大会报告

Creative Telescoping

陈绍示

中国科学院数学与系统科学研究院

Abstract: Creative telescoping is a method for finding linear recurrence or differential equations for definite sums or integrals with parameters. It has been intensively studied since the early 1990s, and can now be considered as a classical technique in combinatorics and symbolic computation. At the same time, it is still a subject of ongoing research. This talk presents recent developments and open problems related to creative telescoping.

q-analog Deza-Erdős-Frankl theorem and its applications

胡思煌

山东大学

Abstract: Let M be a metric space and D a finite set of positive integers. A subset $C \subseteq M$ is called a D-distance code if the distance between any two distinct elements of C takes values only in D. Few-distance codes have been extensively studied in various metric spaces. In this work, we focus on few-distance codes in Hamming space, leveraging the Deza-Erdős-Frankl theorem as our primary tool. This theorem provides an exact bound for uniform families with restricted intersection sizes, resolving the binary case in Johnson space. We extend this result to the q-ary case, deriving a q-analogue of the Deza-Erdős-Frankl theorem. Remarkably, the upper bound for few-distance codes in q-ary Johnson space matches that of the binary case and is independent of q, the alphabet size. We then apply this result to address several problems concerning few-distance codes in Hamming space.

Recent Progress on Antimagic Labeling Problems

李渭天

台湾中兴大学

Abstract: In 1990s, Hartsfield and Rangel proposed the following graph labeling problem: Given a connected graph G on m edges, can one label the edges of G with $1, 2, \ldots, m$ such that every edge have a distinct label and when summing up the labels of edges incident to a vertex, distinct vertices have distinct sums. They conjectured that every connected graph on more than two vertices has a such kind of labeling. Numerous graphs have been proved to satisfy this conjecture. However, it still remains widely

open. Besides, there are various generalizations of this problem. We call all these problems the antimagic labeling problems.

In this talk, I will introduce some recent results of mine and my coworkers on the antimagic labeling problems. A main result is that we have settled a local antimagic orientation conjecture proposed by Chang, Jing, and Wang in 2020. In addition, a conjecture of Hefetz, Műtze, and Schwartz in 2010 that every connected graph admits an antimagic orientation can be proved to be true for almost all graphs using the same ideas.

Progress on several Ramsey-type problems

林启忠

福州大学

Abstract: "Complete disorder is impossible". This statement captures the essence of Ramsey theory. Similar ideas can be found in many areas of mathematics, including geometry, number theory, logic, and analysis. A classic example is van der Waerden's theorem (1927), which states that for any given k-coloring of the set of natural numbers, there must exist a monochromatic arithmetic progression of arbitrary length. In this talk, we will introduce several Ramsey-type problems and their recent developments, including the Ramsey goodness problem, the Erdős-Hajnal function, the Erdős-Rogers function, and the Erdős-Gyarfas function, among other related topics.

Combinatorics of gamma-positivity

林志聪

山东大学

Abstract: Gamma-positivity implies unimodality for palindromic polynomials. The idea behind it stems from work of Foata, Schutzenberger and Strehl on the Eulerian polynomials. I will present my work on this theme from the view point of permutation statistics, from q-Eulerian polynomials to Gessel's gamma-positivity conjecture, to our recent exciting connections found between multiset Eulerian polynomials and weakly increasing trees, as well as some of my favorite conjectures.

Recent Progress in Rainbow Matching fo k-Uniform Hypergraphs

鲁红亮

西安交通大学

Abstract: Let $\mathcal{F} = \{F_1, \ldots, F_t\}$ be a family of hypergraphs. A set of pairwise disjoint edges, one from each F_i, is called a *rainbow matching* for $\mathcal{F}$, and we say that $\mathcal{F}$ or $\{F_1, \ldots, F_t\}$ *admits* a rainbow matching. In this talk, we will introduce some problems and recent results on rainbow matchings in hypergraphs.

Local density in K_r-free graphs

汪彦

上海交通大学

Abstract: In 2003, Keevash and Sudakov showed that for $r \geq 3$ and $1 - \frac{1}{2(r-1)^2} \leq \alpha \leq 1$, every K_r-free graph G on n vertices contains $\lfloor \alpha n \rfloor$ vertices spanning at most $\frac{r-2}{2(r-1)}(2\alpha - 1)n^2$ edges, and if every $\lfloor \alpha n \rfloor$ vertices in G span at least $\frac{r-2}{2(r-1)}(2\alpha - 1)n^2$ edges, then G is isomorphic to the Turán graph $T_{r-1}(n)$. They conjectured that the range of α can be extended to $1 - \frac{1}{r-1} \leq \alpha \leq 1$ when $r \geq 4$. We show that this conjecture is true for all $r \geq 5$. We also prove this conjecture for $r = 4$ and $\alpha \geq 0.76$, which greatly improves the previous range $\alpha \geq 0.861$. This is joint work with Xinyuan Li and Jiaao Li.

Multiple Perspectives on Eulerian-Type and Stirling-Related Polynomials

叶均承

台湾高雄师范大学

Abstract: In this talk, we investigation into Eulerian type polynomials and Stirling permutations from multiple perspectives. Building upon the framework introduced in our previous work—including differential equations, differential operators, and combinatorial models—we further develop structural and algebraic connections between these two central families.

