



第九届欧拉子图及相关问题 国际学术会议

The **9th** International Symposium on
Eulerian Subgraphs and Related Problems

会议手册

May 31-June 2, 2024

School of Mathematics and Statistics

Fujian Normal University, Fuzhou, China

福州·2024年6月



目录

1	第九届欧拉子图及相关问题国际会议组织委员会·····	1
2	欧拉子图及相关问题研讨会发展历程·····	4
3	福建师范大学简介·····	5
4	福建师范大学数学与统计学院简介·····	7
5	第九届欧拉子图及相关问题国际会议日程安排·····	9
6	第九届欧拉子图及相关问题国际会议报告摘要·····	13
7	第九届欧拉子图及相关问题国际会议通讯录·····	28

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Conference Host:

会议主办方:

School of Mathematics and Statistics, Fujian Normal University, Fuzhou, China

Key Laboratory of Analytical Mathematics and Applications (Ministry of Education)

Center for Applied Mathematics of Fujian Province, Fuzhou, China

Financial Support:

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School of Mathematics and Statistics, Fujian Normal University

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Fujian Alliance of Mathematics (2023SXMLMS04)

Conference Venue:

会议地点:

Meiyuan Hotel, Cangshan District Panyu Road, Fuzhou

福州市仓山区盘屿路奥体梅园酒店

Conference Hall:

会议场地:

Meiyuan Hotel in Fuzhou, Yangguang/Cangshan Hall, Floor 2nd

福州奥体梅园酒店，二楼，阳光/仓山厅

欧拉子图及相关问题研讨会发展历程



福建师范大学简介

福建师范大学坐落于素有“海滨邹鲁”之誉的历史文化名城福州，是一所历史悠久、声誉斐然的百年省属高等学府。学校肇始于1907年清朝帝师陈宝琛先生创办的“福建优级师范学堂”，后由华南女子文理学院、福建协和大学、福建省立师范专科学校等单位几经调整合并，于1953年成立福建师范学院，1972年易名为福建师范大学并沿用至今。2012年，福建省人民政府与教育部共建福建师范大学。2014年被确定为福建省重点建设的高水平大学。2018年被确定为福建省一流大学建设高校。2022年被确定为福建省第二轮“双一流”建设A类高校。

百载春秋，薪火相传。叶圣陶、郭绍虞、董作宾、林兰英、郑作新、黄维垣、唐仲璋、唐崇惕、姚建年等诸多蜚声海内外的大师巨匠曾在学校任教。经过一代又一代师大人的传承创新，学校砥砺出“知行笃，立诚致广”的校训精神，孕育了“重教、勤学、求实、创新”的优良校风，着力推动各项事业不断向前发展，荣获“全国文明单位”“全国文明校园”等一大批高级别荣誉称号。滋兰树蕙，桃李芬芳。建校以来，学校向社会培养输送各级各类人才近60万名，为国家和福建经济社会发展作出了突出贡献。

学校本部共有旗山、仓山两个校区，占地面积4000多亩。现有本科专业84个（2023年全日制普通本科招生专业78个），全日制普通本科学生2.5万余人，各类研究生1万余人。拥有专任教师2046人，其中，高级职称人员占60.7%、具有博士学位教师占66.1%，加拿大皇家科学院院士、欧洲科学院院士、国际欧亚科学院院士、双聘院士各1人，国家高层次人才特殊支持计划领军人才7人、青年拔尖人才5人，“长江学者奖励计划”特聘教授6人、青年项目2人、讲座教授1人，国家杰出青年科学基金获得者9人，国家优秀青年科学基金获得者7人，国务院学位委员会学科评议组成员3人，国务院学位委员会学科发展战略咨询委员会委员1人，国家级有突出贡献中青年专家6人，百千万人才工程国家级人选6人，国家级教学名师2人，全国文化名家暨“四个一批”人才4人，科技部中青年科技创新领军人才2人，教育部“新世纪优秀人才支持计划”入选者13人，全国高校黄大年式教师团队3个，教育部创新团队2个，国家级教学团队3个。

学校深入落实立德树人根本任务，坚持以人才培养为中心，不断深化教育教学改革，着力提升人才培养质量。学校充分发挥学科龙头带动作用，着力构建一流文科、高水平理科、有特色工科的学科体系，基本形成了综合性大学的学科布局。拥有国家重点学科1个、福建省第二轮“双一流”建设主干学科3个、省高峰学科9个和高原学科13个，博士后科研流动站20个，博士学位授权一级学科19个，博士专业学位授权点3个，硕士学位授权一级学科32个，硕士专业学位类别26个。化学、工程学、材料科学、计算机科学、环境科学与生态学、农学、社会科学总论、植物与动物学8个学科进入ESI全球排名前1%，其中5个学科进入ESI前5%。学校积极发挥地处21世纪海上丝绸之路核心区、毗邻台港澳等区位优势，着力深化对外交流与合作。目前已与美国、英国、意大利、澳大利亚、日本等国家和地区的130多所高校、科研机构及联合国教科文组织建立友好合作关系，与台湾40多所高校建立实质性合作关系。学校主办多种学术期刊，《福建师范大学学报》哲学社会科学版和自然科学版均为全国中文核心期刊，哲学社会科学版被评为教育部名栏建设学报、中文社科引文索引（CSSCI）来源期刊，自然科学版被列为中国科技核心期刊、中国科学引文数据库（CSCD）来源期刊。

走过116年光荣历程的福建师范大学，不忘立德树人初心，牢记为党育人、为国育才使命，全面深化综合改革，全面推进内涵发展，全面提高办学质量，正朝着加快建成富有鲜明特色的综合性全国一流大学的奋斗目标大踏步前进，努力为谱写全面建设社会主义现代化国家福建篇章、实现中华民族伟大复兴的中国梦作出新的更大贡献。

福建师范大学数学与统计学院简介

百载春秋，薪火相传。数学与统计学院肇始于1907年陈宝琛先生创办的“福建优级师范学堂”的数学科。后由华南女子文理学院、福建协和大学、福建省立师范专科学校等院校几经调整合并，于1953年成立福建师范学院，保留和发展了数学系。1972年，改名为福建师范大学数学系。1996年，成立计算机科学系，与数学系合称为福建师范大学数学系、计算机科学系。2002年，成立数学与计算机科学学院。2017年6月，数学与计算机科学学院、软件学院整合成立数学与信息学院。2021年6月，数学与信息学院分设数学与统计学院、计算机与网络空间安全学院（软件学院）。

