2021

中華民國數學年會

TMS Annual Meeting

中研院數學所

大會手冊

Conference Program

Jan. 17 (Mon.) - 18 (Tue.), 2022

數學年會一直是國內最大型的數學交流會議活動。為促進數學教育及推動國內外學術交流，中央研究院數學研究所接受中華民國數學會委託，於 2022 年 1 月 17 日至 1 月 18 日在國立台灣大學天文數學館舉辦「2021 中華民國數學年會」，邀請國內外數學相關領域之專家學者分享其研究成果，也陸續邀集新銳數學家拍攝短片，透過影片向與會來賓介紹其研究歷程；期待以此促進全國數學研究教學人員交流，並期待提升學生們對數學的熱情。

數學年會長期以來由全台各大學及研究機構輪流承辦，一方面，每個承辦單位都有機會為此活動付出心力，進而展現各自的特色，另一方面，也可適切平衡各區域之學術發展，讓各地大學生及研究生皆有機會就近聆聽精彩的學術演講。本所曾分別於 1989 年、1997 年、 2007 年舉辦數學年會。睽違 15 年再度獲選承辦單位，不僅是一份榮譽，也承擔著本所推動台灣數學學術研究的責任。

2021 中華民國數學年會

2021 Taiwan Mathematical Society Annual Meeting

會議時間：2022年1月17日（一）至2022年1月18日（二）
會議地點：國立台灣大學天文數學館
主辦單位：中華民國數學會
承辦單位：中央研究院數學研究所
協辦單位：科技部自然司科學推展中心數學組、國立台灣大學數學系

學術委員會
Scientific Committee

國立台灣大學數學系	李瑩英（召集人）
中央研究院數學研究所	王姿月（110年承辦單位）
國立清華大學數學系	何南國
國立台灣大學數學系	夏俊雄
國立陽明交通大學應用數學系	陳冠宇
國立中央大學數學系	楊肅煜
中央研究院數學研究所	謝銘倫

承辦單位人員
Organizing Committee

召集人	王姿月
籌備委員	謝銘倫　陳怡全　賴俊儒　林玉端　郭玫玲
行政總召	董祐菁
行政人員	王姵鈞　皮漢章　江亘婷　何家萱　吳克勤 李月華　洪妙萍　洪培勳　洪瑋傑　許華庭 黃家虹　黃舒淳　葉淑敏　劉筱青　賴宜伶

議程
Agenda

2021 中華民國數學年會
2021 Taiwan Mathematical Society Annual Meeting

2022 年 1 月 17 日(星期一)

08:00 - 09:30	報到註冊									
09:40 - 10:00	年會開幕式 主持人:李螢英 理事長									1F 國際會議廳 Room 202
10:00 - 10:50	大會演講 蕭美琪 教授 主持人:鄭日新 教授									
10:50 - 11:00	團體照									1F 國際會議廳
11:00 - 11:25	茶會、討論									1F
Room	1F 國際會議廳		Room 101		Room 102		Room 202		Room 639	
11:25 – 12:10 共同演講	演講者: Kenichi Bannai (online) 主持人:謝銘倫		演講者:尤釋賢 主持人:吳恭儉		演講者:余正道 主持人:陳榮凱		演講者:李志光 (online) 主持人:黃毅青		演講者:林敏雄 主持人:楊肅煜	
12:15 – 13:45	午餐 Lunch Break									
Sessions	數論與代數	微分幾何與 代數幾何	分析	偏微分方程	最佳化	離散數學	動態系統與 生物數學	計算數學	機率	統計
Room	Room 202	Room 101	Room 617	Room 638	Room 609	Room 639	Room 201	Room 102	Room 722	Room 714
13:45 – 14:10 領域演講 場次一	演講者:李庭綸 主持人:楊一帆	演講者:林學庸 主持人:蕭欽玉	演講者:王國仲 主持人:Daniel Spector	演講者:王冠祥 主持人:王振男	演講者:張毓麟 主持人:許瑞麟	演講者:王道明 主持人:張惠蘭	演講者:王琪仁 主持人:張覺心	演講者:胡偉帆 主持人:林敏雄	演講者:黃建豪 主持人:黃皓瑋	演講者:王紹宣 主持人:陳定立
14:15 – 14:40 領域演講 場次二	演講者:佐藤信夫 主持人:楊一帆	演講者:楊劼之 主持人:蕭欽玉		演講者:黃志強 主持人:王振男	演講者:林仁彥 主持人:許瑞麟	演講者:李渭天 主持人:陳宏賓	演講者:戴佳原 主持人:張覺心	演講者:林得勝 主持人:胡偉帆	演講者:千野由喜 主持人:黃建豪	演講者:李宜真 主持人:陳定立
14:45 – 15:10 領域演講 場次三	演講者:王崇亘 主持人:楊一帆	演講者:廖軒毅 主持人:蕭欽玉	演講者:蔡明誠 主持人:Daniel Spector	演講者:林英杰 主持人:王振男	演講者:李雨青 主持人:許瑞麟	演講者:Shagnik Das 主持人:俞韋亘	演講者: 陳彥宇 主持人: 曾睿彬	演講者:蔣俊岳 主持人:林敏雄	演講者:林偉傑 主持人:千野由喜	****
15:10 – 15:35	茶會、討論									1F
15:35 – 16:25	大會演講 余家富 教授 主持人:程舜仁 教授									1F 國際會議廳 Room 202
16:25 – 16:35	年會傳承 (111年承辦單位:國立清華大學數學系)									1F 國際會議廳 Room 202
16:40 – 18:00	2021 公共議題論壇 演講者:林惠文 教授、崔茂培 教授、鄭經斅 副教授 主持人: 林俊吉 教授									1F 國際會議廳
18:30	晚宴									水源會館

2021 中華民國數學年會
2021 Taiwan Mathematical Society Annual Meeting

2022 年 1 月 18 日(星期二)

08:30 - 09:00	報到註冊									
09:00 - 09:50	大會演講 侯一釗 教授 主持人: 陳宜良 教授									1F 國際會議廳 Room 202
09:50 - 10:15	茶會、討論									1F
Room	1F 國際會議廳		Room 101		Room 102	Room 202		Room 638		Room 639
10:15 – 11:00 共同演講	演講者: Sijong Kwak (online) 主持人:陳榮凱		演講者:楊柏因 主持人:陳君明		演講者:崔茂培 主持人:何南國	演講者: 吳浩樞 (online) 主持人:劉聚仁		演講者:陳隆奇 主持人:陳冠宇		演講者:陳俊全 主持人:夏俊雄
Sessions	數論與代數	微分幾何與 代數幾何	分析	偏微分方程	最佳化	離散數學	動態系統與 生物數學	計算數學	機率	統計
Room	Room 202	Room 101	Room 617	Room 638	Room 609	Room 639	Room 201	Room 102	Room 722	Room 714
11:15 – 11:40 領域演講 場次四	演講者:彭勇寧 主持人:賴俊儒 (45分鐘)	演講者: Adeel Khan 主持人:林學庸	演講者:王雅書 主持人:黃毅青	演講者:江金城 主持人:夏俊雄 (45分鐘)	演講者:黃同瑤 主持人:陳界山	演講者:游森棚 主持人:陳秋媛 (45分鐘)	演講者:班榮超 主持人:吳昌鴻 (45分鐘)	演講者:陳孟豁 主持人:林晉宏	演講者:洪正濱 主持人:黃皓瑋	演講者:林良靖 主持人:陳定立
11:45– 12:10 領域演講 場次五		演講者:卓士堯 主持人:林學庸	演講者:陳中川 主持人:黃毅青		演講者:莊智升 主持人:陳界山			演講者:郭岳承 主持人:林晉宏	****	演講者:林聖軒 主持人:陳定立
12:15 – 13:45	午餐 Lunch Break									
	女數學人Gathering									Room 901
13:45 – 14:10 領域演講 場次六	演講者: Changningphaabi Namoijam 主持人:魏福村	演講者:邱聖夫 主持人:楊劼之	演講者: Daniel Spector 主持人:陳中川 (45分鐘)	演講者: Junsik Bae 主持人:夏俊雄	演講者:林立岡 主持人:陳界山	演講者:余冠儒 主持人:符麥克	演講者:陳世昕 主持人:吳昌鴻	演講者:林晉宏 主持人:林敏雄	****	****
14:15 – 14:40 領域演講 場次七	****	演講者:吳佬儒 主持人:楊劼之		****	演講者:李靜沛 主持人:陳界山	****	****	****	****	****
14:45 – 15:10 領域演講 場次八	****	演講者:許佑鴻 主持人:楊劼之	演講者:黃耀德 (中山大學) 主持人:陳中川	****	演講者:Jan Harold Alcantara 主持人:陳界山	****	****	****	****	****
15:10	下屆清華大學數學系見									

議程
Agenda

2021 Taiwan Mathematical Society Annual Meeting

January 17, 2022 (Monday)

08:00 - 09:30	Registration	
09:40 - 10:00	Opening Ceremony Chair: President Yng-Ing Lee	1F Auditorium Room 202
10:00 - 10:50	Plenary Talk by Professor Mei-Chi Shaw Chair: Professor Jih-Hsin Cheng	
10:50 - 11:00	Group Photo Session	1F Auditorium
11:00 - 11:25	Coffee Break	1F

Room	1F Auditorium	Room 101	Room 102	Room 202	Room 639
11:25 – 12:10 Keynote Talks I	Speaker: Kenichi Bannai (online) Chair: Ming-Lun Hsieh	Speaker: Shih-Hsien Yu Chair: Kung-Chien Wu	Speaker: Jeng-Daw Yu Chair: Jungkai Alfred Chen	Speaker: Chi-Kwong Li (online) Chair: Ngai-Ching Wong	Speaker: Min-Hsiung Lin Chair: Suh-Yuh Yang
12:15 – 13:45	Lunch Time				