This year, we introduce the notion of Stirling permutation codes and explore their power in encoding equidistribution phenomena and generating multivariate expansions. We also incorporate the theory of grammatical bases and show how formal grammars offer a unifying language for various families of polynomials, including Eulerian, Narayana, and derivative polynomials.

Through this extended framework, we derive a series of gamma-positive and e-positive expansions, establish interlacing and alternatingly increasing properties, and reveal new connection among statistics on signed, colored, and Stirling permutations.

特邀报告

Constructions of strong orthogonal arrays

包经俊

宁波大学

Abstract: Strong orthogonal arrays have better space-filling properties than ordinary orthogonal arrays for computer experiments. Strong orthogonal arrays of strength two plus, two star and three minus can improve the space-filling properties in low dimensions and column orthogonality plays a vital role in computer experiments. In this talk, I will introduce some direct and recursive constructions of strong orthogonal arrays and column-orthogonal strong orthogonal arrays of strength two plus and t.

Cycle lengths in graphs of given minimum degree

白延东

西北工业大学

Abstract: The distribution of cycle lengths in graphs of given basic parameters, such an minimum degree, edge number, etc, has been extensively studied in the literature and remains one of the most active and fundamental research areas in graph theory. In this talk, I will introduce some problems together with our recent progress on cycle lengths in graphs of given minimum degree.

简单图的边染色问题中的Vizing猜想与Overfull猜想

曹龚

大连理工大学

Abstract: 自从Vizing于60年代使用Vizing fan结构证明了简单图的边染色数只可能是Δ或$\Delta+1$(Δ为图的最大度), 并将图分为第一类和第二类开始, 图的分类问题就成为了边染色方向的核心问题. 遗憾的是, 确定简单图的边染色数这一问题在1981年被Holyer证明是NP困难的. 于是人们只好退而求其次, 开始寻找在某种条件下判断图为第一类还是第二类的方法. 在所有这些研究当中, 临界图自然地受到了特别的关注. 一个第二类图被称为临界图, 如果它的任意真子图的边染色数都小于该图的边染色数. 报告人所在团队近年来对临界图相关的猜想进行了深入的研究, 本次报告将着重介绍团队在Vizing的几个临界图相关猜想与Hilton的Overfull猜想上的成果.

New result on orthogonal array OA$(3,6,v)$

曹海涛

南京师范大学

Abstract: An orthogonal array of index unity, order v, degree k and strength 3, or an OA$(3,k,v)$ in short, is a $k\times v3$ array on v symbols and in every $3\times v3$ subarray, each 3-tuple column vector occurs exactly

once. Few results are known about the existence of an $\mathrm{OA}(3,k,v)$ for $k>4$. In this talk, we will introduce new infinite classes of $\mathrm{OA}(3,k,v)$s for $k=5,6$.

Total positivity problems and planar network approaches

陈曦

大连理工大学

Abstract: Total positivity problems have been widely studied in both pure and applied mathematics. In this talk, we present sufficient conditions for the total positivity of combinatorial triangles and their reversals, as well as the real-rootedness of generating functions of the rows. The proof technique is to construct a unified planar network that represent the corresponding matrices when selecting different sets of sources and sinks. Then we apply the results to several combinatorial matrices, including Riordan arrays and recursive matrices.

Some results on the classification of the graphical m-semiregular representation of finite groups

杜佳丽

南京师范大学

Abstract: A graph or digraph is called regular if each vertex has the same valency, or, the same out-valency and the same in-valency, respectively. Recently, we extend the classical notion of digraphical and graphical regular representation of a group. A (di)graphical m-semiregular representation (respectively, GmSR and DmSR, for short) of a group G is a regular (di)graph whose automorphism group is isomorphic to G and acts semiregularly on the vertex set with m orbits. When $m=1$, this definition agrees with the classical notion of GRR and DRR. Finite groups admitting a D1SR were classified by Babai in 1980, and the analogue classification of finite groups admitting a G1SR was completed by Godsil in 1981. In this talk, I'll introduce the recent results about GmSRs and DmSRs (for arbitrary positive integers m).

Congruence properties for partition functions

杜庆丹

河北师范大学

Abstract: Ramanujan discovered the three celebrated partition congruences modulo the powers of $5, 7$ and 11 satisfied by the partition function $p(n)$. There are many partition functions enjoying the congruence properties. In this talk, we will present a method to prove infinite families of congruences, which can be used to prove congruence families which are associated with the modular curve with genus 1.

Toughness, hamiltonicity and spectral radius in graphs

樊丹丹

新疆农业大学

Abstract: A graph G is t-tough if $|S| \geq tc(G-S)$ for every subset $S \subseteq V(G)$ with $c(G-S) > 1$, where $c(G-S)$ denotes the number of components of a graph $G-S$. Note that if G has a Hamiltonian cycle, then G is 1-tough. Conversely, Chvátal proposed the conjecture that there exists a finite constant t_0 such that every t_0-tough graph is Hamiltonian. In this talk, we provide the spectral conditions to guarantee the existence of a Hamiltonian cycle among 1-tough graphs and split graphs, respectively. Moreover, we also consider the toughness of a graph in terms of its spectral radius.