数学与统计学院现设数学系和统计学系，拥有数学与应用数学（师范类）、统计学、数据科学3个本科专业。数学与应用数学专业是国家级特色专业、入选国家级一流本科专业建设点、通过教育部师范类专业二级认证；统计学专业入选国家级一流本科专业建设点。近年来，学院获得国家级教学成果二等奖1项，福建省教学成果奖特等奖1项，一等奖2项；获批国家级一流课程2门、省级一流课程4门，国家级资源共享课程1门，省级教育教学改革项目5项（重点项目1项、一般项目4项），省级人才培养模式创新实验区1个，省级研究生教育创新基地1个。现有在读学生1625人，其中研究生398人、本科生1227人。

现有，数学、统计学2个一级学科博士学位授权点，数学、统计学2个博士后科研流动站，数学、统计学2个一级学科硕士学位授权点，学科教学（数学）、应用统计2个专业学位硕士点。数学是福建省高峰学科，统计学是福建省重点学科。现有分析数学及应用教育部重点实验室、福建省分析数学及应用重点实验室、统计学与人工智能福建省高校重点实验室、福建省应用数学中心、福建师范大学数学研究中心和福建数学基础教育研究中心等科研平台。学院主办《福建中学数学》杂志，同时学院是福建省中小学数学学科教学带头人培养基地。

近年来，学院主动融入国家战略和地方经济社会发展，强化有组织的科研。学院教师获国家自然科学基金等国家级项目30多项；其中，国家自然科学基金杰出青年项目1项、国家自然科学基金优秀青年项目1项、国家自然科学基金重点项目3项（含参加）；获教育部自然科学奖一等奖1项、福建省自然科学奖一等奖、二等奖、三等奖各1项以及福建省社会科学奖二等奖1项、三等奖1项。

学院高度重视高层次人才队伍建设，师资力量雄厚。学院现有在职教职工112人，其中教授28人，副教授46人，博士生导师16人；其中，长江学者特聘教授1人，国家杰出青年科学基金获得者2人，国家优秀青年科学基金获得者1人，国务院政府特殊津贴2人，闽江学者7人，入选福建省“百人计划”2人，福建省“雏鹰计划”青年拔尖人才2人，福建省“百千万人才工程”3人，福建省优秀教师1人，福建省“运盛”青年科技奖2人，建有“随机分析及相关领域”福建省高校科技创新团队、“非线性分析及应用”福建省博士生导师团队。学院已为党和国家培养了许多优秀的人才，他们积极工作，奋发向上，成为各行业的骨干，为教育发展、经济建设和社会进步做出了重要的贡献。江文哉、张远南、王毓泉、李必成、刘金星、林风、林群、叶青柏、林顺来、郑一平、李迅、林燎、邵东生、徐明杰、周灵、黄金德、赵祥枝、王奇南、林亚南、李海北等校友荣获“福建省杰出人民教师”荣誉称号。广大校友爱国爱校，慷慨解囊，捐资助学。2006年，福建师范大学数学系61级学生、香港知名企业家、福建师范大学客座教授吴维新先生捐资设立“吴维新教育基金”；2015年，吴维新先生再次捐资设立“吴维新研究生奖学金”。

学院党委认真履行党建工作主体责任，汇聚人心，凝聚力量，推动学院各项工作不断取得新的成绩。学院党委被福建省委教育工委评为“福建省学校创先争优先进基层党组织”、1个学生党支部被福建省委教育工委评为“先进基层党组织”。学院工会被中华全国总工会评为“模范职工小家”、被福建省总工会评为“五一先锋号”。学院团委获得“全国五四红旗团委创建单位”“福建省新长征突击手”“福建省五四红旗团委标兵”“福建省五四红旗团委”“福建省基层团建示范单位”等荣誉称号。学院教师还获得“福建青年五四奖章”“福建省优秀共青团干部”“福州市青年五四奖章”“校五一劳动奖章”等荣誉称号。

第九届欧拉子图及相关问题国际学术会议日程安排			
Saturday, June 1, 2024, Morning Session			
梅园酒店-阳光厅 (Meiyuan Hotel-Yanguang Hall)			
8:00-8:30	Opening Ceremony		
	Take Photo		
Plenary Talk (Tencent Meeting: 571-4867-3650)			
Time	Speaker	Title	Chair
8:30-9:00	赖虹建 (Hong-Jian Lai) West Virginia University	The Conjectures of Catlin on Eulerian Subgraph Problems	陈志宏
9:00-9:30	Kiyoshi Yoshimoto Nihon University	Spanning Even Trees of Graphs	
9:30-9:50	茶歇 (Coffee/Tea Break)		
Plenary Talk (Tencent Meeting: 571-4867-3650)			
9:50-10:20	董峰明 (Feng-Ming Dong) Nanyang Technological University	On the Colorability of Bi-Hypergraphs	晏卫根
10:20-10:50	熊黎明 (Li-Ming Xiong) 北京理工大学	How Does a Necessary Condition Effect a Graph to Have Hamiltonian Property	
10:50-11:20	Kinkar Chandra Das Sungkyunkwan University	On Vertex-Degree-Based Exponential Topological Indices of Graphs	董峰明
11:20-11:50	陈志宏 (Zhi-Hong Chen) Butler University	New Results Toward Solving a Catlin's Conjecture on Reduced Graphs	
11:50-13:00	午餐+午休 (Lunch Break)		

Saturday, June 1, 2024, Afternoon Session

梅园酒店-阳光厅 (Meiyuan Hotel-Yanguang Hall)

Invited Talk (Tencent Meeting: 571-4867-3650)