Sessions	Number Theory and Algebra	Differential and Algebraic Geometry	Analysis	Partial Differential Equations	Optimization	Discrete Mathematics	Dynamical Systems and Biomathematics	Computational Mathematics	Probability	Statistics
Room	Room 202	Room 101	Room 617	Room 638	Room 609	Room 639	Room 201	Room 102	Room 722	Room 714
13:45 – 14:10 Special Sessions I	Speaker: Ting-Yu Lee Chair: Yi-Fan Yang	Speaker: Hsueh-Yung Lin Chair: Chin-Yu Hsiao	Speaker: Kuo-Zhong Wang Chair: Daniel Spector	Speaker: Kuan-Hsiang Wang Chair: Jenn-Nan Wang	Speaker: Yu-Lin Chang Chair: Ruey-Lin Sheu	Speaker: Tao-Ming Wang Chair: Hui-Lan Chang	Speaker: Chi-Jen Wang Chair: Chueh-Hsin Chang	Speaker: Wei-Fan Hu Chair: Matthew M. Lin	Speaker: Chien-Hao Huang Chair: Hao-Wei Huang	Speaker: Shao-Hsuan Wang Chair: Ting-Li Chen
14:15 – 14:40 Special Sessions II	Speaker: Nobuo Sato Chair: Yi-Fan Yang	Speaker: Ryosuke Takahashi Chair: Chin-Yu Hsiao		Speaker: Chih-Chiang Huang Chair: Jenn-Nan Wang	Speaker: Jen-Yen Lin Chair: Ruey-Lin Sheu	Speaker: Wei-Tian Li Chair: Hong-Bin Chen	Speaker: Jia-Yuan Dai Chair: Chueh-Hsin Chang	Speaker: Te-Sheng Lin Chair: Wei-Fan Hu	Speaker: Yuki Chino Chair: Chien-Hao Huang	Speaker: I-Chen Lee Chair: Ting-Li Chen
14:45 – 15:10 Special Sessions III	Speaker: Chung-Hsuan Wang Chair: Yi-Fan Yang	Speaker: Hsuan-Yi Liao Chair: Chin-Yu Hsiao	Speaker: Ming-Cheng Tsai Chair: Daniel Spector	Speaker: Ying-Chieh Lin Chair: Jenn-Nan Wang	Speaker: Yu-Ching Lee Chair: Ruey-Lin Sheu	Speaker: Shagnik Das Chair: Wei-Hsuan Yu	Speaker: Yan-Yu Chen Chair: Jui-Pin Tseng	Speaker: Chun-Yueh Chiang Chair: Matthew M. Lin	Speaker: Wai-Kit Lam Chair: Yuki Chino	****

15:10 – 15:35	Coffee Break	
15:35 – 16:25	Plenary Talk by Professor Chia-Fu Yu Chair: Professor Shun-Jen Cheng	1F Auditorium Room 202
16:25 – 16:35	Pass-it-on Ceremony (National Tsing Hua University, Host of 2022)	1F Auditorium Room 202
16:40 – 18:00	Forum of Public Issues in Math Community Speaker: Professor Ching-Hsiao Cheng, Hui-Wen Lin, Mao-Pei Tsui Chair: Professor Chun-Chi Lin	1F Auditorium
18:30	Banquet	La marée

2021 Taiwan Mathematical Society Annual Meeting

January 18, 2022 (Tuesday)

08:30 - 09:00	Registration	
09:00 - 09:50	Plenary Talk by Professor Thomas Yizhao Hou Chair: Professor I-Liang Chern	1F Auditorium Room 202
09:50 - 10:15	Coffee Break	1F

Room	1F Auditorium	Room 101	Room 102	Room 202	Room 638	Room 639
10:15 – 11:00 Keynote Talks II	Speaker: Sijong Kwak (online) Chair: Jungkai Alfred Chen	Speaker: Bo-Yin Yang Chair: Chun-Ming Chen	Speaker: Mao-Pei Tsui Chair: Nan-Kuo Ho	Speaker: Hau-Tieng Wu (online) Chair: Gi-Ren Liu	Speaker: Lung-Chi Chen Chair: Guan-Yu Chen	Speaker: Chiun-Chuan Chen Chair: Chun-Hung Hsia

Sessions	Number Theory and Algebra	Differential and Algebraic Geometry	Analysis	Partial Differential Equations	Optimization	Discrete Mathematics	Dynamical Systems and Biomathematics	Computational Mathematics	Probability	Statistics
Room	Room 202	Room 101	Room 617	Room 638	Room 609	Room 639	Room 201	Room 102	Room 722	Room 714
11:15 – 11:40 Special Sessions IV	Speaker: Yung-Ning Peng Chair: Chun-Ju Lai (45 min)	Speaker: Adeel Khan Chair: Hsueh-Yung Lin	Speaker: Ya-Shu Wang Chair: Ngai-Ching Wong	Speaker: Jin-Cheng Jiang Chair: Chun-Hiung Hisa (45 min)	Speaker: Tone-Yau Huang Chair: Jein-Shan Chen	Speaker: Sen-Peng Eu Chair: Chiu-Yuan Chen (45 min)	Speaker: Jung-Chao Ban Chair: Chang-Hong Wu (45 min)	Speaker: Meng-Huo Chen Chair: Jephian C.-H. Lin	Speaker: Jyy-I Hong Chair: Hao-Wei Huang	Speaker: Liang-Ching Lin Chair: Ting-Li Chen
11:45– 12:10 Special Sessions V		Speaker: Shin-Yao Jow Chair: Hsueh-Yung Lin	Speaker: Chung-Chuan Chen Chair: Ngai-Ching Wong		Speaker: Chih-Sheng Chuang Chair: Jein-Shan Chen			Speaker: Yuen-Cheng Kuo Chair: Jephian C.-H. Lin	****	Speaker: Sheng-Hsuan Lin Chair: Ting-Li Chen
12:15 – 13:45	Lunch Time									
		Gathering of Female Mathematicians								Room 901
13:45 – 14:10 Special Sessions VI	Speaker: Changningphaabi Namoijam Chair: Fu-Tsun Wei	Speaker: Sheng-Fu Chiu Chair: Ryosuke Takahashi	Speaker: Daniel Spector Chair: Chung-Chuan Chen (45 min)	Speaker: Junsik Bae Chair: Chun-Hiung Hisa	Speaker: Li-Gang Lin Chair: Jein-Shan Chen	Speaker: Guan-Ru Yu Chair: Michael Fuchs	Speaker: Shih-Hsin Chen Chair: Chang-Hong Wu	Speaker: Chin-Hung Lin Chair: Min-Hsiung Lin	****	****
14:15 – 14:40 Special Sessions VII	****	Speaker: Kuang-Ru Wu Chair: Ryosuke Takahashi		****	Speaker: Ching-Pei Lee Chair: Jein-Shan Chen	****	****	****	****	****
14:45 – 15:10 Special Sessions VIII	****	Speaker: You-Hung Hsu Chair: Ryosuke Takahashi	Speaker: Yao-Te Huang (Sun Yat-sen University) Chair: Chung-Chuan Chen	****	Speaker: Jan Harold Alcantara Chair: Jein-Shan Chen	****	****	****	****	****
15:10	Let's mee at Tsing Hua University next time!									

時間表
Timetable

2022/1/17　10:00 - 10:50 大會演講
蕭美琪 (University of Notre Dame), *The Cauchy-Riemann Equations in Complex Analysis*　1F 國際會議廳 /Room 202
2022/1/17　11:25 - 12:10 共同演講
林敏雄 (成功大學數學系), *Low Rank Approximation of Entangled Bipartite Systems*　Room 639
李志光 (College of William and Mary), *Numerical range techniques in quantum information science*　Room 202
尤釋賢 (中央研究院數學研究所), *Green's function and Path integral*　Room 101
Kenichi Bannai (日本慶應義塾大學), *Pure Mathematicians meet Machine Learning*　1F 國際會議廳
余正道 (台灣大學數學系), *Moments of Airy Functions as Ulterior Motives*　Room 102
2022/1/17　13:45 - 15:10 領域演講
數論與代數　Room 202
13:45 - 14:10 李庭諭 (台灣大學數學系), *Embeddings of Maximal Tori in Classical Groups, Odd Degree Descent and Totaro's question*
14:15 - 14:40 佐藤信夫 (台灣大學數學系), *On alternating multiple zeta values*
14:45 - 15:10 王崇亘 (成功大學數學系), *Transformation formulas of p-adic hypergeometric functions*
微分幾何與代數幾何　Room 101
13:45 - 14:10 林學庸 (台灣大學數學系), *Motivic invariants of birational maps and Cremona groups*
14:15 - 14:40 楊劼之 (成功大學數學系), *Structure of $\mathbb{Z}/2$-harmonic spinors*
14:45 - 15:10 廖軒毅 (清華大學數學系), *Formal exponential maps and Fedosov resolutions*
分析　Room 617
13:45 - 14:40 王國仲 (陽明交通大學應用數學系), *Numerical Ranges of Foguel Operators*
14:45 - 15:10 蔡明誠 (台北科技大學通識教育中心), *Additive Hermitian idempotent preservers*
偏微分方程　Room 638
13:45 - 14:10 王冠祥 (國家理論科學研究中心), *Ground states for a linearly coupled indefinite Schrödinger system with steep potential well*
14:15 - 14:40 黃志強 (中正大學數學系), *Traveling Waves for a nonlocal equation*
14:45 - 15:10 林英杰 (高雄大學應用數學系), *Global entropy solution and relaxation limit for Greenberg-Klar-Rascle multi-lane traffic flow model*
最佳化　Room 609
13:45 - 14:10 張毓麟 (台灣師範大學數學系), *Characterizations of Boundary Conditions on Some Non-Symmetric Cones*
14:15 - 14:40 林仁彥 (嘉義大學應用數學系), *Joint Replenishment Problem with Permissible Delay in Payments and the Resource Constraints under Power-of-Two Policy*
14:45 - 15:10 李雨青 (清華大學工業工程學系), *Competitive Demand Learning: an Equilibrium Pricing Algorithm*
離散數學　Room 639
13:45 - 14:10 王道明 (東海大學應用數學系), *Local Antimagic Vertex Coloring of Trees*
14:15 - 14:40 李渭天 (中興大學應用數學系), *Shifted-Antimagic Labelings for Graphs*
14:45 - 15:10 Shagnik Das (台灣大學數學系), *Tight bounds for divisible subdivisions*
動態系統與生物數學　Room 201
13:45 - 14:10 王琪仁 (中正大學數學系), *Schloegl' s second model on a Bethe lattice*
14:15 - 14:40 戴佳原 (中興大學應用數學系), *Selective Feedback Stabilization of Ginzburg-Landau Spiral Waves in Circular and Spherical Geometries*
14:45 - 15:10 陳彥宇 (台灣大學數學系), *Weak entire solution with finite excited intervals for a reaction-interface system*
計算數學　Room 102
13:45 - 14:10 胡偉帆 (中央大學數學系), *A Discontinuity Capturing Shallow Neural Network for Anisotropic Elliptic Interface Problems*
14:15 - 14:40 林得勝 (陽明交通大學應用數學系), *Machine Learning to solve elliptic interface problem*
14:45 - 15:10 蔣俊岳 (虎尾科技大學通識教育中心), *An efficient iteration for solving the extremal solutions of discrete-time algebraic Riccati equations*
機率　Room 722
13:45 - 14:10 黃建豪 (政治大學應用數學系), *One-dimensional polymers in random environments: the ballistic regime*
14:15 - 14:40 千野由喜 (陽明交通大學應用數學系), *A crossover on SAW in random environment*
14:45 - 15:10 林偉傑 (台灣大學數學系), *Dynamical critical first-passage percolation in two dimensions*
統計　Room 714
13:45 - 14:10 王紹宣 (中央大學統計研究所), *Perturbation Theory for Cross Data Matrix-based PCA*
14:15 - 14:40 李宜真 (成功大學統計學系), *Minimax Design for an Accelerated Life Test*
2022/1/17　15:35 - 16:25 大會演講
余家富 (中央研究院數學研究所), *Mass formula and Oort's conjecture for supersingular abelian threefolds*　1F 國際會議廳 /Room 202