Puzzles in Schubert Calculus

范久瑜

四川大学

Abstract: Puzzles were introduced by Knutson and Tao around 2000, who used it to enumerate structure constants of the cohomology ring of Grassmannians. We will review the main development of puzzles in the field of Schubert calculus and present our results on using this model to compute structure constants for the three-variable Schubert calculus with separated descents. This talk is based on joint work with Peter L. Guo and Rui Xiong.

Zeta Functions: From Numbers to Graphs

冯立华

中南大学

Abstract: In this talk, I will briefly introduce the history of Zeta Functions and its variations, then introduce the graph version. Using linear algebra and representation theory, we get the complexity of the relative lift of a graph, which extends the related results on the regular lift version.

Inverse Kazhdan-Lusztig polynomials of fan matroids, thagomizer matroids and double-cycle matroids

郜璐璐

西北工业大学

Abstract: The inverse Kazhdan-Lusztig polynomial of a matroid remains a relatively unexplored invariant. In this talk, we determine the inverse Kazhdan-Lusztig polynomials for three families of graphic matroids: fan matroids, thagomizer matroids, and double-cycle matroids. We further present a formula that relates the inverse Kazhdan-Lusztig polynomial of a matroid M to those of the matroids obtained by deleting an element, and by taking various restrictions and contractions of M.

Rogers-Ramanujan type identities and generalized Lambert series

谷珊珊

南开大学

Abstract: The Rogers-Ramanujan identities were first discovered by Rogers in 1894 and were rediscovered by Ramanujan around 1913. During the study of these two identities, more Rogers-Ramanujan type identities appeared. Furthermore, generalizations of this kind of identities have also attracted the attention of mathematicians. In this talk, by using some identities involving generalized Lambert series, we derive more generalizations of Rogers-Ramanujan type identities.

Improper coloring of planar graphs

黄丹君

浙江师范大学

Abstract: A graph G is improperly $(d_1, d_2, \ldots, d_k)$-colorable if its vertices can be partitioned into k subsets $V_1, V_2, \ldots, V_k$ such that the maximum degree of $G[V_i]$ is at most d_i for each $1 \leq i \leq k$. In this talk, we will show that every planar graph without cycles of length $4, 5$ or 10 is improper $(1, 0, 0)$-colorable.

Number of Subgraphs and Their Converses in Tournaments

雷辉

南开大学

Abstract: An oriented graph D is converse invariant if, for any tournament T, the number of copies of D in T is equal to that of its converse $-D$. El Sahili and Ghazo Hanna [J. Graph Theory 102 (2023), 684-701] showed that any oriented graph D with maximum degree at most 2 is converse invariant. They proposed a question: Can we characterize all converse invariant oriented graphs?

In this talk, we introduce a digraph polynomial and employ it to give a necessary condition for an oriented graph to be converse invariant. We characterize all orientations of trees with diameter at most 3 that are converse invariant. In addition, in contrast to the findings of El Sahili and Ghazo Hanna, we prove that every connected graph G with maximum degree at least 3, admits an orientation D of G such that D is not converse invariant.

This is joint work with Jiangdong Ai, Gregory Gutin, Anders Yeo, Yacong Zhou

Proper additive choice number of planar graphs

赖欣豪

台湾高雄师范大学

Abstract: A proper additive coloring of a graph G is a labeling of its vertices with positive integers such that, for every pair of adjacent vertices, the assigned integers are distinct and the sums of integers assigned to their neighbors are different. The proper additive choice number of G is the least integer k such that, whenever each vertex is given a list of at least k available integers, a proper additive coloring can be chosen from the lists.

In this talk, I will introduce some applications of Combinatorial Nullstellensatz in the study of proper additive coloring and present upper bounds on the proper additive choice number of planar graphs. This is a joint work with Cheng-Lin Tsou, Yi-Hsuan Huang, and Yu-Jhan Su.

Hamilton cycles in vertex-transitive graphs of order $10p$

李靖建

广西大学

Abstract: The existence of Hamilton cycles in vertex-transitive graphs is a fundamental problem in graph theory. In 2012, Kutnar, Marušič, and Zhang proved that every connected vertex-transitive graph of order $10p$ (where $p \neq 7$ is a prime), with the exception of a specific family of graphs, contains a Hamilton path. Recently, Du, Luo, and the third author resolved this exceptional case, establishing that all such graphs admit a Hamilton path.

In this paper, we strengthen these results by proving a stronger conclusion: every connected vertex-transitive graph of order $10p$ (with p prime) in fact contains a Hamilton cycle. This settles the Hamiltonicity problem for this class of graphs completely, providing an advancement in the study of symmetry and properties in finite graphs. Our result contributes to the broader understanding of Hamiltonian properties in vertex-transitive graphs, a central topic in algebraic and structural graph theory.