Time	Speaker	Title	Chair
13:40-14:05	詹明权 (Ming-Quan Zhan) Millersville University	Exploring Hamilton-Connectedness in {Hourglass, P_{18} , Claw}-Free Graphs	宝音都仍
14:05-14:30	胡智全 (Zhi-Quan Hu) 华中师范大学	Some Results on Erdős-Gyárfás Conjecture	
14:30-14:55	涂建华 (Jian-Hua Tu) 北京工商大学	Counting Dissociation Sets and Graph Homomorphisms	田应智
14:55-15:20	李书超 (Shu-Chao Li) 华中师范大学	Eigenvalue of Graphs: Surrounding the Cycle Structure of Bipartite Graphs	
15:20-15:45	杜俊峰 (Jun-Feng Du) 北京化工大学	Vertex-Degree Function Index and Hamiltonian Properties of Graphs	崔庆
15:45-16:10	郑伟 (Wei Zheng) 山东师范大学	Disproof of a Conjecture on Minimally t -Tough Graphs	
16:10-16:30	茶歇 (Coffee/Tea Break)		
16:30-16:55	石玲娟 (Ling-Juan Shi) 西北工业大学	The Star Packing of Cubic Graphs	雷澜
16:55-17:10	马惠 (Hui Ma) 太原理工大学	The Minimum Degree of Minimally t -Tough, Claw-Free Graphs	
17:10-17:25	杨洪 (Hong Yang) 新疆大学	Antidirected Hamiltonian Paths and Antidirected Hamiltonian Cycles of k -Hypertournament	邓波
17:25-17:40	卫培超 (Pei-Chao Wei) 华南农业大学	Some New Results on the Majorization Theorem and Topological Indices	
18:30-20:00	晚宴 (Dinner)		

Saturday, June 1, 2024, Afternoon Session

梅园酒店-仓山厅 (Meiyuan Hotel-Cangshan Hall)

Invited Talk (Tencent Meeting:557-7588-4983)

Time	Speaker	Title	Chair
13:40-14:05	郝荣霞 (Rong-Xia Hao) 北京交通大学	Bounds for the Ranks of Complex Unit Gain Graphs in terms of the Matching Number	王大进
14:05-14:30	李佳傲 (Jia-Ao Li) 南开大学	Collapsible Graphs and Group Connectivity of Graphs	
14:30-14:55	张明祖 (Ming-Zu Zhang) 新疆大学	Edge Isoperimetric Problem for Recursive Graphs and Bollobás-Leader Type Many to Many Edge Disjoint Paths	李相文
14:55-15:20	戈鋆 (Jun Ge) 四川师范大学	Counting Spanning Trees in Bipartite-Related Graphs	
15:20-15:45	王世鹏 (Shi-Peng Wang) 江苏大学	Extremal Triangle-Free Graphs with Chromatic Number at Least Four	侯建峰
15:45-16:10	陈晓东 (Xiao-Dong Chen) 辽宁师范大学	Local Dirac's Condition on the Existence of 2-Factor	
16:10-16:30	茶歇 (Coffee/Tea Break)		
16:30-16:55	任翔宇 (Xiang-Yu Ren) 山西大学	Zero Net-Regular Signed Graph and Signed Graph Factor	杨卫华
16:55-17:10	王素素 (Su-Su Wang) 南开大学	Recoloring P_5 -Free Graphs	
17:10-17:25	郝常青 (Chang-Qing Xi) 南开大学	3-Component Domination Numbers in Graphs	何伟骅
17:25-17:40	曲军浩 (Jun-Hao Qu) 青海师范大学	Independent Isolation Number and Total Isolation Number of Graphs	
18:30-20:00	晚宴 (Dinner)		

Sunday, June 2, 2024, Morning Session			
梅园酒店-阳光厅 (Meiyuan Hotel-Yanguang Hall)			
Invited Talk (Tencent Meeting:571-4867-3650)			
Time	Speaker	Title	Chair
8:00-8:25	吕盛梅 (Sheng-Mei Lv) 青海民族大学	Hamiltonian Indices of Generalized Petersen Graph	张肇明
8:25-8:50	苏贵福 (Gui-Fu Su) 北京化工大学	Some Recent Results for k -Leaf-Connected Graphs and Digraphs	
8:50-9:15	刘霞 (Xia-Liu) 西北师范大学	Forbidden Subgraphs on Hamilton-Connected Graphs	张淑敏
9:15-9:40	刘木伙 (Mu-Huo Liu) 华南农业大学	Bounds for Zero Forcing Numbers of Connected Graphs with Fixed Order and Maximum Degree	
9:40-10:00	茶歇 (Coffee/Tea Break)		
10:00-10:25	冯星 (Xing Feng) 集美大学	Some Problems and Recent Progress on Matching Covered Graphs	李霄民
10:25-10:50	马天龙 (Tian-Long Ma) 厦门大学	Convolution Formulas for Multivariate Arithmetic Tutte Polynomials	
10:50-11:15	宋苏琳 (Su-Lin Song) West Texas A&M University	Hamilton Line Graphs of Hypergraphs	陈海燕
11:15-11:30	庄宏滨 (Hong-Bin Zhuang) 福州大学	Paired 2-Disjoint Path Covers of k -Ary n -Cubes Under the Partitioned Edge Fault Model	
11:30-11:45	杨晨琳 (Chen-Lin Yang) 福建师范大学	Counting Spanning Trees of Multiple Complete Split-like Graph Containing a Given Spanning Forest	徐丽琼
11:45-12:00	金玉新 (Yu-Xin Jin) 福建师范大学	Sufficient Conditions for Hamiltonian Properties of Graphs Based on Some Topological Indices	
12:00-12:10	闭幕式 (Closing Ceremony)		周书明

The Conjectures of Catlin on Eulerian Subgraph Problems

Hong-Jian Lai (West Virginia University)

In seeking necessary and sufficient version of the Thomassen conjecture that every 4-connected line graph is hamiltonian, we find a relationship between such necessary and sufficient version of the Thomassen conjecture and a former conjecture of Catlin. We will explain such relationship and use this opportunity to refresh our minds on other conjectures and open problems raised by Catlin on eulerian subgraph problems.

Spanning Even Trees of Graphs

Kiyoshi Yoshimoto (Nihon University)

A tree T is said to be *even* if all pairs of vertices of degree one in T are joined by a path of even length. We conjecture that every r -regular non-bipartite connected graph G has a spanning even tree and verify this conjecture when G has a 2-factor. Well-known results of Petersen and Hanson et al. imply that the only remaining unsolved case is when r is odd and G has at least r bridges. We investigate this case further and propose some related conjectures.

On the Colorability of Bi-Hypergraphs

Feng-Ming Dong (Nanyang Technological University)

Graph coloring is one of the most important and long-standing topics in graph theory. Not only does it tie many concepts in graph theory in surprising ways, but it also has a wide range of real-world applications. This talk will focus on the colorability of bi-hypergraphs.