時間表
Timetable

2022/1/18 09:00 - 09:50 大會演講

侯一釗 (California Institute of Technology), *Potential singularity of 3D incompressible Euler equations and the nearly singular behavior of 3D Navier-Stokes equations* 1F 國際會議廳 /Room 202

2022/1/18 10:15 - 11:00 共同演講

Sijong Kwak (韓國科學技術院), *Higher secant varieties of minimal degree and del Pezzo higher secant varieties* 1F 國際會議廳

楊柏因 (中央研究院資訊科學研究所), *Postquantum Cryptography and the NIST Competition* Room 101

陳隆奇 (政治大學應用數學系), *The Critical Behavior for Percolation and the Mean Field Behavior for Oriented Percolation in High Dimensions* Room 638

崔茂培 (台灣大學數學系), *Data, Geometry and Randomness* Room 102

陳俊全 (台灣大學數學系), *Diffusive Lotka-Volterra competition systems* Room 639

吳浩樾 (Duke University), *Some recent advances in time-frequency analysis methods for biomedical signals* Room 202

2022/1/18 11:15 - 12:10 領域演講

數論與代數 Room 202

11:15 - 12:10 彭勇寧 (中央大學數學系), *From nilpotent element to finite W-algebra*

微分幾何與代數幾何 Room 101

11:15 - 11:40 Adeel Khan (中研院數學所), *Derived specialization*

11:45 - 12:10 卓士堯 (清華大學數學系), *Asymptotic constructions and invariants of graded linear series*

分析 Room 617

11:15 - 11:40 王雅書 (中興大學應用數學系), *2-local isometries on differentiable function spaces*

11:45 - 12:10 陳中川 (台中教育大學數學教育學系), *Disjoint dynamics on weighted ORLICZ spaces*

偏微分方程 Room 638

11:15 - 12:10 江金城 (清華大學數學系), *On the monotonic property of the spatially homogeneous Landau equation*

最佳化 Room 609

11:15 - 11:40 黃同瑤 (逢甲大學應用數學系), *Optimality and Duality for Multi-objective Fractional Programming in Complex Spaces.*

11:45 - 12:10 莊智升 (嘉義大學應用數學系), *A unified Douglas-Rachford algorithm for generalized DC programming*

離散數學 Room 639

11:15 - 12:10 游森棚 (台灣師範大學數學系), *Hankel Determinants from Lattice Paths*

動態系統與生物數學 Room 201

11:15 - 12:10 班榮超 (政治大學應用數學系), *Stem and topological entropy on Cayley trees*

計算數學 Room 102

11:15 - 11:40 陳孟豁 (中正大學數學系), *Fluid-structure interactions: one-field monolithic fictitious domain method and its parallelization*

11:45 - 12:10 郭岳承 (高雄大學應用數學系), *The nonnegative least squares problem*

機率 Room 722

11:15 - 11:40 洪芷漪 (政治大學應用數學系), *An m-spread model using branching process*

統計 Room 714

11:15 - 11:40 林良靖 (成功大學統計學系), *Monitoring Photochemical Pollutants for Anomaly Detection based on Symbolic Interval-Valued Data Analysis*

11:45 - 12:10 林聖軒 (陽明交通大學統計科學研究所), *From linear structural equation modeling to generalized multiple mediation formula*

2022/1/18 13:45-15:10 領域演講

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微分幾何與代數幾何 Room 101

13:45 - 14:10 邱聖夫 (中研院數學所), *From Energy-Time Uncertainty to Symplectic Excalibur*

14:15 - 14:40 吳恍儒 (中研院數學所), *Positivity and negativity of vector bundles*

14:45 - 15:10 許佑鴻 (國家理論科學研究中心), *Semi-orthogonal decomposition via categorical representation theory*

分析 Room 617

13:45 - 14:40 Daniel Spector (台灣師範大學數學系), *An Atomic Decomposition for Divergence Free Measures*

14:45 - 15:10 黃耀德 (中山大學應用數學系), *Linear Angle Preservers of Hilbert Bundles*

偏微分方程 Room 638

13:45 - 14:10 Junsik Bae (國家理論科學研究中心), *Linear stability of solitary waves for the isothermal Euler-Poisson system*

最佳化 Room 609

13:45 - 14:10 林立岡 (中央大學機械工程學系), *Exact Optimization: A Status Report with Future Promises*

14:15 - 14:40 李靜沛 (中研院統計所), *Accelerating Inexact Successive Quadratic Approximation for Regularized Optimization Through Manifold Identification*

14:45 - 15:10 Jan Harold Alcantara (中研院統計所), *Proximal algorithms for a class of nonconvex nonsmooth minimization problems involving piecewise smooth and min-weakly-convex functions*

離散數學 Room 639

13:45 - 14:10 余冠儒 (高雄師範大學數學系), *Enumeration of d-combining Tree-Child Networks*

動態系統與生物數學 Room 201

13:45 - 14:10 陳世昕 (國家理論科學研究中心), *On Mathematical Analysis of Synchronization for Bidirectionally Coupled Kuramoto Oscillators*

計算數學 Room 102

13:45 - 14:10 林晉宏 (中山大學應用數學系), *On the inverse eigenvalue problem for block graphs*

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Plenary Talks

蕭美琪 Mei-Chi Shaw

Department of Mathematics, University of Notre Dame
E-mail: mei-chi.shaw.1@nd.edu
Fields: Complex Analysis and Partial Differential Equations

THE CAUCHY-RIEMANN EQUATIONS IN COMPLEX ANALYSIS

Holomorphic functions are solutions to the homogeneous Cauchy-Riemann equations. The profound influence of partial differential equations on complex analysis began from Riemann's proof of the Mapping Theorem with the Dirichlet problem. In this talk, we discuss the important role that the inhomogeneous Cauchy-Riemann equations play in one and several complex variables. The emphasis is on the recent progress on domains in complex manifolds.

AFFILIATION

University of Notre Dame

RESEARCH AREA

Complex Analysis and Partial Differential Geometry

HONORS

Fellows of the American Mathematical Society, Inaugural class 2012
Bergman Prize 2019

侯一釗 Thomas Yizhao Hou

Applied and Computational Mathematics,
California Institute of Technology
E-mail: hou@cms.caltech.edu
Fields: Multiscale Analysis and Computation

POTENTIAL SINGULARITY OF 3D INCOMPRESSIBLE EULER EQUATIONS AND THE NEARLY SINGULAR BEHAVIOR OF 3D NAVIER-STOKES EQUATIONS

Whether the 3D incompressible Euler and Navier-Stokes equations can develop a finite time singularity from smooth initial data is one of the most challenging problems in nonlinear PDEs. In an effort to provide a rigorous proof of the potential Euler singularity revealed by Luo-Hou's computation, we develop a novel method of analysis and prove that the original De Gregorio model and the Hou-Lou model develop a finite time singularity from smooth initial data. Using this framework and some techniques from Elgindi's recent work on the Euler singularity, we prove the finite time blowup of the 2D Boussinesq and 3D Euler equations with $C^{1,\alpha}$ initial velocity and boundary. Further, we present some new numerical evidence that the 3D incompressible Euler equations with smooth initial data develop a potential finite time singularity at the origin, which is quite different from the Luo-Hou scenario. Our study also shows that the 3D Navier-Stokes equations develop nearly singular solutions with maximum vorticity increasing by a factor of 10^7. However, the viscous effect eventually dominates vortex stretching and the 3D Navier-Stokes equations narrowly escape finite time blowup. Finally, we present strong numerical evidence that the 3D Navier-Stokes equations with slowly decaying time-dependent viscosity develop a finite time singularity.