On the permutation group of irreducible cyclic codes

李伟聪

大湾区大学

Abstract: Let q be a prime power and n be a positive integer with $\gcd(n, q) = 1$. Let m be the multiplicative order of q modulo n, and ξ a primitive n-th root of unity in F_{q^m}. An irreducible cyclic code of length n over F_q has a trace representation

$$\left\{ \left(\mathrm{Tr}_{F_{q^m}/F_q}(a), \mathrm{Tr}_{F_{q^m}/F_q}(a\xi), \ldots, \mathrm{Tr}_{F_{q^m}/F_q}(a\xi^{n-1}) \right) : a \in F_{q^m} \right\}.$$

The permutation group $\mathrm{PAut}(C)$ of such a code C is typically *standard* (generated by the cyclic shift and Frobenius map), but some codes are *nonstandard* ith larger groups. Using CFSG and Aschbacher's theorem, we classify all nonstandard irreducible cyclic codes: they either appear in explicit sporadic examples, belong to a new infinite family, or are built from these via four fundamental constructions. Furthermore,

we generalize results on linear recurring sequence subgroups (resolving Brison–Nogueira's conjecture) and verify the Schmidt–White conjecture for two-weight irreducible cyclic codes in the nonstandard case. This is joint work with Tao Feng, Henk D.L. Hollmann, and Qing Xiang.

Connected graphs whose second largest eigenvalue does not exceed 1

刘木伙

华南农业大学

Abstract: Connected graphs whose second largest eigenvalue does not exceed 1 have been investigated in the last four decades. Over the years only few particular classes with this spectral property are completely determined. In this talk, we will introduce some recent results on connected graphs with this spectral property.

On the binomial transforms of Apery-like sequences

刘纪彩

温州大学

Abstract: In this proof of the irrationality of $\zeta(3)$ and $\zeta(2)$, Apery defined two integer sequences through 3-term recurrences, which are known as the famous Apery numbers. Zagier et al. introduced the other 13 sporadic sequences through variants of Apery's 3-term recurrences. All of the 15 sporadic sequences are called Apery-like sequences. Let $\{u_n\}_{n\geq 0}$ be one of the 15 Apery-like sequences and N_α be the largest positive integer such that $u_n \equiv \alpha^n (\mathrm{mod} N_\alpha)$ for all non-negative integers n. In this talk, we investigate the values of N_α for all of the 15 Apery-like sequences through the binomial transforms. The main results cover Gessel's congruences and Malik–Straub's congruences.

Spectral Turán problem of non-bipartite graphs: Forbidden books

刘瑞芳

郑州大学

Abstract: A book graph B_{r+1} is a set of $r+1$ triangles with a common edge, where $r \geq 0$ is an integer. Zhai and Lin [J. Graph Theory 102 (2023) 502-520] proved that for $n \geq \frac{13}{2}r$, if G is a B_{r+1}-free graph of order n, then $\rho(G) \leq \rho(T_{n,2})$, with equality if and only if $G \cong T_{n,2}$. Note that the extremal graph $T_{n,2}$ is bipartite. Motivated by the above elegant result, we investigate the spectral Turán problem of non-bipartite B_{r+1}-free graphs of order n. For $r = 0$, Lin, Ning and Wu [Comb. Probab. Comput. 30 (2021) 258-270] provided a complete solution and proved a nice result: If G is a non-bipartite triangle-free graph of order n, then $\rho(G) \leq \rho\big(SK_{\lfloor \frac{n-1}{2} \rfloor, \lceil \frac{n-1}{2} \rceil}\big)$, with equality if and only if $G \cong SK_{\lfloor \frac{n-1}{2} \rfloor, \lceil \frac{n-1}{2} \rceil}$, where $SK_{\lfloor \frac{n-1}{2} \rfloor, \lceil \frac{n-1}{2} \rceil}$ is the graph obtained from $K_{\lfloor \frac{n-1}{2} \rfloor, \lceil \frac{n-1}{2} \rceil}$ by subdividing an edge.

For general $r \geq 1$, let $K^{r,r}_{\lfloor \frac{n-1}{2} \rfloor, \lceil \frac{n-1}{2} \rceil}$ be the graph obtained from $K_{\lceil \frac{n-1}{2} \rceil, \lfloor \frac{n-1}{2} \rfloor}$ by adding a new vertex v_0 such that v_0 has exactly r neig -hbours in each part of $K_{\lceil \frac{n-1}{2} \rceil, \lfloor \frac{n-1}{2} \rfloor}$. By adopting a different technique named the residual index, Chvátal-Hanson theorem and typical spectral extremal methods, we in this paper prove that: If G is a non- bipartite B_{r+1}-free graph of order n, then $\rho(G) \leq \rho\Big(K^{r,r}_{\lfloor \frac{n-1}{2} \rfloor, \lceil \frac{n-1}{2} \rceil}\Big)$, with equality if and only if $G \cong K^{r,r}_{\lfloor \frac{n-1}{2} \rfloor, \lceil \frac{n-1}{2} \rceil}$. An interesting phenomenon is that the spectral extremal graphs are completely different for $r = 0$ and general $r \geq 1$.