A mixed hypergraph $\mathcal{H} = (\mathcal{V}, \mathcal{C}, \mathcal{D})$ consists of the vertex set \mathcal{V} and two families of subsets of $2^{\mathcal{V}}$; the family \mathcal{C} of co-edges and the family \mathcal{D} of edges. \mathcal{H} is said to be colorable if there is a mapping f from \mathcal{V} to the set of positive integers such that $|\{f(v) : v \in e\}| < |e|$ for each $e \in \mathcal{C}$ and $|\{f(v) : v \in e\}| > 1$ for each $e \in \mathcal{D}$. There exist mixed hypergraphs which are uncolorable, and quite little about these mixed hypergraphs is known. A mixed hypergraph is called a bi-hypergraph if its co-edge set and edge set are the same. In this talk, I will introduce our recent research on the size of minimal uncolorable bi-hypergraphs.

This is a joint work with Meiqiao Zhang and Ruixue Zhang.

How Does a Necessary Condition Effect a Graph to Have Hamiltonian Property

Li-Ming Xiong (Beijing Institute of Technology)

If a graph G has property A implying G also has the property B , then B is a necessary condition for G to have A . There exists some property for a graph to have it such that is the same even we impose a necessary condition on it, while there exists some property for a graph to have it such that is different from it if one impose a necessary condition on it. For example, to be 2-connected is necessary condition for a graph to be hamiltonian cycle. Ore condition say that if minimum degree sum of two vertices of a graph G is at least its order, then G is hamiltonian. If we impose a necessary condition that it has a hamiltonian path, then the condition could not be changed; while it would be changed to be that one of degree of a pair of vertices of distance two is at most half of the order of G , which be much improved than those without it. In this talk, we focus on hamiltonian property and forbidden subgraphs condition: Hamiltonian cycle or path, and so on.

On Vertex-Degree-Based Exponential Topological Indices of Graphs

Kinkar Chandra Das (Sungkyunkwan University)

Given a symmetric function $f : [1, \infty) \times [1, \infty) \rightarrow R$, we consider the general topological index of a graph G , $F(G) = \sum_{v_i v_j \in E(G)} f(d_i, d_j)$, with its corresponding exponential index $e^F(G) = \sum_{v_i v_j \in E(G)} e^{f(d_i, d_j)}$, where $v_i v_j$ is an edge in G and d_i is a degree of the vertex v_i in G . Several exponential vertex-degree-based topological indices like exponential second Zagreb index (e^{M_2}), exponential atom-bond connectivity index (e^{ABC}), exponential augmented Zagreb index (e^{AZI}), exponential geometric-arithmetic index (e^{GA}), and exponential Randić index (e^R) are widely studied in graph theory very recently. We investigate here from mathematical point of view to all of the above exponential vertex-degree-based topological indices of graphs. Some crucial bounds are set up in terms of graph order for numerous classes of graphs with characterizing extremal structures. Finally we discuss several open problems on these indices of graphs.

New Results Toward Solving a Catlin's Conjecture on Reduced Graphs

Zhi-Hong Chen (Butler University)

For a graph G , a closed trail is a vertex-edge alternating sequence $v_0, e_1, v_1, e_2, \dots, v_{k-1}, e_k, v_k$ such that $v_0 = v_k$, and all the e_i 's are distinct and $e_i = v_{i-1}v_i$ for all i . A closed trail T is called a spanning closed trail if $V(T) = V(G)$. Let H be a connected subgraph of G , the contraction G/H is obtained from G by contracting each edge of H and deleting the resulting loops. We use $O(G)$ for the set of odd degree vertices of G . In the study of spanning closed trails in graphs, Catlin developed the concept of collapsible graphs and a powerful reduction method: A graph G is collapsible if for every even subset $R \subseteq V(G)$, G has a spanning connected subgraph H_R such that $O(H_R) = R$ and the reduction G' of G is a graph obtained from G by contracting all the non-trivial collapsible subgraphs of G . A graph is reduced if it has no non-trivial collapsible subgraphs. Catlin shown that a graph G has a spanning closed trail if and only if its reduction G' has a spanning closed trail. It is known that the smallest 3-edge-connected reduced graph without spanning closed trails is the Petersen graph. Catlin conjectured (1985) that if a 3-edge-connected reduced graph of order at most 17 either is contractible to the Petersen graph or has a spanning closed trail. In this talk we will present some new results toward solving this Catlin's conjecture and its applications to solve other related conjectures on spanning closed trails of graphs.

Exploring Hamilton-Connectedness in $\{ \text{Hourglass}, P_{18}, \text{Claw} \}$ -Free Graphs

Ming-Quan Zhan (Millersville University of Pennsylvania)

An hourglass Γ_0 is a graph consisting of two triangles meeting at exactly one vertex. In 2018, Ryjáček, Vrána and Xiong conjectured that every 3-connected $\{ K_{1,3}, \Gamma_0, P_{16} \}$ -free graph is Hamilton connected. Liu and Xiong proved this conjecture in 2022. In this note, we prove that for a 3-connected $\{ K_{1,3}, \Gamma_0, P_{18} \}$ -free graph G , G is Hamilton connected if and only if G is not the line graph of the graph obtained from Wagner graph W_8 by subdividing each edge and adding pendant edges to each vertex.

Some Results on Erdős-Gyárfás Conjecture

Zhi-Quan Hu (Central China Normal University)

Let P_{10} be a path on 10 vertices. A graph is said to be P_{10} -free if it does not contain P_{10} as an induced subgraph. The well-known Erdős-Gyárfás Conjecture states that every graph with minimum degree at least three has a cycle whose length is a power of 2. In this talk, we show some results on Erdős-Gyárfás Conjecture. In particular, we show that every P_{10} -free graph with minimum degree at least three contains a cycle of length 4 or 8. This implies that the conjecture is true for P_{10} -free graphs.