AFFILIATION

California Institute of Technology

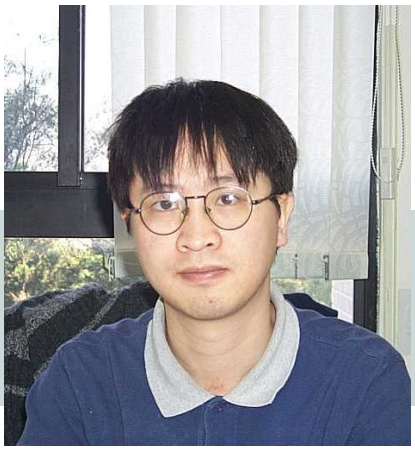
RESEARCH AREA

Multiscale Analysis and Computation

HONORS

Fellow of the American Mathematical Society, 2012
Fellow of the American Academy of Art and Sciences, 201
Fellow of Society of Industrial and Applied Mathematics, 2009
James H. Wilkinson Prize (2001)
Sloan Fellowship (1990)

余家富 Chia-Fu Yu



Institute of Mathematics, Academia Sinica
E-mail: chiafu@math.sinica.edu.tw
Fields: Arithmetic Geometry

MASS FORMULA AND OORT'S CONJECTURE FOR SUPERSINGULAR ABELIAN THREEFOLDS

The problem we study in this talk is originated from works of Eichler and Deuring who proved a beautiful correspondence between supersingular elliptic curves and ideal classes of a definite quaternion algebra over the rational numbers. Its generalization to supersingular abelian varieties has been studied by Ekedahlm Ibukiyama, Katsura, K.-Z. Li, Oort and others. We compute the mass of each orbit of supersingular abelian threefolds with same crystalline cohomology. This decomposes the supersingular locus into strata which play a key role for jumps of automorphism groups and yields a solution to a conjecture of Oort. This is based on joint work with Valentijn Karemaker and Fuetaro Yobuko.

AFFILIATION

Institute of Mathematics, Academia Sinica

RESEARCH AREA

Number Theory, Arithmetic Geometry and Representation Theory

HONORS

數學學會學術獎 2021
科技部傑出獎 2010
數學學會青數講 2009
中央研究院年輕學者研究成果獎 2006

共 同 演 講

Keynote Talks

2022 年 1 月 17 日 (星期一)		Speaker
11:25 – 12:10	Pure Mathematicians Meet Machine Learning Chair: 謝銘倫	Kenichi Bannai
	Green's Function and Path Integral Chair: 吳恭儉	尤釋賢 Shih-Hsien Yu
	Moments of Airy Functions as Ulterior Motives Chair: 陳榮凱	余正道 Jeng-Daw Yu
	Numerical Range Techniques in Quantum Information Science Chair: 黃毅青	李志光 Chi-Kwong Li
	Low Rank Approximation of Entangled Bipartite Systems Chair: 楊肅煜	林敏雄 Matthew M. Lin

2022 年 1 月 18 日 (星期二)		Speaker
10:15 – 11:00	Higher Secant Varieties of Minimal Degree and Del Pezzo Higher Secant Varieties Chair: 陳榮凱	Sijong Kwak
	Postquantum Cryptography and the NIST Competition Chair: 陳君明	楊柏因 Bo-Yin Yang
	Data, Geometry and Randomness Chair: 何南國	崔茂培 Mao-Pei Tsui
	Some Recent Advances in Time-Frequency Analysis Methods for Biomedical Signals Chair: 劉聚仁	吳浩榳 Hau-Tieng Wu
	The Critical Behavior for Percolation and the Mean Field Behavior for Oriented Percolation in High Dimensions Chair: 陳冠宇	陳隆奇 Lung-Chi Chen
	Diffusive Lotka-Volterra competition systems Chair: 夏俊雄	陳俊全 Chiun-Chuan Chen

Kenichi Bannai

Keio University/RIKEN

Pure Mathematicians meet Machine Learning

I have worked in the field of arithmetic geometry ever since my graduate studies. My speciality is the Bloch-Beilinson-Kato conjecture concerning the special values of Hasse-Weil L-functions associated to algebraic varieties defined over number fields. However, in 2016, on the occasion of the founding of AIP, a new research project in artificial intelligence and machine learning affiliated with RIKEN, I was suddenly asked to organize a team of pure mathematicians to conduct research in Machine Learning. In this talk, I will describe the circumstance of the formation of our team, the Mathematical Science Team, as well as some of the recent projects we are undertaking.

Lung-Chi Chen

National Chengchi University

The Critical Behavior for Percolation and the Mean Field Behavior for Oriented Percolation in High Dimensions

In this talk, we consider percolation on the d-dimensional integral lattice $\mathbb{Z}^d$, and oriented percolation on the d-dimensional body-centered cubic (BCC) lattice $\mathbb{L}^d$ in high dimensions.
For percolation, we focus on long-range models, whose bond-occupation probability is proportional to D. Suppose that D(x) decays as $|x|^{-d-\alpha}$ for some $\alpha > 0$. Thanks for lace expansion, we can estimate the bootstrapping functions in the lace-expansion analysis and obtain that the following critical two-point function

$$G_{p_c}(x) := P_{p_c}(o \leftrightarrow x) \sim \begin{cases} C_\alpha |x|^{\alpha \wedge 2-d}, & d > 3(\alpha \wedge 2) \text{ and } \alpha \neq 2, \\ C_2 |x|^{2-d} / \log |x|, & d \geq 6 \text{ and } \alpha = 2, \end{cases}$$

where the constant $C_\alpha \in (0, \infty)$ is depending only on α and L.
For oriented percolation, we focus on nearest-neighbor oriented percolation with independent Bernoulli bond-occupation probability on $\mathbb{L}^d$ and the set of non-negative integers $\mathbb{Z}_+$. Thanks to the nice structure of the BCC lattice, we obtain that the infrared bound holds on $\mathbb{L}^d \times \mathbb{Z}_+$ in all dimensions $d \geq 9$. As opposed to ordinary percolation, we have to deal with the complex numbers due to asymmetry induced by time-orientation, which makes it hard to estimate the bootstrapping functions in the lace-expansion analysis from above. It's the joint work with Akira, Handa at Hokkaido university and Kamijima at NCTS.

Chiun-Chuan Chen

National Taiwan University

Diffusive Lotka-Volterra competition systems

In this talk, we consider the wave phenomenon of two and three species Lotka-Volterra competition systems and present the results collaborated with or inspired by Professor Masayasu Mimura and his collaborators during the past years. In particular, we investigate the problems related to exact solutions, 2-species singular limit problems with "latent heat" effect, and 3-species non-monotone waves.

Sijong Kwak
(jointly with J. Choe)
Korea Advanced Institute of Science and Technology

Higher secant varieties of minimal degree and del Pezzo higher secant varieties

There are two basic objects in projective algebraic geometry: one is a variety of minimal degree and the other is a del Pezzo variety. In this talk, I'd like to introduce higher secant varieties of minimal degree and del Pezzo higher secant varieties to nonexpert with modest backgrounds. Classification and characterization of such varieties have been focused recently. I will also introduce many interesting examples explaining main results.

Chi-Kwong Li
College of William and Mary

Numerical range techniques in quantum information science

In this talk, we will discuss how to use numerical range techniques to study problems arising in quantum information sciences such as quantum tomography, quantum error corrections. Recent results are open problems will be mentioned.

Matthew M. Lin
National Cheng Kung University

Low Rank Approximation of Entangled Bipartite Systems

Gauging the distance between a mixed state and its nearest separable state is important but challenging in the quantum mechanical system. We, in this talk, propose a dynamical system approach to tackle low rank approximation of entangled bipartite systems, which has several advantages, including 1) A gradient dynamics in the complex space can be described in a fairly concise way; 2) The global convergence from any starting point to a local solution is guaranteed; 3) The requirement that the combination coefficients of pure states must be a probability distribution can be ensured; 4) The rank can be dynamically adjusted. The theory, algorithms, and some numerical experiments will be presented in this talk.

Mao-Pei Tsui
National Taiwan University

Data, Geometry and Randomness

Modern data science uses geometric analysis to find the structural features of data sets before further supervised or unsupervised analysis. Geometry are very natural tools for analysing massive amounts of data since geometry can be regarded as the study of distance functions. The point clouds are finite samples taken from a geometric object, perhaps with noise. We will explain how geometry and probability can be used to study in understanding the structure of data. We will also show some examples to demonstrate the success and limitation in real application.

Hau-Tieng Wu

Duke University

Some recent advances in time-frequency analysis methods for biomedical signals

Analysis of signals with oscillatory modes with crossover instantaneous frequencies is a challenging problem in time series analysis. One way to handle this problem is considering the chirplet transform (CT) that lifts the 2-dimensional time-frequency representation to a 3-dimensional representation, called time-frequency-chirp rate (TFC) representation, by adding one extra chirp rate parameter so that crossover frequencies are disentangles in the higher dimension. However, in practice we found that CT has a strong "blurring" effect in the chirp rate axis, which limits its application in real world data. With my PhD student Dr. Ziyu Chen, we propose the synchrosqueezed chirplet transform (SCT) that enhances the TFC representation given by the CT. The resulting concentrated TFC representation has a high contrast so that one can better distinguish different modes and even crossover instantaneous frequencies. The basic idea is using the phase information in the TFC representation to determine a reassignment rule that reallocates coefficients to the "true" frequency and chirp rate of the signal. Besides providing various numerical results, we also provide theoretical guarantees of SCT based on the well-known oscillatory integral results in the harmonic analysis society.

Bo-Yin Yang

Academia Sinica

Postquantum Cryptography and the NIST Competition

Shor's algorithm with a large-scale quantum computer will break all currently deployed public-key cryptography. In anticipation, the U.S. National Institute of Standards and Technology (NIST) is calling for new standard Key Establishment Methods (KEMs) and Digital Signature Schemes (DSSs) in an open competition to determine the next generation standards for public-key cryptography. The result will no doubt decide what the internet will be using for the next two decades. We will go over the story of postquantum cryptography and the competition, and will describe some of the NISTPQC candidates as well some mathematics behind them.

Shih-Hsien Yu

Academia Sinica

Green's function and Path integral

In this talk, one presents a way to build a Green's function of a heat equation for heterogeneous media.