Spectral radius of bipartite graphs with prescribed number of edges

刘家安

台湾东吴大学

Abstract: The Brualdi-Hoffman conjecture, proved by Rowlinson in 1988, characterized the graph with maximal spectral radius among all simple graphs with prescribed number of edges. In 2008, Bhattacharya, Friedland, and Peled proposed an analog of the Brualdi-Hoffman conjecture for bipartite graphs. However, we provided counterexamples to the Bhattacharya-Friedland-Peled conjecture in 2022. In this talk, we will give some approaches on this topic. This is a joint work with Yen-Jen Cheng, Feng-lei Fan, and Chih-wen Weng.

Optimal Conflict-Avoiding Codes and Related Topics

罗元勋

台湾屏东大学

Abstract: A conflict-avoiding code (CAC) of length L and weight w is a collection of w-subsets of $\mathbb{Z}_L$ such that $d^*(S_1) \cap d^*(S_2) = \emptyset$ for any two distinct w-subsets $S_1, S_2 \in C$, where $d^*(S) = \{a - b \ (\mathrm{mod} L) : a, b \in S, a \neq b\}$. A CAC is a deterministic transmission scheme for asynchronous multiple-access without feedback. When the number of simultaneously active users is less than or equal to w, a CAC of length L and weight w can provide a hard guarantee that each active user has at least one successful transmission within every consecutive L time slots. The design goal of CACs is to determine the maximum code size, denoted by $K(L, w)$, for given L and w. A CAC is called optimal if its code size achieves the value $K(L, w)$. In this talk, we will provide a series of optimal CACs by the help of Kneser's Theorem and some other techniques in Additive Combinatorics. Mixed-weight CACs and multichannel CACs, two classes of natural generalizations of CACs, will be discussed as well.

Combinatorics of context-free grammars

马世美

山东理工大学

Abstract: In this talk, we shall discuss some recent progress in the theory of context-free grammars, which can be divided into two parts: we first give a survey on the main methods in this theory, we then discuss some new properties of Eulerian-type polynomials and combinatorial numbers, including derivative polynomials, Eulerian polynomials of types A and B, alternating run polynomials of types A and B, Euler numbers and Springer numbers.

Subdivisions, real rootedness and total positivity

牟丽丽

江苏师范大学

Abstract: A fundamental problem in algebraic and geometric combinatorics is the characterization of face enumerating vectors, or f-vectors, of triangulations of various topological spaces. The f-vector vector records for each dimension k the number of simplices of that dimension.

In recent years, the behavior of this vector under subdivision operations (e.g., barycentric, edgewise, etc.) has been studied intensively. The corresponding transformation of the f-vector or of its encoding in the h-vector is linear and the matrix of the transformation relates closely to permutation statistics, the theory of real rooted polynomials and total positivity. In this talk we are interested in subdivision operations which can be applied iteratively or face uniform subdivision operations. Under suitable additional hypothesis on such subdivision it was shown that the generating polynomial of the h-vector becomes real rooted after subdivision.

Max-Bisections of graphs without perfect matching

毋述斐

河南理工大学

Abstract: A bisection of a graph is a bipartition of its vertex set such that the two resulting parts differ in size by at most 1, and its size is the number of edges that connect vertices in the two parts. The perfect matching condition and forbidden even cycles subgraphs are essential in finding large bisections of graphs. In this paper, we show that the perfect matching condition can be replaced by the minimum degree condition. Let C_ℓ be a cycle of length ℓ for $\ell \geq 3$, and let G be a $\{C_4, C_6\}$-free graph with m edges and minimum degree at least 2. We prove that G has a bisection of size at least $m/2+\Omega\left(\sum_{v\in V(G)}\sqrt{d(v)}\right)$. As a corollary, if G is also C_{2k}-free for $k \geq 3$, then G has a bisection of size at least $m/2+\Omega\left(m^{(2k+1)/(2k+2)}\right)$, thereby confirming a conjecture proposed by Lin and Zeng [J. Comb. Theory A, 180 (2021), 105404]. Joint work with Jianfeng Hou and Yuanyuan Zhong.

A subgraph centrality of graphs via tensor eigenvalue

孙丽珠

哈尔滨工程大学

Abstract: Let G be a connected graph and let F be a connected subgraph of G with a given structure. In this talk, we propose an F-subgraph tensor and an F-subgraph eigenvector centrality of G. And we give a necessary and sufficient condition for the existence of the F-subgraph eigenvector centrality. Specifically, when F is a path P_1 of length 1(or a complete graph K_2), the F-eigenvector centrality of G is exactly its eigenvector centrality. Furthermore, we propose the (K_2, F)-subgraph eigenvector centrality of G and prove it always exists when G is connected. The centrality measures are studied when F is P_2 and K_3 respectively. Some examples show that the ranking of vertices under them differs from the rankings under several classic centralities. Vertices of a regular graph have the same eigenvector centrality scores.

But the (K_2, K_3)-subgraph eigenvector centrality can distinguish vertices in a given regular graph.