Bounds for the Ranks of Complex Unit Gain Graphs in terms of the Matching Number

Rong-Xia Hao (Beijing Jiaotong University)

A complex unit gain graph (or \mathbb{T} -gain graph) is a triple (G, \mathbb{T}, φ) (or (G, φ) for short) consisting of a simple graph G , as the underlying graph of (G, φ) , the set of unit complex numbers $\mathbb{T} = \{z \in \mathbb{C} : |z| = 1\}$ and a gain function $\varphi : \vec{E} \rightarrow \mathbb{T}$ with the property that $\varphi(e_{i,j}) = \varphi(e_{j,i})^{-1}$. In this talk, we gave the bounds for the ranks $r(G, \varphi)$ of the Hermitian adjacency matrix of (G, φ) : $2m(G) - 2c(G) \leq r(G, \varphi) \leq 2m(G) + c(G)$, where $m(G)$ and $c(G)$ are the matching number and the cyclomatic number of G , respectively. And the complex unit gain graphs (G, φ) with $r(G, \varphi) = 2m(G) - 2c(G)$ and $r(G, \varphi) = 2m(G) + c(G)$ are characterized. Moreover, $2m(G - V_0) \leq r(G, \varphi) \leq 2m(G) + b(G)$ holds for any subset V_0 of $V(G)$ such that $G - V_0$ is acyclic, where $b(G)$ is the minimum integer $|S|$ such that $G - S$ is bipartite for $S \subset V(G)$.

Collapsible Graphs and Group Connectivity of Graphs

Jia-Ao Li (Nankai University)

The equivalence of group connectivity for non-homogeneous groups with the same order has been concerned since Jaeger, Linial, Payan and Tarsi introduced this concept in [J. Combin. Theory Ser. B, 56 (1992) 165-182]. Hušek, Mohelníková and Šámal in [J. Graph Theory, 93 (2020) 317-327] showed that Z_4 -connectivity and Z_2^2 -connectivity are not equivalent by finding counterexamples with a computer-assisted proof, and they asked whether one can find a proof

that does not use computers. Langhede and Thomassen [European J. Combin., (2023) 103816] provided a compute-free proof to show that there exist 3-edge-connected and Z_2^2 -connected, but not Z_4 -connected graphs. In this talk, by using properties of collapsible graphs, we construct 3-edge-connected graphs which are Z_4 -connected but not Z_2^2 -connected in which we prove those properties without any involvement of computers. These two results together answer the question proposed by Hušek et al. about computer-free proofs on the non-equivalence of Z_4 -connectivity and Z_2^2 -connectivity. In addition, by using both theoretical reductions and computer searching we find the smallest graph whose Z_4 -connectivity varies from Z_2^2 -connectivity. This smallest graph (in terms of order and size) is unique, which has 10 vertices and 14 edges.

Counting Dissociation Sets and Graph Homomorphisms

Jian-Hua Tu (Beijing University of Business and Technology)

The study of the problem of determining the maximum number of maximal independent sets and all independent sets in certain graph classes has been a fascinating object in extremal graph theory for recent decades. We consider dissociation sets and graph homomorphisms which are two generalizations of the concept of independent set. In this talk, I will give an overview of our recent work involving determining the maximum number of maximal (or maximum) dissociation sets, all dissociation sets and graph homomorphisms.

Eigenvalue of Graphs: Surrounding the Cycle Structure of Bipartite Graphs

Shu-Chao Li (Central China Normal University)

In 1962, Erdős and Pósa determined the maximum size of a graph without k disjoint cycles. In 1965, they determined the maximum size of a graph without 2 edge-disjoint cycles. In 1975, Erdős proposed a classic problem of determining the maximum size of a graph without two cycles possessing the same length. In this talk, from spectral perspective, we address above problems for bipartite graphs. That is, we utilize the eigenvalue conditions to reveal the existence for disjoint cycles, edge-disjoint cycles and cycles of the same length in bipartite graphs, respectively. We first establish sharp upper bounds on the spectral radius of n -vertex bipartite graphs without two edge-disjoint cycles and characterize all the corresponding extremal graphs. Then we obtain sharp upper bounds on the spectral radius of n -vertex bipartite graphs without two cycles possessing the same length and characterize all the corresponding extremal graphs. Finally, we get a sharp

upper bound on the spectral radius of n -vertex bipartite graphs without k disjoint cycles. The corresponding unique extremal graph is identified. Some research problems are given for further research. This is a joint work with Shujing Miao.

Edge Isoperimetric Problem for Recursive Graphs and Bollobás-Leader Type Many to Many Edge Disjoint Paths

Ming-Zu Zhang (Xinjiang University)

The edge isoperimetric problem on a graph is a useful tool for evaluation the edge fault tolerance of a graph G in terms of various kinds of the conditional edge-connectivities. Since this concept was first proposed by Harper, its optimal solution $\xi_m(G)$ has found a widely popularity in theoretic computer science and graph theory. Previous studies focus on the problem of determining the exact value and λ_h -optimality of the h -extra edge-connectivity for various kinds of graphs, i.e. $\lambda_h(G) = \xi_h(G)$, where $\xi_h(G) = \min\{|[X, \bar{X}]| : |X| = h \leq \lfloor |V(G)|/2 \rfloor, G[X] \text{ and } G[\bar{X}] \text{ are connected}\}$. Once for each integer $h_1 \leq h \leq h_2$, the exact value of $\lambda_h(G)$ is a constant, then we say that the h -extra edge-connectivity of G represents a concentration phenomenon on this integer interval. Based on the analysis the self-similarity (fractal) properties on the function $\xi_m(G_n)$ of some recursive graphs G_n , because this function is closely related to an everywhere-continuous and nowhere-differentiable function, the concentration phenomenon of the exact value of the h -extra edge-connectivity is a common phenomenon. We want to go further. Actually, as the integer n increases, for some recursive graphs G_n , such as power graph under Cartesian product, and their variants, the exact value of the $\lambda_h(G_n)$ is more likely to not be λ_h -optimality. The concentration phenomenon also occurs for the problem of many to many disjoint paths on the corresponding recursive graph. It is also related to the Bollobás-Leader conjecture.

Counting Spanning Trees in Bipartite-Related Graphs

Jun Ge (Sichuan Normal University)

In this talk, we will first introduce several methods on counting spanning trees, including the rank-one perturbation to the Laplacian, the electrical network method, and Wang algebra. Then we will introduce some recent work on Moon-type formulae (the number of spanning trees containing any fixed spanning forest) for some graphs. For a bipartite graph G , we will explain our recent results on expressing the number of spanning trees of the K_n -complement $K_n - G$ in terms of the determinant of the biadjacency matrices of all induced balanced bipartite subgraphs of G .