Jeng-Daw Yu
National Taiwan University

Moments of Airy Functions as Ulterior Motives

Anderson introduced the arithmetic Hodge structures and ulterior motives in order to factorize the motives of Fermat hypersurfaces into simpler, although non-classical, objects. We indicate that such structures appear as a special case of irregular Hodge structures, and in addition, show that the symmetric moments of classical Airy functions provide an interesting example. Joint work with Claude Sabbah.

領 域 演 講

Special Sessions

數論與代數

NUMBER THEORY AND ALGEBRA

Organizer: 魏福村
地點：Room 202

2022 年 1 月 17 日 (星期一)		Speaker
13:45 – 14:10	Embeddings of Maximal Tori in Classical Groups, Odd Degree Descent and Totaro's Question Chair: 楊一帆	李庭諭 Ting-Yu Lee
14:15 – 14:40	On Alternating Multiple Zeta Values Chair: 楊一帆	佐藤信夫 Nobuo Sato
14:45 – 15:10	Transformation Formulas of p-Adic Hypergeometric Functions Chair: 楊一帆	王崇亘 Chung-Hsuan Wang

2022 年 1 月 18 日 (星期二)		Speaker
11:15 – 12:10	From Nilpotent Element to Finite W-Algebra Chair: 賴俊儒	彭勇寧 Yung-Ning Peng
13:45 – 14:10	Transcendence of Special Values of Goss L-Functions Attached to Drinfeld Modules Chair: 魏福村	Changningphaabi Namoijam

Ting-Yu Lee

National Taiwan University

Embeddings of Maximal Tori in Classical Groups, Odd Degree Descent and Totaro's question

B. Totaro proposed the following question in his paper in 2004 : A homogeneous space has a zero-cycle of degree one. Does it also have a rational point?
In this talk, I will briefly review how to reformulate the question of embeddings of maximal tori in classical groups into a question of rational points of homogeneous spaces under classical groups. Then we will discuss the odd degree descent of the embedding problem. At the end of the talk, we give an affirmative answer to Totaro's question in this case. This is a joint work with E. Bayer and Parimala.

Changningphaabi Namoijam

National Tsing Hua University

Transcendence of Special Values of Goss L-functions Attached to Drinfeld Modules

Anderson introduced abelian t-modules, and then Goss defined L-function associated to abelian t-modules. In this talk, we discuss transcendence of special values of L-functions attached to Drinfeld modules (abelian t-modules of dimension one) defined over the rational function field $\mathbb{F}_q(\theta)$. We prove our result by employing a result of Anglès, Ngo Dac, and Tavares Ribeiro, and transcendence theory of Papanikolas. This is a joint work with Oğuz Gezmiş.

Yung-Ning Peng

National Central University

From nilpotent element to finite W-algebra

Finite W-algebra, which is essentially determined by a nilpotent element in a simple or reductive Lie algebra, can be viewed as a refinement of the universal enveloping algebra. It has appeared in many different fields of mathematics, possibly with different terminologies. The study of W-algebra can be traced back to Kostant's classic works on nilpotent orbits around 1980's. It has being studied intensively since Premet's works on Slodowy slices around 2000's, where the modern terminologies are introduced. In this talk, we will focus on the type A case: starting from a nilpotent matrix, we explain how the associated W-algebra is defined, and then introduce a realization of W-algebra established by Brundan-Kleshchev, in terms of some algebraic structure called shifted Yangian. Finally we will mention a recent generalization of this realization to the case of general linear Lie superalgebra.

Nobuo Sato

National Taiwan University

On alternating multiple zeta values

Alternating multiple zeta values are periods of the fundamental group of a four-point punctured projective line. I will talk about my recent work concerning alternating multiple zeta values and their linear relations arising from differential equations of hyperlogarithms. This is a joint work with Minoru Hirose at Nagoya University.

Chung-Hsuan Wang

National Cheng Kung University

Transformation formulas of p-adic hypergeometric functions

In this talk, we recall p-adic hypergeometric functions $F^{\mathrm{Dw}}_{a_1,\cdots,a_s}(t)$, $F^{(\sigma)}_{a_1,\cdots,a_s}(t)$, $\widehat{F}^{(\sigma)}_{a,\cdots,a}(t)$ and the conjecture of their transformation formulas. There are the transformation formulas of Dwork's p-adic hypergeometric functions

$$F^{\mathrm{Dw}}_{a,\cdots,a}(t) = ((-1)^s t)^l F^{\mathrm{Dw}}_{a,\cdots,a}(t^{-1})$$

and the transformation formulas of $F^{(\sigma)}_{a,\ldots,a}(t)$ and $\widehat{F}^{(\sigma)}_{a,\ldots,a}(t)$

$$F^{(\sigma)}_{a,\cdots,a}(t) = -\widehat{F}^{(\widehat{\sigma})}_{a,\cdots,a}(t^{-1}).$$

So far, only some special cases of these transformation formulas have been proved (the case $s = 1$ and the case $s = 2$, $a \in \frac{1}{N}\mathbb{Z}$, $0 < a < 1$ and $p > N$).

微分幾何與代數幾何

DIFFERENTIAL AND ALGEBRAIC GEOMETRY

Organizer: 蕭欽玉
地點：Room 101

2022 年 1 月 17 日 (星期一)		Speaker
13:45 – 14:10	Motivic Invariants of Birational Maps and Cremona Groups Chair: 蕭欽玉	林學庸 Hsueh-Yung Lin
14:15 – 14:40	Structure of $\mathbb{Z}/2$-Harmonic Spinors Chair: 蕭欽玉	楊劼之 Ryosuke Takahashi
14:45 – 15:10	Formal Exponential Maps and Fedosov Resolutions Chair: 蕭欽玉	廖軒毅 Hsuan-Yi Liao

2022 年 1 月 18 日 (星期二)		Speaker
11:15 – 11:40	Derived Specialization Chair: 林學庸	韓善瑜 Adeel Khan
11:45 – 12:10	Asymptotic Constructions and Invariants of Graded Linear Series Chair: 林學庸	卓士堯 Shin-Yao Jow
13:45 – 14:10	From Energy-Time Uncertainty to Symplectic Excalibur Chair: 楊劼之	邱聖夫 Sheng-Fu Chiu
14:15 – 14:40	Positivity and Negativity of Vector Bundles Chair: 楊劼之	吳佻儒 Kuang-Ru Wu
14:45 – 15:10	Semi-Orthogonal Decomposition Via Categorical Representation Theory Chair: 楊劼之	許佑鴻 You-Hung Hsu

Sheng-Fu Chiu

Academia Sinica

From Energy-Time Uncertainty to Symplectic Excalibur

Heisenberg's Uncertainty Principle is one of the most celebrated features of quantum mechanics, which states that one cannot simultaneously obtain the precise measurements of two conjugated physical quantities such as the pair of position and momentum or the pair of electric potential and charge density. Among the different formulations of this fundamental quantum property, the uncertainty between energy and time has a special place. This is because the time is rather a variable parametrizing the system evolution than a physical quantity waiting for determination. Physicists working in quantum information theory have understood this energy-time relation by a universal bound of how fast any quantum system with given energy can evolve from one state to another in a distinguishable (orthogonal) way. In this talk, we will provide a viewpoint of this evolutional speed limit based on a persistence-like distance of the derived category of sheaves : during a fixed time period what is the minimal energy needed for a system to evolve from one sheaf to a status that is distinguishable from a given subcategory? As an application, we will discuss its relation to the dynamics of classical mechanics, namely the notion of symplectic displacement. We will show that such categorical energy gives rise to an effective lower bound of Hofer displacement energy.

You-Hung Hsu

National Center for Theoretical Sciences

Semi-orthogonal decomposition via categorical representation theory

The derived category of coherent sheaves on an algebraic variety plays an important role in modern algebraic geometry and related areas. One fundamental way to study the structure of the derived category is via semi-orthogonal decomposition, which divides a triangulated category into simpler pieces. On the other hand, categorification has been an active research topic in representation theory and related areas. One of the essential questions is to lift the representations of Lie algebras/quantum groups from vector spaces (cohomology/K-theory) to categories (derived category), and such a notion is called categorical action. In this talk, we explain how to obtain a semi-orthogonal decomposition from a categorical action of a particular algebra, which we called it the shifted $q = 0$ affine algebra. The main idea comes from the interpretation of the Kapranov exceptional collection in terms of convolutions of Fourier-Mukai kernels under the categorical action. Finally, if time permits, we provide an explicit example which shows that the projection functors to components in the semi-orthogonal decomposition are kernel functors.

Shin-Yao Jow

National Tsing Hua University

Asymptotic constructions and invariants of graded linear series

Let X be a complete variety of dimension n over an algebraically closed field $\mathbf{K}$. Let $V_\bullet$ be a graded linear series associated to a line bundle L on X, that is, a collection $\{V_m\}_{m\in\mathbb{N}}$ of vector subspaces $V_m \subseteq H^0(X, L^{\otimes m})$ such that $V_0 = \mathbf{K}$ and $V_k \cdot V_\ell \subseteq V_{k+\ell}$ for all $k, \ell \in \mathbb{N}$. For each m in the semigroup

$$\mathbf{N}(V_\bullet) = \{m \in \mathbb{N} \mid V_m \neq 0\},$$

the linear series V_m defines a rational map

$$\phi_m \colon X \dashrightarrow Y_m \subseteq \mathbb{P}(V_m),$$

where Y_m denotes the closure of the image $\phi_m(X)$. We show that for all sufficiently large $m \in \mathbf{N}(V_\bullet)$, these rational maps $\phi_m \colon X \dashrightarrow Y_m$ are birationally equivalent, so in particular Y_m are of the same dimension κ, and if $\kappa = n$ then $\phi_m \colon X \dashrightarrow Y_m$ are generically finite of the same degree. If $\mathbf{N}(V_\bullet) \neq \{0\}$, we show that the limit

$$\mathrm{vol}_\kappa(V_\bullet) = \lim_{m\in\mathbf{N}(V_\bullet)} \frac{\dim_{\mathbf{K}} V_m}{m^\kappa/\kappa!}$$

exists, and $0 < \mathrm{vol}_\kappa(V_\bullet) < \infty$. Moreover, if $Z \subseteq X$ is a general closed subvariety of dimension κ, then the limit

$$(V_\bullet^\kappa \cdot Z)_{\mathrm{mov}} = \lim_{m\in\mathbf{N}(V_\bullet)} \frac{\#\big((D_{m,1} \cap \cdots \cap D_{m,\kappa} \cap Z) \setminus \mathrm{Bs}(V_m)\big)}{m^\kappa}$$

exists, where $D_{m,1}, \ldots, D_{m,\kappa} \in |V_m|$ are general divisors, and

$$(V_\bullet^\kappa \cdot Z)_{\mathrm{mov}} = \deg\big(\phi_m|_Z \colon Z \dashrightarrow \phi_m(Z)\big)\, \mathrm{vol}_\kappa(V_\bullet)$$

for all sufficiently large $m \in \mathbf{N}(V_\bullet)$.