Tilings in dense graphs

孙琳

青岛大学

Abstract: Determining the average degree threshold that guarantees an n-vertex r-graph contains an F-tiling of a given size remains largely unexplored. Lang proposed a conjecture about F-tilings for r-partite r-graph F, which generalized our conjecture for Y-tilings (Gan-Han-Sun-Wang) and extended the Erdős Matching Conjecture. We determine asymptotically the two extremal constructions for the tiling problem of the H-shaped tree. This result refutes the Lang's conjecture. This is joint work with Nannan Chen, Xizhi Liu and Guanghui Wang.

Extremal results on the few smallest normalized Laplacian eigenvalues of a graph

孙少伟

浙江科技大学

Abstract: As one of the important graph matrices, the normalized Laplacian matrix is in a "normalized" form, and its spectrum behaves quite differently with other graph matrices. In this talk, we discuss the properties of the second and third smallest normalized Laplacian eigenvalues of a graph, respectively. As an application, we confirm a class of graphs are determined by their normalized Laplacian spectra.

On the maximal A_α-index of graphs with a prescribed number of edges

谭必信

台湾淡江大学

Abstract: For any real number $\alpha \in [0, 1]$, by the A_α-matrix of a graph G we mean the matrix $A_\alpha(G) = \alpha D(G) + (1-\alpha)A(G)$, where $A(G)$ and $D(G)$ are the adjacency matrix and the diagonal matrix of vertex

degrees of G, respectively. The largest eigenvalue of $A_\alpha(G)$ is called the A_α-index of G. Chang and Tam (2023) have solved the problem of determining graphs with maximal A_α-index over $G(n,m)$, the class of graphs with n vertices and m edges, for $\alpha \in \left[\frac{1}{2}, 1\right)$ and $1 \leq m \leq 2n-3$. In the same paper, they posed the problem of characterizing graphs in $G(n,m)$ that maximize the A_α-index for $0 < \alpha < \frac{1}{2}$ and $m \leq n-1$.

In this work, it is noted that, for any $\alpha \in [0,1)$, the problem of characterizing graphs with maximal A_α-index over $G(n,m)$ with $m \leq n-1$ is equivalent to the problem of characterizing graphs with maximal A_α-index over $S(m)$, the class of graphs with m edges. In connection with the latter problem, we pose the following conjecture: Let $m \geq 3$ be a positive integer and suppose that $m = \binom{a}{2} + t$ with $0 \leq t < a$. There exists a real number α_0, $\alpha_0 = \frac{1}{2}$ for $m = 3$ and $\alpha_0 \in \left[0, \frac{1}{2}\right)$ for $m \geq 4$, such that for any $\alpha \in [0,1)$, either C^m_{a+1} (replaced by K_a, in case $t = 0$) or $K_{1,m}$, where C^m_{a+1} denotes the quasi-complete graph with $a+1$ vertices and m edges, is the unique connected graph with m edges that maximize the A_α-index over $S(m)$, depending on whether $\alpha \in [0, \alpha_0)$ or $\alpha \in (\alpha_0, 1)$; when $\alpha = \alpha_0$, there are exactly two connected graphs that maximize the A_α-index over $S(m)$, namely, C^m_{a+1} (or K_a, in case $t = 0$) and $K_{1,m}$. The conjecture is established when $t = 0$.

This is a joint work with Ting-Chung Chang.

Developments on the eccentricity spectra of graphs

王建锋

山东理工大学

Abstract: Randic introduced the Dmax-matrix of a graph in 2013. J.F. Wang et al. gave its standard definition, renamed as the eccentricity matrix, and studied the spectral properties at the end of 2018. Since then, this matrix has been drawing more and more attention. In this lecture, we will introduce the developments on the eccentricity spectra of graphs.

代数结构与加法组合中的零和问题

王国庆

天津工业大学

Abstract: 零和理论是加法组合中的一个方向, 其研究起始于上世纪60年代Erdos、Davenport 等学者关于群上序列加法性质的研究, 相应零和问题的提出也具有组合意义以及代数数论的背景. 报告人将结合其研究工作, 在群(交换群与非交换群)、半群、环等代数结构上介绍零和研究相关的问题与部分进展.

A refined q-analogue of some congruences of Van Hamme

王晨

南京林业大学

Abstract: In 1997, Van Hamme proposed 13 supercongruences corresponding to the Ramanujan-type series. In this talk, we introduce our recent work on a unified q-analogue of Van Hamme's $(B.2)$, $(E.2)$ and $(F.2)$ supercongruences, which is also a refinement of some known results obtained by different authors. As a consequence, we give a parametric supercongruence related to the Euler polynomials.

l_1-embeddability of 4-regular quadrilateral torus maps

王广富

烟台大学

Abstract: A connected graph G is said to be l_1-embeddable if it can be isometrically embedded into the l_1-space. Thomassen classified that 4-regular quadrilateral maps are the graphs $G(m,n,r)$ and $Q_{k,l}$. The graph $G(m,n,r)$ is constructed from the grid graph $P_m \Box P_n$ by adding edges connecting $a_{i,1}$ to $a_{i,m}$ $(i=1,2,\ldots,n)$, and edges connecting $a_{1,i}$ to $a_{n,(i+r)}$ mod m. The graph $Q_{k,l}$ is obtained from a cycle of length k by connecting each vertex i to $i+l$ mod k. In this talk, we determine that all the $G(m,n,r)$ and $Q_{k,l}$ are not l_1-embeddable except for $G(m,n,0), G(m,2,1), Q_{k,1}, Q_{5,2}$ and $Q_{2i,2}$ $(i \in Z^+)$.