Vertex-Degree Function Index and Hamiltonian Properties of Graphs

Jun-Feng Du (Beijing University of Chemical Technology)

The problem of deciding whether a given graph is Hamiltonian or not is one of the most difficult classical problems in graph theory. In 2019, Zhou, Wang and Lu give some sufficient conditions in terms of Wiener-type index for Hamiltonian properties of graphs. And in the same year, the vertex-degree function index, which is denoted by $H(f)(G) = \sum_{v \in V(G)} f(d(v))$ for a function $f(x)$ defined on non-negative real numbers, was proposed by Yao, Liu, Belardo and Yang. In this presentation, we will introduction some results for a connected general graph to be traceable, Hamiltonian, k -Hamiltonian, Hamilton-connected and k -Hamilton-connected from every vertex in terms of the vertex-degree function index.

Disproof of a Conjecture on Minimally t -Tough Graphs

Wei Zheng (Shandong Normal University)

Let G be a graph and let $\omega(G)$ denote the number of components of G . The graph G is said to be t -tough if $t \cdot \omega(G - X) \leq |X|$ for all $X \subseteq V(G)$ with $\omega(G - X) > 1$, where t is a nonnegative real number. The *toughness* $\tau(G)$ of the graph G is the maximum value of t such that G is t -tough (taking $\tau(K_n) = \infty$ for all $n \geq 1$). A graph G is said to be *minimally t -tough* if $\tau(G) = t$ and $\tau(G - e) < t$ for every $e \in E(G)$. Katona and Varga (2018) conjectured that every minimally t -tough graph has a vertex of degree $\lceil 2t \rceil$. In this talk, we give a disproof of this conjecture by constructing an infinite family of counterexamples.

Extremal Triangle-Free Graphs With Chromatic Number at Least Four

Shi-Peng Wang (jiangsu university)

Let G be an n -vertex triangle-free graph. The celebrated Mantel's theorem showed that $e(G) \leq \lfloor \frac{n^2}{4} \rfloor$. In 1962, Erdős (together with Gallai), and independently Andrásfai, proved that if G is non-bipartite then $e(G) \leq \lfloor \frac{(n-1)^2}{4} \rfloor + 1$. In this paper, we extend this result and show that if G has chromatic number at least four and $n \geq 150$, then $e(G) \leq \lfloor \frac{(n-3)^2}{4} \rfloor + 5$. The blow-up of Grötzsch graph shows that this bound is best possible.

Local Dirac's Condition on the Existence of 2-Factor

Xiao-Dong Chen (Liaoning Normal University)

In a graph G , we use $d(u, v)$ to denote the distance of a pair of vertices u and v in G . For a vertex u in a graph G and a given positive integer k , let $M_k(u)$ denote the set of vertex v with $d(u, v) \leq k$. A graph G satisfies the local Dirac's condition if for each vertex $u \in V(G)$, $d(u) \geq \frac{|M_2(u)|}{2}$. Asratian et al. disproved that a connected graph G on at least three vertices is Hamiltonian if G satisfies the local Dirac's condition. In this paper, we prove that if a connected graph G on at least three vertices satisfies the local Dirac's condition, then G contains a 2-factor. We give a counterexample to show our result is best possible.

Zero Net-Regular Signed Graph and Signed Graph Factor

Xiang-Yu Ren (Shanxi University)

For a signed graph $\dot{G} = (G, \sigma)$, the net-degree of a vertex u in \dot{G} is the number of positive edges incident with u minus the number of negative edges incident with u , i.e., $d_{\dot{G}}^{\pm}(u) = d_G^+(u) - d_G^-(u)$. A zero net-regular signed graph, for short called zero net-regular graph, is a graph with a constant net-degree zero. In this report, we give characterizations for zero net-regular graph and its minimal nonempty structure. As a byproduct, using the Combinatorial Nullstellensatz Theorem, we give a simple condition for the existence of a nonempty zero net-regular subgraph in \dot{G} . We also generalize the Lovász's (g, f) -factor theorem to signed graphs, and apply it to net-degree sequence.

The Star Packing of Cubic Graphs

Ling-Juan Shi (Northwestern Polytechnical University)

A subgraph of graph G is called an H -packing of G if its each component is isomorphic to H , and we call it perfect if it is a spanning subgraph of G . Recently, for general or specified cubic graphs, we have studied their $K_{1,3}$ -packing. We show that the number of vertices of a fullerene graph admitting a perfect $K_{1,3}$ -packing must be divisible by 8. This answers an open problem asked by Došlić et al. and also shows that a fullerene graph with an efficient dominating set has $8n$ vertices. In fact, this conclusion is still valid for any cubic bipartite graph.

Hamiltonian Indices of Generalized Petersen Graph

Sheng-Mei Lv (Qinghai Nationalities University)

In this speech, authors mainly consider Hamiltonian indices of Generalized Petersen Graphs. Whether Hamiltonian cycles in Generalized Petersen Graphs $P(n, k)$ exist has been relatively perfect. Based on the research of Alspach in [1], this speech mainly provided the Hamiltonian index of $P(n, k)$ ($k = 2, \frac{n-1}{2}, \frac{n+1}{2}, n-2$), while $n \equiv 5 \pmod{6}$ and the Hamiltonian index of $P(n, \frac{n}{2})$, while $n \geq 8$ and $n \equiv 0 \pmod{4}$.

[1] Alspach B. The Classification of Hamiltonian Generalized Petersen Graphs[J]. Combin Theory Ser B, 1983, 34: 293-312.

Some Recent Results for k -Leaf-Connected Graphs and Digraphs

Gui-Fu Su (Beijing University of Chemical Technology)

A tree T in a digraph G is said to be a rooted tree if there exists a vertex, say v , such that $d_T^-(v) = 0$, and $d_T^-(u) = 1$ for any other vertices $u \in V(T) \setminus \{v\}$. Such tree T is called a spanning rooted tree if T is a rooted tree and $V(T) = V(G)$. For integer $k \geq 2$, a graph (resp. digraph) G is called k -leaf-connected if $|V(G)| \geq k+1$ and given any subset $S \subseteq V(G)$ with $|S| = k$, there always exists a spanning tree (resp. spanning rooted tree) T in G such that S is precisely the set of leaves of T . Exploring sufficient conditions for (di)-graphs possessing certain properties is an significant and meaningful problem. In this talk, we will first present several sufficient conditions in terms of the inverse degree, the reciprocal product-degree distance and the multiplicative version of the first Zagreb index for a graph to be k -leaf-connected. We will also introduce some recent results of k -leaf-connected digraphs.