Adeel Khan

Academia Sinica

Derived specialization

I will discuss a derived version of the specialization functors of Kashiwara-Schapira and Verdier, and explain how it can be regarded as a categorification of Kontsevich's virtual fundamental class. I will also discuss some connections with topics such as Beilinson's singular support of étale sheaves, and with Joyce's categorification of Donaldson-Thomas invariants of Calabi-Yau threefolds.

Hsuan-Yi Liao

National Tsing Hua University

Formal exponential maps and Fedosov resolutions

Exponential maps arise naturally in the contexts of Lie theory and smooth manifolds. I will explain how exponential maps can be understood algebraically and how these maps can be extended to graded manifolds. As an application, I will show a new construction of Dolgushev–Fedosov resolutions in deformation quantization.

Hsueh-Yung Lin

National Taiwan University

Motivic invariants of birational maps and Cremona groups

(Joint work with E. Shinder) The study of Cremona groups has been one of the central themes in algebraic geometry since the late 19th century. We will focus on questions and results related to the non-simplicity of Cremona groups. Motivated by weak factorizations of birational maps, we construct invariants of birational maps of motivic nature. Relying on these invariants, we provide new explanations of the non-simplicity of Cremona groups, as well as negative answers to questions of Cheltsov and Dolgachev.

Ryosuke Takahashi

National Cheng Kung University

Structure of $\mathbb{Z}/2$-harmonic spinors

In this talk, I will briefly introduce the development of $\mathbb{Z}/2$-harmonic spinors and discuss the structure of it. This is a very important ingredient in the study of higher dimensional gauge theory. The main difficulty of study $\mathbb{Z}/2$-harmonic spinors is to figure out the deformation theory for the moduli space.

Kuang-Ru Wu

Academia Sinica

Positivity and negativity of vector bundles

Positivity of direct image bundles plays an increasingly important role in complex geometry since the recent works of Berndtsson, Mourougane, Takayama, and many others. In this talk, we will take a different turn and study negativity of direct image bundles. One of our results is that Kobayashi positivity implies ampleness and convex Kobayashi positivity. We will also talk about that it is possible to prove Kobayashi positivity for ample vector bundles with additional curvature assumptions. This last part is work in progress.

分析

ANALYSIS

Organizer: 方向
地點：Room 617

2022 年 1 月 17 日 (星期一)		Speaker
13:45 – 14:40	Numerical Ranges of Foguel Operators Chair: Daniel Spector	王國仲 Kuo-Zhong Wang
14:45 – 15:10	Additive Hermitian Idempotent Preservers Chair: Daniel Spector	蔡明誠 Ming-Cheng Tsai

2022 年 1 月 18 日 (星期二)		Speaker
11:15 – 11:40	2-Local Isometries on Differentiable Function Spaces Chair: 黃毅青	王雅書 Ya-Shu Wang
11:45 – 12:10	Disjoint Dynamics on Weighted Orlicz Spaces Chair: 黃毅青	陳中川 Chung-Chuan Chen
13:45 – 14:40	An Atomic Decomposition for Divergence Free Measures Chair: 陳中川	Daniel Spector
14:45 – 15:10	Linear Angle Preserves of Hilbert Bundles Chair: 陳中川	黃耀德 Yao-Te Huang

Chung-Chuan Chen

National Taichung University of Education

Disjoint dynamics on weighted ORLICZ spaces

We give some sufficient and necessary conditions for translation operators on the weighted Orlicz spaces to be disjoint topologically transitive and disjoint topologically mixing. In particular, we show that in certain cases, operators are disjoint topologically transitive if, and only if, their direct sum is topologically transitive. This is a joint work with Prof. S. Öztop and Prof. S. M. Tabatabaie.
Keywords: Disjoint topological transitivity, Translation operator, Orlicz space, Locally compact group.

Yao-Te Huang

National Sun Yat-sen University

Linear Angle Preservers of Hilbert Bundles

Let x, y be two vectors in a (real or complex) Hilbert C^*-module $\mathcal{H}$ over a C^*-algebra $\mathcal{A}$. The angle $\angle(x, y)$ between x and y can be defined in several ways. When $\mathcal{A} = C_0(X)$ is a commutative C^*-algebra, in other words, $\mathcal{H}$ is a continuous field of Hilbert spaces over a locally compact space X, we define the cosine of the angle, $u = \cos\angle(x, y) \in C(X)$, by the equation

$$|\langle x, y\rangle| = |x||y|u.$$

We show that if $T : \mathcal{H} \to \mathcal{K}$ is a linear module map between two Hilbert $C_0(X)$-modules preserving (cosines of) non-flat angles, then $T = \alpha J$ for a bounded, strictly positive and continuous scalar function α on X and a module into isometry $J : \mathcal{H} \to \mathcal{K}$.

Daniel Spector

National Taiwan Normal University

An Atomic Decomposition for Divergence Free Measures

In this talk we describe a recent result obtained in collaboration with Felipe Hernandez where we give an atomic decomposition for the space of divergence free measures. The atoms in this setting are piecewise C^1 closed curves which satisfy a ball growth condition, while our result can be used to deduce certain "forbidden" Sobolev inequalities which arise in the study of electricity and magnetism.

Ming-Cheng Tsai

National Taipei University of Technology

Additive Hermitian idempotent preservers

Let L be an additive map between (real or complex) matrix algebras sending $n \times n$ Hermitian idempotent matrices to $m \times m$ Hermitian idempotent matrices. We show that there are nonnegative integers p, q with $n(p+q) = r \leq m$ and an $m \times m$ unitary matrix U such that

$$L(A) = U[(I_p \otimes A) \oplus (I_q \otimes A^t) \oplus 0_{m-r}]U^*, \quad \text{for any } n \times n \text{ Hermitian } A \text{ with rational trace.}$$

We also extend this result to the (complex) von Neumann algebra setting. This is a joint work with Chi-Kwong Li, Ya-Shu Wang and Ngai-Ching Wong.

Kuo-Zhong Wang

National Yang Ming Chiao Tung University

Numerical Ranges of Foguel Operators

In this talk, we will present some properties of the numerical ranges of Foguel operators $F_T = \begin{bmatrix} S^* & T \\ 0 & S \end{bmatrix}$, where S is the simple unilateral shift and T an operator, both on ℓ^2. Among other things, we show that if T is nonzero compact, then the numerical radius $w(F_T)$ is strictly less than $1 + (\|T\|/2)$, and if T is a scalar operator aI, then $W(F_T)$, the numerical range of F_T, is open and is not a circular disc unless $a = 0$. For the Foguel–Halmos operator F_T, where $T = \mathrm{diag}(a_1, a_2, \ldots)$ with $a_n = 1$ if $n = 3^k$ for some $k \geq 1$ and $a_n = 0$ otherwise, we show that $W(F_T)$ is neither open nor closed and give lower and upper bounds for $w(F_T)$.

Co-author: Hwa-Long Gau, Pei Yuan Wu

Ya-Shu Wang

National Chung Hsing University

2-local isometries on differentiable function spaces

Let E and F be Banach spaces. Let $\mathcal{S}$ be a subset of the space $L(E, F)$ of all continuous linear maps from E to F. A (non-necessarily linear nor continuous) mapping $\Delta : E \to F$ is a *2-local $\mathcal{S}$-map* if for any $x, y \in E$, there exists $T_{x,y} \in \mathcal{S}$, depending on x and y, such that

$$\Delta(x) = T_{x,y}(x) \text{ and } \Delta(y) = T_{x,y}(y).$$

In this talk, I will present a description of the 2-local isometries between continuously differentiable function spaces $C^{(1)}[0,1]$, equipped with the norm $\|f\| = \sup_{x \in [0,1]} \{|f(x)| + |f'(x)|\}$.

偏微分方程

PARTIAL DIFFERENTIAL EQUATIONS

Organizer: 陳逸昆
地點：Room 638

2022 年 1 月 17 日 (星期一)		Speaker
13:45 – 14:10	Ground States for a Linearly Coupled Indefinite Schrödinger System with Steep Potential Well Chair: 王振男	王冠祥 Kuan-Hsiang Wang
14:15 – 14:40	Traveling Waves for a Nonlocal Equation Chair: 王振男	黃志強 Chih-Chiang Huang
14:45 – 15:10	Global Entropy Solution and Relaxation Limit for Greenberg-Klar-Rascle Multi-Lane Traffic Flow Model Chair: 王振男	林英杰 Ying-Chieh Lin

2022 年 1 月 18 日 (星期二)		Speaker
11:15 – 12:10	On the Monotonic Property of the Spatially Homogeneous Landau Equation Chair: 夏俊雄	江金城 Jin-Cheng Jiang
13:45 – 14:10	Linear Stability of Solitary Waves for the Isothermal Euler-Poisson System Chair: 夏俊雄	Junsik Bae

Junsik Bae

National Center for Theoretical Sciences

Linear stability of solitary waves for the isothermal Euler-Poisson system

The Euler-Poisson system with the Boltzmann relation is a fluid model which describes the dynamics of ions in electrostatic plasmas. We introduce the linear stability result of small amplitude solitary waves of the isothermal Euler-Poisson system as well as the linear instability criterion for the large amplitude solitary waves. In order to study the eigenvalue problem, we show that the Evans function for the Euler-Poisson system converges to that for the KdV equation as the small amplitude parameter tends to zero. If time is allowed, we briefly present a finite time blow-up scenario for the pressureless Euler-Poisson system. Our result particularly implies that smooth solutions to the pressureless Euler-Poisson system can break down even if the gradient of initial velocity is identically zero. These are joint works with J. Choi and B. Kwon.