Some q-supercongruences modulo the fifth and sixth powers of a cyclotomic polynomial

魏传安

海南医科大学

Abstract: In terms of Jackson's ${}_8\phi_7$ summation formula,the creative microscoping method introduced by Guo and Zudilin,, and the Chinese remainder theorem for coprime polynomials, we shall establish some q-supercongruences modulo the fifth and sixth powers of a cyclotomic polynomial. More concretely, we give a q-analogue of a nice formula due to Long and Ramakrishna [Adv. Math. 290 (2016), 773–808] and two q-supercongruences involving double series and triple series.

Sizes of cross-intersecting families

向子卿

南方科技大学

Abstract: In the literature, two different functions are used to measure the size of cross-intersecting families. One is the sum, and the other is the product. For these two size functions, different techniques are developed and different results are obtained. We introduce a new size function, which unifies the two size functions mentioned above. Moreover, we obtain some results on maximal cross-intersecting families. This talk is based on joint work with Huajun Zhang.

Combinatorics via Catalan matrices

徐祥峻

台湾淡江大学

Abstract: A generalized Catalan matrix $\left(a_{n,k}\right)_{n,k\geq 0}$ is generated by two seed sequences $\mathbf{s} = \{s_0, s_1, \ldots\}$ and $\mathbf{t} = \{t_0, t_1, \ldots\}$ together with a recurrence relation. By taking $s_l = 2l + 1$ and $t_l = l^2$ we can interpret $a_{n,k}$ as the number of partial permutations, which are $n \times n$ 0, 1-matrices of k zero rows with at most one 1 in each row or column. In this talk we show that most of fundamental statistics and some set-valued statistics on permutations can also be defined on partial permutations and be encoded in the seed sequences.

Keyworks: partial permutations, Catalan matrices, statistics.

Uniform set systems with small VC-dimension

徐子翔

韩国基础科学研究院

Abstract: The Vapnik-Chervonenkis (VC) dimension is a fundamental concept in learning theory that has found growing applications in extremal combinatorics. Over the years, substantial progress has been made in understanding the interplay between VC-dimension theory and extremal set theory. A cornerstone result from the 1970s, the Sauer-Shelah Lemma, precisely characterizes the maximum size of a set system with bounded VC-dimension in the non-uniform setting. However, the corresponding problem for uniform set systems remains a major open question.

In this talk, I will present recent advances on this problem, including improved bounds and new structural insights. The results are based on a series of joint works with Ting-Wei Chao, Gennian Ge, Jian Wang, Chi Hoi Yip, Shengtong Zhang, and Xiaochen Zhao.

On r-Euler-Mahonian statistics on permutations and multipermutations

严慧芳

浙江师范大学

Abstract: In this talk, we will present our recent results on r-Euler-Mahonian statistics on permutations and multipermutations. Our results extend several known results derived by Foata-Zeilberger, Liu and Han.

Topological cliques in graphs

杨东雷

山东大学

Abstract: For a graph H, a subdivision of H, denoted as TH, is a graph obtained by replacing edges of H with internally vertex-disjoint paths. This is a fundamental concept for studying topological and structural

aspects of graphs. We will talk on extremal problems of finding large topological cliques in graphs with high average degree and survey recent developments.

Maximum size of two-distance sets in Hamming, Johnson and Euclidean space

俞韦亘

台湾中央大学

Abstract: We address the maximum size of binary codes and binary constant weight codes with few distances. Previous works established a number of bounds for these quantities as well as the exact values for a range of small code lengths. As our main results, we determine the exact size of maximal binary codes with two distances as well as the exact size of maximal binary constant weights. We also determined the maximum size of two-distance sets in Euclidean space for dimension n from 9 to 14.

Anti-Ramsey numbers of paths

袁龙图

华东师范大学

Abstract: The anti-Ramsey number of a given graph H is the maximum number of colors in an edge-colored complete graph which does not contain a rainbow copy of H. We determine the anti-Ramsey numbers for paths. This confirms a conjecture posed by Erdős, Simonovits and Sós in 1973.

New combinatorial proof of Gaussian polynomial and the monotonicity of the Garvan's k-rank

臧经涛

西北工业大学

Abstract: Gaussian polynomial, which is also known as q-binomial coefficient, is one of the fundamental concepts in the theory of partitions. Zeilberger provided a combinatorial proof of Gaussian polynomial, which is called Algorithm Z by Andrews and Bressoud. In this talk, we provide a new bijection on Gaussian polynomial, which leads to a refinement of Algorithm Z. Moreover, using this bijection, we provide an alternative proof of generalized Rogers-Ramanujan identity, which was first proved by Bressoud and Zeilberger. Furthermore, we give a combinatorial proof of the monotonicity property of Garvan's k-rank, which is a generalization of Dyson's rank and Andrews-Garvan's crank. Joint work with Wenxia Qu.

