浙江師範大學
ZHEJIANG NORMAL UNIVERSITY

2022图论组合青年论坛

会议手册

浙江师范大学离散数学研究中心

2022 年 12 月

2022图论组合青年论坛日程安排

日期	时间	报告人	报告题目
12月17日	腾讯会议：865-564-479　密码：1217		
	主持人：王维凡		
	8:40-9:00	开幕式致辞 杨敏波（浙江师范大学数学科学学院院长） 朱绪鼎(浙江师范大学离散数学研究中心主任)	
	主持人：朱绪鼎		
	9:00-9:35	马　杰	On extremal numbers of the triangle plus the four-cycle
	9:35-10:10	韩　杰	Spanning trees in sparse pseudorandom graphs
	10:10-10:15	休息	
	主持人：张　昭		
	10:15-10:50	李佳傲	Circular coloring and circular flows of signed graphs
	10:50-11:25	鲁红亮	Spectral radius and rainbow matchings of graphs
	11:25-12:00	彭　兴	Ramsey numbers: books versus long even cycles
	12:00-14:00	午休	
	主持人：王维凡		
	14:00-14:35	史永堂	Some bounds for the spectral radius in H-saturated graphs
	14:35-15:10	王光辉	Embeddings in “random like” hypergraphs
	15:10-15:15	休息	
	主持人：陆　由		
	15:15-15:50	王建锋	A complete characterization of graphs with exactly two positive eigenvalues
	15:50-16:25	王艺桥	Star edge coloring of 1-planar graphs
	16:25-17:00	吴河辉	A Ramsey Type problem for highly connected subgraphs

日期	时间	报告人	报告题目
12月18日	腾讯会议：865-564-479　密码：1217		
	主持人：侯庆虎		
	9:00-9:35	冯　涛	On the construction of new families of flag transitive linear spaces
	9:35-10:10	傅士硕	Burstein's permutation conjecture, Hong and Li's inversion sequence conjecture, and restricted Eulerian distributions
	10:10-10:15	休息	
	主持人：　陈　敏		
	10:15-10:50	侯建锋	Two stability theorems for κ_{l+1}^{r} -saturated hypergraphs
	10:50-11:25	季　青	A combinatorial framework of Rogers-Ramanujan identities
	11:25-12:00	金贤安	On the polymatroid Tutte polynomial
	12:00-14:00	午休	
	主持人：严慧芳		
	14:00-14:35	汪　彦	Rainbow clique subdivisions
	14:35-15:10	杨立波	Recent developments in matroid theory
	15:10-15:15	休息	
	主持人：杨大庆		
	15:15-15:50	张华军	Some problems and results on cross intersecting families
	15:50-16:25	张先得	Batch optimization for balanced sequences
	16:25-17:00	祝宝宣	Zeros of combinatorial polynomials and some applications

报告摘要

On the construction of new families of flag transitive linear spaces

冯涛　浙江大学

摘要： In this talk, I will report on some recent progress on flag-transitive linear spaces. To be specific, we construct new families of flag-transitive linear spaces with q^{2n} points and q^2 points on each line that admit a one-dimensional affine automorphism group. We achieve this by building a natural connection with permutation polynomials of F_{q^2} of a particular form and following the scheme of Pauley and Bamberg in [A construction of one-dimensional affine flag-transitive linear spaces, Finite Fields Appl. 14 (2008) 537-548]. This is joint work with Jianbing Lu.

Burstein's permutation conjecture, Hong and Li's inversion sequence conjecture, and restricted Eulerian distributions

傅士硕　重庆大学

摘要： In this talk, we address two conjectures on the enumeration of pattern restricted permutations (resp. inversion sequences) due to Burstein (resp. Hong and Li). Indeed, we will not only confirm Hong and Li's conjecture and Burstein's first conjecture, but also establish two more delicate generating function identities with the ides (for inverse descent) statistic

concerned in the restricted permutation case, and the asc (for ascent) statistic concerned in the restricted inversion sequence case, which yield a new equidistribution result. The talk is based on joint work with Shane Chern and Zhicong Lin.