Reference

[1] J. Bae and B. Kwon, *Small amplitude limit of solitary waves for the Euler-Poisson system* , J. Differential Equations **266** (2019), 3450-3478.

[2] J. Bae and B. Kwon, *Linear stability of solitary waves for the isothermal Euler-Poisson system* , to appear in Arch. Ration. Mech. Anal.

[3] J. Bae, J. Choi, and B. Kwon, *Formation of singularities in cold ion dynamics* , preprint, arXiv:2012.09657

Chih-Chiang Huang

National Chung Cheng University

Traveling Waves for a nonlocal equation

In this talk, we consider a nonlocal equation induced by a free energy. Based on Turing's instability, we can observe pattern formation and wave propagation. By applying a variational method, we construct the existence of traveling waves. Moreover, we pose a sufficient condition for wave speeds of two traveling waves, which ensures the existence of the third wave.
This is a joint work with Prof. Chao-Nien Chen, Prof. Yung-Sze Choi and Prof. Shyuh-yaur Tzeng.
Keywords: Traveling Wave, Variational Method, Non-local Equation

Reference

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[3] P. C. Fife and J. B. Mcleod, *The approach of solutions of nonlinear diffusion equations to travelling front solutions* , Arch. Rational Mech. Anal. **65** (1977), 335-361.

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[6] A. Volpert and V. Volpert, *Existence of multidimensional travelling waves and systems of waves,* Comm. Partial Differential Equations **26** (2001), no. 3-4, 421-459.

Jin-Cheng Jiang

National Tsing Hua University

On the monotonic property of the spatially homogeneous Landau equation

In this talk, I will describe a time-dependent functional involving the relative entropy and the $\dot{H}^1$ seminorm, which decreases along solutions to the spatially homogeneous Landau equation with Coulomb potential. The study of this monotone functionial sheds light on the competition between the dissipation and the nonlinearity for this equation. It enables to obtain new results concerning regularity/blowup issues for the Landau equation with Coulomb potential. This talk is based on the joint work with L. Desvillettes and L.-B He.

Ying-Chieh Lin

National University of Kaohsiung

Global entropy solution and relaxation limit for Greenberg-Klar-Rascle multi-lane traffic flow model

In this talk, we consider the Greenberg-Klar-Rascle multi-lane traffic flow model. This model is a relaxation system with the equilibrium state that is a discontinuous function of the car density. We study the existence of global entropy solutions and the relaxation limit for the GKR model. To construct the approximate solutions, we find two sequences of invariant regions under some suitable condition of initial data. As the relaxation time approaches 0, we prove that the limit of the entropy solutions for the GKR model is a weak solution of its equilibrium equation. It is interesting that the equilibrium equation is a scalar conservation law with discontinuous flux.

Kuan-Hsiang Wang

National Center for Theoretical Sciences

Ground states for a linearly coupled indefinite Schrödinger system with steep potential well

In this talk, we are concerned with the investigation of a class of linearly coupled Schrödinger systems with steep potential well, which arises in nonlinear optics. The existence of positive ground states is investigated by exploiting the relation between the Nehari manifold and fibering maps. Some interesting phenomena are that we do not need the weight functions in the nonlinear terms are integrable or bounded and we can relax the upper control condition of the coupling function. This is a joint work with Prof. Tsung-fang Wu and Prof. Ying-Chieh Lin.

最佳化

OPTIMIZATION

Organizer: 陳界山
地點：Room 609

2022 年 1 月 17 日 (星期一)		Speaker
13:45 – 14:10	Characterizations of Boundary Conditions on Some Non-Symmetric Cones Chair: 許瑞麟	張毓麟 Yu-Lin Chang
14:15 – 14:40	Joint Replenishment Problem with Permissible Delay in Payments and the Resource Constraints under Power-of-Two Policy Chair: 許瑞麟	林仁彥 Jen-Yen Lin
14:45 – 15:10	Competitive Demand Learning: An Equilibrium Pricing Algorithm Chair: 許瑞麟	李雨青 Yu-Ching Lee

2022 年 1 月 18 日 (星期二)		Speaker
11:15 – 11:40	Optimality and Duality for Multi-Objective Fractional Programming in Complex Spaces Chair: 陳界山	黃同瑤 Tone-Yau Huang
11:45 – 12:10	A Unified Douglas-Rachford Algorithm for Generalized DC Programming Chair: 陳界山	莊智升 Chih-Sheng Chuang
13:45 – 14:10	Exact Optimization: A Status Report with Future Promises Chair: 陳界山	林立岡 Li-Gang Lin
14:15 – 14:40	Accelerating Inexact Successive Quadratic Approximation for Regularized Optimization through Manifold Identification Chair: 陳界山	李靜沛 Ching-Pei Lee
14:45 – 15:10	Proximal Algorithms for a Class of Nonconvex Nonsmooth Minimization Problems Involving Piecewise Smooth and Min-Weakly-Convex Functions Chair: 陳界山	Jan Harold Alcantara

Jan Harold Alcantara

Academia Sinica

Proximal algorithms for a class of nonconvex nonsmooth minimization problems involving piecewise smooth and min-weakly-convex functions

We establish global convergence of a class of proximal algorithms for minimizing the sum of two functions, where one is piecewise smooth and the other is the difference between the pointwise minimum of finitely many weakly-convex functions and a piecewise smooth convex function. For minimization of a piecewise smooth function over a nonconvex set that is expressible as a finite union of convex sets, we establish the local linear convergence of a projected subgradient algorithm. We also propose two globally convergent acceleration schemes, one by extrapolation and another by component identification. Our framework is then applied to a feasibility reformulation of the linear complementarity problem. Numerical results exemplify that the proposed acceleration and identification procedure significantly improve the efficiency of the non-accelerated counterparts. This is a joint work with Ching-pei Lee.

Yu-Lin Chang

National Taiwan Normal University

Characterizations of Boundary Conditions on Some Non-Symmetric Cones

In contrast to symmetric cone optimization, there has no unified framework for non-symmetric cone optimization. One main reason is that the structure of various non-symmetric cone differs case by case. Especially, their boundary conditions are usually mysterious. In this paper, we provide characterizations of boundary conditions on some non-symmetric cones, including p-order cone, ellipsoidal cone, power cone and general closed convex cone. These results will be key bricks for further investigations on non-symmetric cone optimization accordingly.

Chih-Sheng Chuang

National Chiayi University

A unified Douglas-Rachford algorithm for generalized DC programming

We consider a class of generalized DC (difference-of-convex functions) programming, which refers to the problem of minimizing the sum of two convex (possibly nonsmooth) functions minus one smooth convex part. To efficiently exploit the structure of the problem under consideration, in this paper, we shall introduce a unified Douglas–Rachford method in Hilbert space. As an interesting byproduct of the unified framework, we can easily show that our proposed algorithm is able to deal with convex composite optimization models. Due to the nonconvexity of DC programming, we prove that the proposed method is convergent to a critical point of the problem under some assumptions.

Tone-Yau Huang

Feng Chia University

Optimality and Duality for Multi-objective Fractional Programming in Complex Spaces.

In this paper, we consider a complex multi-objective fractional programming problem(CMFP). We establish the necessary optimality conditions of problem (CMFP) in the sense of Pareto optimality, and derive its sufficient optimality conditions using generalized convexity. Finally, we construct the parametric dual problem to the primal problem (CMFP) and their duality theorems.

Keywords: multi-objective fractional programming, generalized convexity, duality theorems

Yu-Ching Lee

National Tsing Hua University

Competitive Demand Learning: an Equilibrium Pricing Algorithm

We consider a periodical equilibrium pricing problem for multiple firms over a planning horizon of T periods. At each period, firms set their selling prices and receive stochastic demand from consumers. Firms do not know their underlying demand curve, but they wish to determine the selling prices to maximize total revenue under competition. Hence, they have to do some price experiments such that the observed demand data are informative to make price decisions. However, uncoordinated price updating can render the demand information gathered by price experimentation less informative or inaccurate. We design a nonparametric learning algorithm to facilitate coordinated dynamic pricing, in which competitive firms estimate their demand functions based on observations and adjust their pricing strategies in a prescribed manner. We show that the pricing decisions, determined by estimated demand functions, converge to underlying equilibrium as time progresses. We obtain a bound of the revenue difference that is related to the squared number of the competitive firms and is of an order $\mathcal{O}(T^{\frac{3}{4}})$ related to T, and a regret bound that is related to the number of competitive firms and is of a $\mathcal{O}(\sqrt{T})$ rate related to T. We also develop a modified algorithm to handle the situation where some firms may have the knowledge of the demand curve.

Ching-Pei Lee

Academia Sinica

Accelerating Inexact Successive Quadratic Approximation for Regularized Optimization Through Manifold Identification

For regularized optimization that minimizes the sum of a smooth term and a regularizer that promotes structured solutions, inexact proximal-Newton-type methods, or successive quadratic approximation (SQA) methods, are widely used for their superlinear convergence in terms of iterations. However, unlike the counter parts in smooth optimization, they suffer from lengthy running time in solving regularized subproblems because even approximate solutions cannot be computed easily, so their empirical time cost is not as impressive. In this work, we first show that for partly smooth regularizers, although general inexact solutions cannot identify the active manifold that makes the objective function smooth, approximate solutions generated by commonly-used subproblem solvers will identify this manifold, even with arbitrarily low solution precision. We then utilize this property to propose an improved SQA method, ISQA+, that switches to efficient smooth optimization methods after this manifold is identified. We show that for a wide class of degenerate solutions, ISQA+ possesses superlinear convergence not just only in iterations, but also in running time because the cost per iteration is bounded. In particular, our superlinear convergence result holds on problems satisfying a sharpness condition more general than that in existing literature. Experiments on real-world problems also confirm that ISQA+ greatly improves the state of the art for regularized optimization.