圖的列表距離一致數

張飛黃

東華大學

Abstract: 考慮圖上從頂點集到正整數集$[n] = \{1, 2, \ldots, n\}$的一對一且映成的點標號函數$f$, $f: V(G) \to [n]$, 且依照點標號我們定義圖上兩點v, w的f列表距離為$d_f(v, w) = |f(v) - f(w)|$. 若圖中某一點$u$, 其對圖上任意兩點$v, w$皆滿足$d_G(u, v) < d_G(u, w) \Rightarrow d_f(u, v) \leq d_f(u, w)$, 則我們稱頂點$u$是$f$列表距離一致的. 而圖的列表距離一致數是指在所有雙射$f: V(G) \to [n]$中最多的f列表距離一致頂點數量, 我们将介绍这个问题并給出一些特定圖類上的列表距離一致數.

On the maximal spectral radius of digraphs with a prescribed number of arcs

郑砚仁

台湾屏东大学

Abstract: The spectral radius of a matrix is the largest magnitude of its eigenvalues. The spectral radius of a graph is the spectral radius of its adjacency matrix. It captures important structural information about the graph and plays a key role in spectral graph theory. In this talk, I will introduce a new approach to find upper bounds of the spectral radius of a nonnegative matrix, and use it to identify the unique digraph whose spectral radius is maximum among all digraphs with a prescribed number of arcs. This result resolves a problem independently posed by R. Brualdi and A. Hoffman, as well as F. Friedland, back in 1985. This is a joint work with Chih-wen Weng.

Hoffmann-Ostenhof's 3-Decomposition Conjecture

周垂香

福州大学

Abstract: The 3-Decomposition Conjecture states that every connected cubic graph can be decomposed into three subgraphs: a spanning tree, a 2-regular subgraph, and a matching. In this work, we investigate this conjecture and establish two principal results: (1) the conjecture holds for cubic graphs containing a 2-factor that consists of at most three cycles; and (2) every cubic graph of order n can be decomposed into a spanning tree, a 2-regular subgraph, and a set of paths where each path has length at most two, with the number of length-two paths bounded above by $(n - 4)/6$.

Degree conditions for spanning expansion hypertrees

周文玲

山东大学

Abstract: The k-expansion of a graph G is the k-uniform hypergraph obtained from G by adding $k - 2$ new vertices to every edge. In this talk, we will introduce an asymptotically optimal d-degree conditions that ensure the existence of all spanning k-expansions of bounded-degree trees, for all $k > d \geq 1$.This solves a conjecture by Pehova and Petrova. In addition, we find an unexpected 'parity obstruction': all spanning k-expansions of trees with only odd degree vertices require larger degree conditions to embed. We also show

that if the tree has at least one even degree vertex, the codegree conditions for embedding its k-expansion become substantially smaller. This is joint work with Mengjiao Rao, Nicolás Sanhueza-Matamala, Lin Sun and Guanghui Wang.

A proof of the multi-component q-Baker–Forrester conjecture

周岳

中南大学

Abstract: The Selberg integral, an n-dimensional generalization of the Euler beta integral, plays a central role in random matrix theory, Calogero–Sutherland quantum many body systems, Knizhnik–Zamolodchikov equations, and multivariable orthogonal polynomial theory.The Selberg integral is known to be equivalent to the Morris constant term identity. In 1998, Baker and Forrester conjectured a $(p+1)$-component generalization of the q-Morris identity. It in turn yields a generalization of the Selberg integral. The $p = 1$ case of Baker and Forrester's conjecture was proved by Károlyi, Nagy, Petrov and Volkov in 2015. In this talk, we present our proof of the $(p + 1)$-component q-Baker–Forrester conjecture, thereby settling this 26-year-old conjecture.

Turán problems under an additional parameter condition

朱修涛

南京航空航天大学

Abstract: For a given graph F, the Turán number of F, denoted by $ex(n, F)$, is to ask the maximum number of edges that an n-vertex F-free graph G can have. Let $p(G)$ denote a parameter function of a graph G and $\mathcal{A}_p$ be a set of integers. The Turán number of F under parameter condition, denoted by $ex(n, \{F, \mathcal{A}_p\})$, is to ask the maximum number of edges in the n-vertex F-free graph G which also satisfies $p(G) \in \mathcal{A}_p$. In this talk, we will present some results about the Turán number under a parameter condition, including chromatic number, connectivity, matching number, circumference and so on.

A Min-Max Theorem on Packing Seagulls

赵秋兰

南京大学

Abstract: Let $G = (V, E)$ be a graph with a nonnegative integral weight $w(v)$ on each vertex v. A seagull or P_3 in G is an induced path of length two. A collection $\mathcal{P}$ of seagulls is called seagull packing if each vertex v is covered at most $w(v)$ times by the members in $\mathcal{P}$. A vertex subset S is called a seagull covering if every seagull has a vertex contained in G. G is called seagull Mengerian if, for every nonnegative integral weight function defined on V, the maximum size of a seagull packing is equal to the minimum total weight of a seagull covering. In this talk, I will introduce the characterization of seagull Mengerian graphs.