Spanning trees in sparse pseudorandom graphs

韩杰　北京理工大学

摘要： Let $\mathcal{T}(n,\Delta)$ be the class of trees with n vertices and maximum degree at most Δ. Confirming a conjecture of Kahn, Montgomery established for every fixed tree $T \in \mathcal{T}(n,\Delta)$, the smallest value of p for which $G(n,p)$ a.a.s. contains a copy of T. There have been a wealth of results and open problems on embedding spanning trees in (pseudo)random graphs in the past few decades. In 2005, Alon, Krivelevich and Sudakov asked for determining the best possible spectral gap forcing an (n,d,λ)-graph to be $\mathcal{T}(n,\Delta)$-universal. In this talk, we introduce some recent works and open questions. Similar questions for expander graphs are also considered.

Two stability theorems for $\mathcal{K}^r_{\ell+1}$-saturated hypergraphs

侯建锋　福州大学

摘要： Let $\mathcal{F}$ be a family of r-uniform hypergraphs (henceforth r-graphs). An $\mathcal{F}$-saturated r-graph is a maximal r-graph not containing any member of $\mathcal{F}$ as a subgraph. For integers $\ell \geq r \geq 2$, let $\mathcal{K}^r_{\ell+1}$ be the collection of all r-graphs F with at most $\binom{\ell+1}{2}$ edges such that for some $(\ell+1)$-set S every pair $\{u,v\} \subset S$ is covered by an edge in F, and let $T_r(n,\ell)$ be the complete ℓ-partite r-graph on n vertices with no two part sizes differing by more than one. Let $t_r(n,\ell)$ be the number of edges in $T_r(n,\ell)$. Our first result shows that for each $\ell \geq r \geq 2$ every $\mathcal{K}^r_{\ell+1}$-saturated r-graph on n vertices with $t_r(n,\ell) - o(n^{r-1+1/\ell})$ edges contains a complete ℓ-partite subgraph on

$(1-o(1))n$ vertices, which extends a stability theorem for $K_{\ell+1}$-saturated graphs given by Popielarz, Sahasrabudhe and Snyder. We also show that the bound is best possible.

Our second result is motivated by a celebrated theorem of Andrásfai, Erdős and Sós which states that for $\ell \geq 2$ every $K_{\ell+1}$-free graph G on n vertices with minimum degree $\delta(G) > \frac{3\ell-4}{3\ell-1}n$ is ℓ-partite. We give a hypergraph version of it. The *minimum positive co-degree* of an r-graph $\mathcal{H}$, denoted by $\delta^+_{r-1}(\mathcal{H})$, is the maximum k such that if S is an $(r-1)$-set contained in a edge of $\mathcal{H}$, then S is contained in at least k distinct edges of $\mathcal{H}$. Let $\ell \geq 3$ be an integer and $\mathcal{H}$ be a $\mathcal{K}^3_{\ell+1}$-saturated 3-graph on n vertices. We prove that if either $\ell \geq 4$ and $\delta^+_2(\mathcal{H}) > \frac{3\ell-7}{3\ell-1}n$; or $\ell = 3$ and $\delta^+_2(\mathcal{H}) > 2n/7$, then $\mathcal{H}$ is ℓ-partite; and the bound is best possible. This is the first stability result on minimum positive co-degree for hypergraphs.

A Combinatorial Framework of Rogers-Ramanujan Identities

季青　天津大学国家应用数学中心

摘要： The Rogers–Ramanujan identities are a pair of infinite series-infinite product identities that were first proved by Rogers in 1894 and rediscovered by Ramanujan a few years later. Over the past several decades, these identities and identities of similar type have found applications in number theory, combinatorics, Lie algebra and vertex operator algebra theory, physics (especially statistical mechanics), and computer science (especially algorithmic proof theory). In this talk, we present some combinatorial generalizations of the Rogers-Ramanujan identities, including the Rogers-Ramanujan-Gordon identities, Bressound' s identities and the overpartition analogues.

This talk is based on recent works joint with Thomas Y. He and Alice X.H. Zhao.

