $DET(G)$. We determine the exact values of these indices for certain classes of graphs and establish several bounds and characterizations by applying classical inequalities

Mutual-visibility coloring of graphs

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The mutual-visibility chromatic number of a graph G is the smallest number of colors needed to color the vertices of G such that each color class is a mutual-visibility set. In this paper, we prove that determining the mutual-visibility chromatic number of a graph is NP-complete even when restricted to the class of graphs having diameter four and mutual-visibility chromatic number two. We further determine the exact value of the mutual-visibility chromatic number for glued binary trees and glued t-ary trees.

The Steiner Comb Problem: Complexity Across Different Graph Classes

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Given a connected graph G and a terminal set $R \subseteq V(G)$, the Steiner tree problem (ST) asks for a tree that spans all of R with at most r vertices from $V(G)\backslash R$, for some integer $r \geq 0$. It is known from (Garey et al.,1977 [1]) that ST is NP-complete, even for split graphs [2].

A Steiner tree in which all terminal vertices are constrained to be leaves is called a terminal Steiner tree. A comb graph is a specific type of tree formed by taking a path graph with vertices and attaching a single pendant edge to every vertex. We introduce a new variant of the terminal Steiner tree problem, termed the Steiner comb problem. In this formulation, the solution is restricted to a comb graph rather than a general tree, with the terminal vertices designated as the teeth of the comb. We define three versions of this problem and analyze the complexity on different graph classes.

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Dominated coloring of some classes of graphs

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For a graph G, the dominated coloring of G is a proper vertex coloring such that each color class is dominated by a vertex. The minimum number of colors required for a dominated coloring of G is called dominated chromatic number of G and is denoted by $\chi_{\text{dom}}(G)$. Unicyclic graphs are connected graphs containing exactly one cycle. In this paper, we study the dominated chromatic number of some unicyclic graphs and the generalised Sierpinski graph of some classes of graphs.

Efficient k-Limited Broadcast Domination in Graphs and Graph Products

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An efficient dominating set decomposes a graph into disjoint structures induced by pairwise non-overlapping closed neighborhoods. In contrast, a k-limited dominating broadcast ensures domination in terms of vertices within distance at most k. In this paper, combining these two ideas, we introduce the notion of efficient k-limited dominating broadcast (k-ELDB): a k-limited broadcast in which every vertex is dominated exactly once. An efficient k-LDB offers a powerful framework for controlled information dissemination across diverse networks, guaranteeing full coverage while minimizing overhead. In particular, k-ELDB drives highly efficient communication in IoT sensor networks, where energy consumption, interference, and redundant transmissions are critical design constraints. Beyond IoT, it naturally extends to distributed computing, overlay network design, and a broad range of related domains. Motivated by these, we introduce and systematically investigate this domination parameter for certain standard graph families and a rich collection of graph products.

Ramsey Sequences with Bounded Clique Number

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A sequence of graphs $\{G_k\}$ is a Ramsey sequence if for every positive integer k, the graph G_k is a proper subgraph of G_{k+1}, and there exists an integer $n > k$ such that every red-blue coloring of G_n contains a monochromatic copy of G_k. Among the wide range of open problems in Ramsey theory, an interesting open question is "Does there exist an ascending sequence G_k with $\lim_{k\to\infty} \chi(G_k) = \infty$ and $\lim_{k\to\infty} \omega(G_k) \neq \infty$ that is a Ramsey sequence?" In this paper, we solve this problem by constructing a Ramsey se quence $\{G_k\}$ with a bounded clique number such that $\lim_{k\to\infty} \chi(G_k) = \infty$. Furthermore, using the observation that any monotonic increasing sequence of graphs that contains a Ramsey sequence as a subgraph is also Ramsey, we can generate infinitely many Ramsey sequences using this example.

Matrix-Based Computation Of Topological Descriptors Of Graphs

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For complex graphs, direct computation of indices becomes difficult when we are computing them by using their definitions. In this paper, we investigate most of the degree-based topological indices through a single graph matrix. Efficient programming algorithms are developed. The proposed matrix-based approach simplifies the complex computations and provides a unified framework for studying topological descriptors.

On the Chromatic Total Domination Number of Zero Divisor Graphs of Z_n

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Let $G = (V, E)$ be a simple, finite and undirected graph without isolated vertices.A set $D \subseteq V$ is said to be chromatic total dominating set of G if D is a total dominating set and $\chi(\langle D \rangle) = \chi(G)$. The graph is said to be zero divisor graph $\Gamma(Z_n)$ with vertex set $V(\Gamma(Z_n)) = \{x \in Z_n | x \neq, x \text{ is a zero divisor}\}$ such that there is an undirected edge between the vertices x and y if and only if $x \neq y$ and $xy = 0$. In this paper ,we study chromatic total domination on zero divisor graphs and some of its characteristics .

On Modular Chromatic Number of Generalized Mycielskian Graphs

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The modular chromatic number $\chi_{mc}(G)$ of graph G is least positive integer $q \geq 1$ s.t. G admits an (improper) coloring with colors from $\mathbb{Z}_q$, for every pair of adjacent vertices of G, sum of colors of their neighbors are distinct under Zq. In 2010, Okamoto et al. [1] posed the problem: Does any graph G satisfy $\omega(G) < \chi(G) < \chi_{mc}(G)$? In this work, we find some class of graphs which satisfies the above inequality. Moreover, we focus on modular chromatic number for generalized Mycielskian of some regular graphs, path P_n , star S_n , complete graph K_n and wheel graphs W_n.