Forbidden Subgraphs on Hamilton-Connected Graphs

Xia Liu (Northwest Normal University)

A graph G is said to be *Hamilton-connected* if, for any $u, v \in V(G)$, G has a hamiltonian (u, v) -path, i.e., an (u, v) -path P with $V(P) = V(G)$.

In this talk, we will introduce some results on the sharp forbidden pairs on Hamilton-connected graphs, which one of them must be $K_{1,3}$. What's more, there is one open case in the characterization of pairs of connected forbidden subgraphs implying Hamilton-connectedness, that is $\{K_{1,3}, \Gamma_5\}$.

Bounds for Zero Forcing Numbers of Connected Graphs with Fixed Order and Maximum Degree

Mu-Huo Liu (South China Agricultural University)

The zero forcing number $Z(G)$ of a graph G was proposed by the AIM Minimum Rank-Special Graphs Work Group as an upper bound on the nullities of matrices associated with G . In this talk, we introduce some recent results on the upper bounds for the zero forcing number and for the nullity of a connected graph in terms of its order and maximum degree.

Convolution Formulas for Multivariate Arithmetic Tutte Polynomials

Tian-Long Ma (Xiamen University)

The multivariate arithmetic Tutte polynomial of arithmetic matroids is a generalization of the multivariate Tutte polynomial of matroids. In this talk, we will give the convolution formulas for the multivariate arithmetic Tutte polynomial of the product of two arithmetic matroids. In particular, the convolution formulas for the multivariate arithmetic Tutte polynomial of an arithmetic matroid are obtained. Applying our results, several known convolution formulas are proved by a purely combinatorial proof. The proofs presented here are significantly shorter than the previous ones. In addition, we obtain a convolution formula for the characteristic polynomial of an arithmetic matroid.

This is a joint work with Xian'an Jin and Weiling Yang.

Some Problems and Recent Progress on Matching Covered Graphs

Xing Feng (Jimei University)

A graph is called *matching covered* if it is connected, has at least one edge and each of its edges is contained in some perfect matching. Lovász proved that every matching covered graph may be decomposed into a unique list of bricks (3-connected bicritical graphs) and braces (2-extendable bipartite graphs). The importance of bricks and braces stems from the fact that several problems from matching theory can be reduced to bricks and braces (for example, computing the dimension of the linear hull and lattice of incidence vectors of perfect matchings, or characterizing Pfaffian graphs). This talk contains progress on minimal bricks and minimal braces and some open problems.

Hamilton Line Graphs of Hypergraphs

Su-Lin Song (West Texas A&M University)

A graph is **supereulerian** if it has a spanning eulerian subgraph. Harary and Nash-Williams in 1968 proved that the line graph of a graph G is hamiltonian if and only if G has a dominating eulerian subgraph, Jaeger in 1979 showed that every 4-edge-connected graph is supereulerian, and Catlin in 1988 proved that every graph with two edge-disjoint spanning trees is a contractible configuration for supereulerianity. Utilizing the notion of partition-connectedness of hypergraphs introduced by Frank, Király and Kriesell in 2003, we generalize the above-mentioned results of Harary and Nash-Williams, of Jaeger and of Catlin to hypergraphs by characterizing hypergraphs whose line graphs are hamiltonian, and showing that every 2-partition-connected hypergraph is a contractible configuration for supereulerianity.

3-Component Domination Numbers in Graphs

Chang-Qing Xi (Nankai University)

Let k be a positive integer and let $G = (V(G), E(G))$ be a graph. A vertex set D is a k -component dominating set of G if every vertex outside D in G has a neighbor in D and every component of the subgraph $G[D]$ of G induced by D contains at least k vertices. The minimum cardinality of a k -component dominating set of G is the k -component domination number $\gamma_k(G)$ of G . It was conjectured that if G is a connected graph of order $n \geq k + 1$, and minimum degree at least 2, then $\gamma_k(G) \leq \frac{2kn}{2k+3}$ except for a finite set of graphs. In this paper, we focus on the parameter $\gamma_3(G)$ of G . We first determine the exact values of 3-component domination numbers of paths and cycles. We then proceed to show that if G is a connected graph of order n with minimum degree at least 2 and maximum degree at most 3, then $\gamma_3(G) \leq \frac{2n}{3}$, unless G is one of seven special graphs. This result provides positive support for the conjecture and also generalizes a result by Alvarado et al. [Discrete Math., 2016].

Antidirected Hamiltonian Paths and Antidirected Hamiltonian Cycles of k -Hypertournament

Hong Yang (Xinjiang University)

A k -hypertournament H on n vertices is a pair $(V(H), A(H))$, where $V(H)$ is a set of vertices and $A(H)$ is a set of k -tuples of vertices, called arcs, such that for any k -subset S of $V(H)$, $A(H)$ contains exactly one of the $k!$ k -tuples whose entries belong to S . Clearly, a 2-hypertournament is a tournament. An antidirected path in H is a sequence $x_1 a_1 x_2 a_2 x_3 \dots x_{t-1} a_{t-1} x_t$ of distinct vertices x_1, x_2, \dots, x_t and distinct arcs a_1, a_2, \dots, a_{t-1} such that for any $i \in \{2, 3, \dots, t\}$, either x_{i-1} precedes x_i in a_{i-1} and x_{i+1} precedes x_i in a_i , or x_i precedes x_{i-1} in a_{i-1} and x_i precedes x_{i+1} in a_i . An antidirected cycle can be defined analogously. An antidirected path or cycle containing all vertices of H is antidirected hamiltonian path or cycle. Some results of antidirected hamiltonian paths and antidirected hamiltonian cycles in tournament have been obtained. In this talk, we want to turn our attention to the antidirected hamiltonian paths and antidirected hamiltonian cycles of hypertournaments. We prove that except for four hypertournaments, T_3^c, T_5^c, T_7^c and H_4 , every k -hypertournament with n vertices, where $2 \leq k \leq n - 1$, has an antidirected hamiltonian path, and prove that every even k -hypertournament with n vertices, where $3 \leq k \leq n - 2$, has an antidirected hamiltonian cycle.