On the polymatroid Tutte polynomial

金贤安　厦门大学

摘要： The Tutte polynomial is a well-studied invariant of matroids. The polymatroid Tutte polynomial introduced by Bernardi et al., is an extension of the classical Tutte polynomial from matroids to polymatroids. In this talk, we shall report our results on interpolating and the coefficients of high-order terms. These results generalize results on interior and exterior polynomials of hypergraphs. See arXiv:2207.04421

Circular coloring and circular flows of signed graphs

李佳傲　南开大学

摘要： A circular r-coloring of a graph G is a mapping $\varphi : V(G) \mapsto [0, r)$ such that $|\varphi(u) - \varphi(v)| \in [1, r-1]$ for each edge $uv \in E(G)$. A natural Planar Circular Coloring Conjecture states that every planar graph of girth at least $2k$ is circular $(2 + 2/k)$-colorable. The $k = 1, 2$ cases are known as the 4CT and Grotzsch's theorem(3CT). It is open for $k \geq 3$, and the general girth condition is known for roughly $3k$. Recently, the concept of circular coloring in signed graph was introduced in [Circular chromatic number of signed graphs. R. Naserasr, Z. Wang, and X. Zhu. Electronic Journal of Combinatorics, 28(2)(2021), #P2.44]. For a signed graph (G, σ), a circular r-coloring $\varphi : V(G) \mapsto [0, r)$ applies the same rule for the positive edges, and it satisfies $|\varphi(x) - \varphi(y)| \in [0, \frac{r}{2} - 1] \cup [\frac{r}{2} + 1, r)$ for each negative edge $xy \in E(G)$. In this talk, we will discuss the circular coloring of signed planar graphs with given girth conditions. Specifically, we show that every signed planar graph of girth at least $3k + 2$ is circular $(2 + 2/k)$-colorable, and that every signed bipartite planar graph of girth at least $6t-2$ admits a homomorphism to the negative even cycle C_{-2t}. In fact, these results follow from the dual of more general flow results of signed graphs in a recent joint work with R. Naserasr, Z. Wang, and X. Zhu.

Spectral radius and rainbow matchings of graphs

鲁红亮　西安交通大学

摘要： Let n, m be integers such that $1 \leq m \leq (n-2)/2$ and let $[n] = \{1, \ldots, n\}$. Let $\mathcal{G} = \{G_1, \ldots, G_{m+1}\}$ be a family of graphs on the same vertex set $[n]$. In this paper, we prove that if for any $i \in [m+1]$, the spectral radius of G_i is not less than $\max\{2m, \frac{1}{2}(m-1+\sqrt{(m-1)^2+4m(n-m)})\}$, then $\mathcal{G}$ admits a rainbow matching, i.e. a choice of disjoint edges $e_i \in G_i$, unless $G_1 = G_2 = \ldots = G_{m+1}$ and $G_1 \in \{K_{2m+1} \cup (n-2m-1)K_1, K_m \vee (n-m)K_1\}$.

On extremal numbers of the triangle plus the four-cycle

马杰　中国科学技术大学

摘要： For a family F of graphs, let $ex(n, F)$ denote the maximum number of edges in an n-vertex graph which contains none of the members of F as a subgraph. A longstanding problem in extremal graph theory asks to determine the function $ex(n, C3, C4)$. In this talk, we give a new construction for dense graphs of girth at least five with arbitrary number of vertices, providing the first improvement on the lower bound of $ex(n, C3, C4)$ since 1976. As a corollary, this yields a negative answer to a problem in the book of Chung-Graham. Joint with Tianchi Yang.

Ramsey numbers: books versus long even cycles

彭兴　安徽大学

摘要： Let B_n be the book graph which consists of n triangles all sharing a common edge and let C_m be a cycle of length m. The Ramsey number of $R(B_n, C_m)$ has received a lot of attention. In this talk, I will introduce our result　on the exact value of the Ramsey number of books versus long even cycles.

Some bounds for the spectral radius in H-saturated graphs

史永堂　南开大学

摘要： For given graphs G and H, the graph G is H-saturated if G does not contain H as a subgraph but for any $e \in E(\overline{G})$, $G+e$ contains H. In this note, we prove that if G is an n-vertex K_{r+1}-saturated graph such that for each vertex $v \in V(G)$,

$$\sum_{w \in N(v)} d_G(w) \geq (r-2)d(v) + (r-1)(n-r+1),$$

then $\rho(G) \geq \rho(S_{n,r})$, where $S_{n,r}$ is the graph obtained from a copy of K_{r-1} with vertex set S by adding $n-r+1$ vertices, each of which has neighborhood S. This provides a sharp lower bound for the spectral radius in an n-vertex K_{r+1}-saturated graph for $r = 2, 3$, verifying a special case of a conjecture by Kim, Kim, Kostochka and O.