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Distance-2 Domination in Toeplitz Graphs and Its Applications to Network Monitoring

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The aim of this article is to study the importance of graph theoretical concepts and the applications of distance-2 domination of some graphs. A set D is a distance-2 dominating set if for every vertex $u \in V - D$, $d(u, D) \leq 2$. The minimum cardinality of such a set is called the distance-2 domination number and is denoted by $\gamma_2(G)$. In this paper, we obtain exact values for some Toeplitz graphs.

Quantifying uncertainty in assignment problem: An application of the Fuzzy Wiener index

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The assignment problem is a foundational combinatorial optimization challenge focused on allocating distributed tasks to operational resources while minimizing cumulative costs or maximizing systemic efficiency. Traditional linear programming techniques provide exact resolutions in deterministic environments but lack the mathematical elasticity required to handle the ambiguity, linguistic imprecision, and epistemic uncertainty inherent in real-world decision-making scenarios. To bridge this gap, this study introduces an innovative topological optimization framework that incorporates the Fuzzy Wiener Index (FWI) from fuzzy graph theory to evaluate and determine optimal assignment configurations. The proposed methodology models the allocation infrastructure as a Complete Fuzzy Bipartite Graph ($\mathcal{B}_F$), mapping structural entities into independent vertex sets where edge weights are defined as fuzzy numbers representing qualitative preference profiles. Rather than relying on isolated local-edge evaluations, the framework utilizes shortest path network distances to calculate node-deleted Fuzzy Wiener Index values, establishing a globally balanced disparity assignment matrix. Performance evaluation and localized perturbation sensitivity analysis demonstrate that the proposed method introduces a profound load-smoothing capability. By strategically trading off short-sighted localized cost minimization, the algorithm successfully minimizes systemic workload variance and exhibits exceptional topological persistence under active operational stress. Ultimately, this framework offers a highly resilient, mathematically sound, and flexible alternative to classical assignment techniques, proving exceptionally advantageous for risk-averse engineering and logistical networks operating under high uncertainty.

Existence of Flow-up Basis for Generalized Spline Modules on Arbitrary Trees

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A graph G is given with its edges labeled by ideals of a commutative ring R with identity. A vertex labeling of G by the elements of R is called a generalized spline if the difference of the vertex labels of adjacent vertices lies in the ideal associated to the edge.The set of generalized splines defined on graph G becomes a ring with respect to pointwise operations and also module over the ring R for scalar multiplication by the elements of R. We have studied basis criteria for generalized splines on some isomorphic graphs over GCD domain and constructed ow-up basis for generalized spline modules on arbitrary trees.

Zagreb Indices and Zagreb Energy of Zero-Divisor Graphs of Commutative Rings and Their Applications

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Let $\Gamma(\mathcal{R})$ be the zero-divisor graph of a commutative ring $\mathcal{R}$, whose vertex set consists of all nonzero zero-divisors, where two distinct vertices a and b are adjacent if and only if $ab = 0$. The Zagreb matrix of $\Gamma(\mathcal{R})$ yields eigenvalues $z_1, z_2, ..., z_n$, and the corresponding Zagreb energy is defined as $\mathcal{ZE}(\Gamma(\mathcal{R})) = n\sum_{i=1}^{n} |z_i|$. In this paper, we investigate the Zagreb indices and Zagreb energy of zero-divisor graphs arising from commutative rings, derive explicit formulae for these graph invariants, and analyze their structural properties. The obtained results reveal the relationship between the algebraic properties of commutative rings and the topological characteristics of their associated zero-divisor graphs, thereby contributing to the study of algebraic graph theory and graph-based molecular descriptors.

Total Eccentricity Polynomial of Corona Product of Symmetric Regular Graph And Some Basic Graphs

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This research signifies recent advancements in investigating the Total eccentricity polynomial which is extended to the corona product graphs obtained from the products of some standard graphs like cycle, path, grid, binomial trees etc. with regular symmetric graphs which yields an interesting results because of its uniform regularity and more tractable to analyze the products since it based on the aforementioned standard graph giving this study a good opportunity to understand non-commutativeness in applicable polynomials. The results obtained can be proved algebraically, may serve as a new avenue for investigating polynomials invariants in more complex graphs and its graphs arising from their products.

Decagonal Graceful Labeling of Toeplitz Graphs

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Graph labeling has been a prominent area of research in discrete mathematics since the introduction of graceful labeling by Rosa in 1967. This paper investigates a specialized variant known as decagonal graceful labeling. In this scheme, a graph $G = (V, E)$ with m edges admits a labeling if there exists an injective function $f : V \to \{0, 1, \ldots, D_m\}$, where $D_m = 4m^2 - 3m$ is the m-th decagonal number, such that the induced edge labels $\{|f(u) - f(v)| : uv \in E\}$ form the set of the first m decagonal numbers $\{D_1, D_2, \ldots, D_m\}$. We focus on the application of this labeling scheme to Toeplitz graphs, a well-studied family of graphs defined by constant diagonals. We provide a constructive proof demonstrating that any single-band Toeplitz graph $T_n\langle t\rangle$ (which is isomorphic to a disjoint union of paths) admits a decagonal graceful labeling. Furthermore, we establish necessary conditions for multi-band Toeplitz graphs and prove that certain configurations, such as the 4-cycle $T_4\langle 1, 3\rangle$, inherently cannot admit such labeling due to arithmetic constraints of decagonal numbers.

Some Results on Topological Indices of Generalized Join Graphs

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Topological indices are numerical parameters of a graph that remain invariant under the graph isomorphism.They are widely used in chemical graph theory, network analysis, and QSAR/QSPR studies to describe structural properties.In this paper, we obtain some of the topological indices such as Schultz index , Gutman index , Sombor index , Augmented Zagreb index ,Reciprocal Degree Distance of the generalized join graph.

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