Recoloring P_5 -Free Graphs

Su-Su Wang (Nankai University)

For a positive integer k , the reconfiguration graph for all k -colorings of a graph G , denoted by $\mathcal{R}_k(G)$, is the graph where vertices represent the k -colorings of G and two k -colorings are joined by an edge if they differ in color on exactly one vertex. A result of Bonamy et al. implies that for any 2-colorable P_5 -free graph G , $\mathcal{R}_k(G)$ is connected for any $k \geq 3$. On the other hand, Feghali and Merkel proved that for every positive integer p , there exists a $7p$ -colorable P_5 -free graph G such that $\mathcal{R}_{8p}(G)$ is disconnected. This leaves the open case for t -colorable P_5 -free graphs with $t = 3, 4, 5, 6$. In this paper, we prove that $\mathcal{R}_k(G)$ is connected for each 3-colorable P_5 -free graph G and each $k \geq 4$. We also show that there is a t -colorable P_5 -free graph G with $\mathcal{R}_k(G)$ disconnected for each $t \geq 4$ and $t + 1 \leq k \leq \binom{t}{2}$.

The Minimum Degree of Minimally t -Tough, Claw-Free Graphs

Hui Ma (Taiyuan University of Technology)

A graph G is minimally t -tough if the toughness of G is t and deletion of any edge from G decreases its toughness. Kriesell conjectured that the minimum degree of a minimally 1-tough graph is 2. Katona et al. proposed a generalized version of the conjecture that every minimally t -tough graph has a vertex of degree $\lceil 2t \rceil$ and showed that the conjecture is true for claw-free graphs with $t = \frac{1}{2}, 1$. In this talk, we show that Katona et al.'s conjecture is true for minimally $\frac{3}{2}$ -tough, claw-free graphs, and the minimum degree of minimally t -tough, claw-free graphs is at most $\lceil \frac{10t-5}{3} \rceil$ for $t \geq 2$.

Some New Results on the Majorization Theorem and Topological Indices

Pei-Chao Wei (South China Agricultural University)

The majorization theorem is an important tool to deal with the extremal problem of topological indices and graph spectrum. In this talk, we will introduce some new unified extremal results of topological indices, which is obtained by the application of majorization theorem. Especially, we also introduce the unique extremal graph of Lanzhou index of c -cyclic graphs and all unified extremal trees and unicyclic graphs with given diameter which is obtained by applying the majorization method.

Independent Isolation Number and Total Isolation Number of Graphs

Jun-Hao Qu (Qinghai Normal University)

In 2015, Caro and Hansberg extended the domination to the partial domination, and proposed the concept of an \mathcal{F} -isolating set of graph for the first time. Let $G = (V, E)$ be a graph and \mathcal{F} be a family of graphs. A subset $S \subseteq V(G)$ is said to be an \mathcal{F} -isolating set of G if $G[V(G) \setminus N_G(S)]$ does not contain H as a subgraph for any $H \in \mathcal{F}$. The \mathcal{F} -isolation number of G is the minimum cardinality of an \mathcal{F} -isolating set of G , denoted by $\iota(G, \mathcal{F})$. If $\mathcal{F} = \{H\}$, we denote $\iota(G, \mathcal{F}) = \iota_H(G)$. In recent years, there are more and more research results on isolation number. The main content of this report is the isolation number of the graph under two constraints. On the one hand, we get the case that the independent isolation number is equal to the isolation number and the upper bound of the independent isolation number for trees and graphs. On the other hand, we get the upper bound of the Total isolation number for trees and graphs.

Paired 2-Disjoint Path Covers of k -Ary n -Cubes under the Partitioned Edge Fault Model

Hong-bin Zhuang (Fuzhou University)

The k -ary n -cube Q_n^k serves as an indispensable interconnection network in the design of data center networks, network-on-chips, and parallel computing systems since it possesses numerous attractive properties. In these parallel architectures, the paired (or unpaired) many-to-many m -disjoint path cover (m -DPC) plays a significant role in message transmission. Nevertheless, the construction of m -DPC is severely obstructed by large-scale edge faults due to the rapid growth of the system scale. In this paper, we investigate the existence of paired 2-DPC in Q_n^k under the partitioned edge fault (PEF) model, which is a novel fault model for enhancing the networks' fault-tolerance related to path embedding problem. We exploit this model to evaluate the edge fault-tolerance of Q_n^k when a paired 2-DPC is embedded into Q_n^k . Compared to the other known works, our results can help Q_n^k to achieve large-scale edge fault-tolerance.

Counting Spanning Trees of Multiple Complete Split-Like Graph Containing a Given Spanning Forest

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The multiple complete split-like graph $MCS_{b,s}^a$ is the join of an empty graph \overline{K}_a and s copies of complete graph K_b . In this article, we obtain the formulas for the number of spanning trees of $MCS_{b,s}^a$ containing a given spanning forest when $s = 1$ and 2. Particularly, when $s = 1$, our result unified and generalized Moon's result and Dukes's result (Sung's result).

Sufficient Conditions for Hamiltonian Properties of Graphs Based on Some Topological Indices

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Hamiltonicity and Travelling salesman problem remain the challenging problems because of their NP-hard attribute. They have gained popularity in fields of design of VLSI circuit, mobile robot exploration, artificial intelligence, just to name a few. Numerous topological indices have been proposed to characterize the topological structural properties of graphs, and they are widely recognized as graph invariants. Some sufficient conditions in terms of certain topological indices

have been suggested to describe hamiltonian properties of graphs, such as Hamiltonicity, traceability, Hamiltonian-connectedness, k -leaf-connectedness, as well as β -deficiency. For a graph G , the first and second Zagreb indices and the Sombor index are defined as $M_1(G) = \sum_{u \in V(G)} d_u^2$, $M_2(G) = \sum_{uv \in E(G)} d_u d_v$ and $SO(G) = \sum_{uv \in E(G)} \sqrt{(d_u)^2 + (d_v)^2}$, where d_u denotes the degree of vertex u in G . The difference of Zagreb indices of G is defined as $\Delta M(G) = M_2(G) - M_1(G)$. In this paper, we suggest some sufficient conditions in terms of $M_1(G)$, $SO(G)$ and $\Delta M(G)$ for graphs with restricted minimum degree to be Hamiltonian and Hamiltonian-connected. Moreover, we propose the sufficient condition in terms of $\Delta M(G)$ for the graphs to be β -deficient for $0 \leq \beta \leq \frac{n}{2} - 2$.

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