Joint work with Jaehoon Kim, Alexandr V. Kostochka, Suil O and Zhiwen Wang.

Rainbow Clique Subdivisions

汪彦　上海交通大学

摘要： In this talk, we show that for any integer $t \geq 2$, every properly edge colored n-vertex graph with average degree at least $(\log n)^{2+o(1)}$ contains a rainbow subdivision of a complete graph of size t. Note that this bound is within a log factor of the lower bound. This also implies a result on the rainbow Turán number of cycles.

Embeddings in “random like” hypergraphs

王光辉　山东大学

摘要： An archetype problem in extremal combinatorics is to study the structure of subgraphs appearing in different classes of (hyper)graphs. We will focus on such embedding problems in “random like” hypergraphs.

A complete characterization of graphs with exactly two positive eigenvalues

王建锋　山东理工大学

摘要： In 1977, Smith characterized the connected graphs with exactly one positive eigenvalue. Hereafter, the researchers have drawn their attentions to determine the connected graphs with exactly two positive eigenvalues over the last forty years. Based on the previous studies, we finally give such a complete characterization in this report.

This is a joint work with F. Duan, Q.X. Huang, X.Y. Huang and Z. Stanic based on our paper [A complete characterization of graphs with exactly two positive eigenvalues, Adv. Appl. Math. 144 (2023) 102457].

Star edge coloring of 1-planar graphs

王艺桥　北京中医药大学

摘要： The star chromatic index $\chi'_{\rm st}(G)$ of a graph G is defined as the smallest k for which the edges of G can be colored using k colors so that no two adjacent edges get same color and no bichromatic paths or cycles of length four are produced. A graph G is called 1-planar if it can be drawn in the plane such that each edge crosses at most one other edge. In this talk, we investigate the edge coloring of 1-planar graphs and show that every 1-planar graph G with maximum degree Δ satisfies $\chi'_{\rm st}(G) \leq 7.75\Delta + 166$;

and moreover $\chi'_{\rm st}(G) \leq \lfloor 1.5\Delta \rfloor + 500$ if G contains no 4-cycles, and $\chi'_{\rm st}(G) \leq 2.75\Delta + 116$ if G is 3-connected, or optimal, or NIC-planar.

A Ramsey Type problem for highly connected subgraphs

吴河辉　复旦大学上海数学中心

摘要： Bollobás and Gyárfás conjectured that for any $k, n \in \mathbb{Z}^+$ with $n > 4(k-1)$, every 2-edge-coloring of the complete graph on n vertices leads to a k-connected monochromatic subgraph with at least $n-2k+2$ vertices. We find a counterexample with $n = \lfloor 5k - 2.5 - \sqrt{8k - \frac{31}{4}} \rfloor$, thus disproving the conjecture, and we show the conclusion holds for $n > 5k - 2.5 - \sqrt{8k - \frac{31}{4}}$ when k is sufficiently large.

This is joint work with Dr. Qiqin Xie in Shanghai University.

Recent developments in matroid theory

杨立波　南开大学

摘要： In recent years the log-concavity of matroid invariants has received considerable research attention, and significant progress on some outstanding problems has been achieved. In this talk we shall briefly survey some problems and results proved by June Huh and his coauthors, as well as related theories and tools. We shall also discuss some of our results on the matroid Kazhdan-Lusztig polynomials.

Some problems and results on cross intersecting families

张华军　绍兴文理学院

摘要： Two families $\mathcal{A}$ and $\mathcal{B}$ of $\binom{[n]}{k}$ are called cross t-intersecting if $|A \cap B| \geq t$ for all $A \in \mathcal{A}$ and $B \in \mathcal{B}$. In this talk, we will introduce some problems and results on cross intersecting t-families.

Batch optimization for balanced sequences

张先得　中国科学技术大学

摘要： Batch optimization plays an important role in reducing the cost of large scale DNA synthesis, which is translated to the following algorithmic task. Given a large pool S of random strings of xed length, partition S into batches in a way that minimizes the sum of the lengths of the shortest common supersequences across batches. In this talk, I will discuss our recent progress on the batch optimization for the set of all balanced sequences.

Zeros of combinatorial polynomials and some applications

祝宝宣　江苏师范大学

摘要： The zeros of polynomials play an important role in mathematics. In this talk, we will introduce some results for zeros of combinatorial polynomials and their applications.