Jen-Yen Lin

National Chiayi University

Joint Replenishment Problem with Permissible Delay in Payments and the Resource Constraints under Power-of-Two Policy

When there are multiple items in an inventory system, the manufacturing process or replenishment of different goods often encounters the same elements, such as common suppliers, common personnel costs, and common transportation costs. In order to achieve Economies of Scale, the joint cost can be combined and considered in the manufacturing or replenishment process to achieve the goal of reducing the average total cost. Besides the common costs, permissible delay in period and resource constraints also have a huge impact on the supply chain. In this paper, we combine permissible delay in payments with resource constraints and add them into the joint replenishment problem. We provide some theoretical analysis for the optimal solutions, propose an efficient algorithm, discuss the complexity of the proposed algorithm, and conduct some numerical experiments.

Keywords: Joint Replenishment Problem, Permissible Delay in Payments, Resource Constraints

Li-Gang Lin

National Central University

Exact Optimization: A Status Report with Future Promises

The nonlinear programming, from a bottom-up manner, is being explicitly analyzed via a novel perspective/method. More specifically, the up-to-date optimization literature can be classified by three levels: (1) equality-constrained quadratic programming (QP); (2) linear equality-constrained optimization problem with twice-differentiable objective, as solved using Newton's method by reducing it to a sequence of equality-constrained QPs; and, after further imposing inequality constraints, (3) interior-point methods, which reduce the problem to a sequence of (2). For the first time from the proposed viewpoint toward exact optimization, (1) together with the QPs subject to inequality, equality-and-inequality, and extended constraints, respectively, can be algebraically solved in derivative-free closed formulae. All the results are derived without knowing a feasible point, a priori and any time during the process. Moreover, a variety of practical validations, evaluations, and comparisons with benchmark literature (such as MATLAB®) are provided to demonstrate the superiority of the proposed method, notably the enhanced computational efficiency. Meanwhile, much more comparisons/interactions with extensive (numerical) solvers can be more efficiently obtained by virtue of collaborations. Remarkably, the very first idea along this research direction was originated in Taiwan, the progress so far is obtained by Taiwanese only, and thus it is expected that all the main observations will be Taiwan–marked before reaching out to diverse applications in the world.

離散數學

DISCRETE MATHEMATICS

Organizer: 傅東山
地點：Room 639

2022 年 1 月 17 日 (星期一)		Speaker
13:45 – 14:10	Local Antimagic Vertex Coloring of Trees Chair: 張惠蘭	王道明 Tao-Ming Wang
14:15 – 14:40	Shifted-Antimagic Labelings for Graphs Chair: 陳宏賓	李渭天 Wei-Tian Li
14:45 – 15:10	Tight Bounds for Divisible Subdivisions Chair: 俞韋亘	Shagnik Das

2022 年 1 月 18 日 (星期二)		Speaker
11:15 – 12:10	Hankel Determinants from Lattice Paths Chair: 陳秋媛	游森棚 Sen-Peng Eu
13:45 – 14:10	Enumeration of d-Combining Tree-Child Networks Chair: 符麥克	余冠儒 Guan-Ru Yu

Shagnik Das

National Taiwan University

Tight bounds for divisible subdivisions

Alon and Krivelevich proved that for every n-vertex subcubic graph H and every integer $q \geq 2$ there exists a (smallest) integer $f = f(H, q)$ such that every K_f-minor contains a subdivision of H in which the length of every subdivision-path is divisible by q. Improving their superexponential bound, we show that $f(H, q) \leq 10.5qn + 8n + 14q$, which is optimal up to a constant multiplicative factor. This is a joint work with Nemanja Draganić and Raphael Steiner.

Sen-Peng Eu

National Taiwan Normal University

Hankel Determinants from Lattice Paths

In this talk we survey results on Hankel determinants from the counting of lattice paths. Some new results and conjectures are also given.

Wei-Tian Li

National Chung Hsing University

Shifted-Antimagic Labelings for Graphs

The concept of antimagic labelings of a graph is to produce distinct vertex sums by labeling edges through consecutive integers starting from one. A long-standing conjecture proposed by Hartsfield and Ringel is that every connected graph, except a single edge, is antimagic. Many graphs are known to be antimagic, but little is known about sparse graphs as well as trees.
In this talk, we will study the k-shifted-antimagic labeling which uses the consecutive integers starting from $k + 1$, instead of starting from 1, where k is a given integer. We establish connections among various concepts proposed in the literature of antimagic labelings and extend previous results in three aspects:

- Some classes of graphs, including trees and graphs whose vertices are of odd degrees, which have not been verified to be antimagic are shown to be k-shifted-antimagic for sufficiently large k.
- Some graphs are proved to be k-shifted-antimagic for all k, while some are proved not for some particular k. In particlar, we determine the values of k for which trees of diamter at most 4 are k-shifted antimagic.
- Disconnected graphs are also considered. We characterize the linear forests and star forests that are k-shifted antimagic for every integer k.

This talk contains the joint work with Fei-Huang Chang, Hong-Bin Chen, and Zhishi Pan and some work with my students, Eranda Dhananjaya and Yi-Shun Wang.

Tao-Ming Wang

Tunghai University

Local Antimagic Vertex Coloring of Trees

For a finite simple graph $G = (V, E)$, an **antimagic labeling** is an bijection from E to $\{1, \cdots, |E|\}$ such that the induced vertex sums are pairwise distinct, where the induced vertex sum is the sum of all incident edge labels at such vertex. A well-known conjecture of Hartsfield and Ringel[8] is that every connected graph other than K_2 admits an antimagic labelling, which is still unsettled till present. In past decades various labeling problems of antimagic types have been studied extensively. In 2017 Arumugam et al.[1] and Bensmail et al.[6] independently introduced and initiated the study of the weaker notion of a **local antimagic labeling**, where only adjacent vertices must be distinguished by vertex sums. Thus any local antimagic labeling induces a proper vertex coloring of a graph G, where a vertex is assigned the color with its vertex sum. The **local antimagic chromatic number** $\chi_{la}(G)$ is the minimum number of colors taken over all colorings induced by local antimagic labelings of G. A conjecture raised by Arumugam et al.[1] claims that for a tree T with at least three vertices, the local antimagic chromatic number $\chi_{la}(T) = k + 1$ or $k + 2$, where k is the number of leaves of the tree T.

In this talk, we will survey more recent progress of local antimagic labeling and local antimagic vertex coloring of graphs. In particular, to support the above mentioned conjecture, we will present the local antimagic chromatic number $\chi_{la}(T)$ for a complete full t-ary tree T, $t \geq 2$. More open problems will be posted.

Reference

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Guan-Ru Yu

National Kaohsiung Normal University

Enumeration of d-combining Tree-Child Networks

Phylogenetic networks have replaced phylogenetic trees in many applications in biology within the past few decades. Among the many different subclasses of phylogenetic networks, the one that has attracted the most attention is the class of tree-child networks. Several recent studies have addressed counting questions for bicombining tree-child networks which are tree-child networks with every reticulation node having exactly two parents. In this talk, we extend these studies to d-combining tree-child networks where every reticulation node has now $d \geq 2$ parents. So far, we can completely solve the one-component situation. As for the general situation, we can solve the case of networks with a maximal and a fixed number of reticulation nodes. Moreover, we also tried to extend a recent conjecture by M. Pons and J. Batle from $d = 2$ to $d > 2$. In this talk, we will explain the above results and outline some open problems which we plan to tackle in the near future. This is a joint work with Michael Fuchs, Hexuan Liu, Michael Wallner, and Yu-Sheng Zhang.

動態系統與生物數學

DYNAMICAL SYSTEMS AND BIOMATHEMATICS

Organizer: 吳昌鴻
地點：Room 201

2022 年 1 月 17 日 (星期一)		Speaker
13:45 – 14:10	Schloegl's Second Model on a Bethe Lattice Chair: 張覺心	王琪仁 Chi-Jen Wang
14:15 – 14:40	Selective Feedback Stabilization of Ginzburg-Landau Spiral Waves in Circular and Spherical Geometries Chair: 張覺心	戴佳原 Jia-Yuan Dai
14:45 – 15:10	Weak Entire Solution with Finite Excited Intervals for a Reaction-Interface System Chair: 曾睿彬	陳彥宇 Yan-Yu Chen

2022 年 1 月 18 日 (星期二)		Speaker
11:15 – 12:10	Stem and Topological Entropy on Cayley Trees Chair: 吳昌鴻	班榮超 Jung-Chao Ban
13:45 – 14:10	On Mathematical Analysis of Synchronization for Bidirectionally Coupled Kuramoto Oscillators Chair: 吳昌鴻	陳世昕 Shih-Hsin Chen

Jung-Chao Ban

National Chengchi University

Stem and topological entropy on Cayley trees

In this talk, we consider the existence of the topological entropy of shift spaces on a finitely generated semigroup whose Cayley graph is a tree. The considered semigroups include free groups. On the other hand, the notion of stem entropy is introduced. For shift spaces on a strict free semigroup, the stem entropy coincides with the topological entropy. We reveal a sufficient condition for the existence of the stem entropy of shift spaces on a semigroup. Furthermore, we demonstrate that the topological entropy exists in many cases and is identical to the stem entropy.

Yan-Yu Chen

National Taiwan University

Weak entire solution with finite excited intervals for a reaction-interface system

In this talk, we study a reaction-interface system which is a singular limit problem of a FitzHugh-Nagumo type system. To understand the global dynamics of it, we consider the entire solution. Due to the annihilation of the interface may occur, we introduce the definition of weak entire solution with finite excited intervals. Then, we show that any weak entire solution with one excited interval must be a traveling pulse solution. Also, we obtain that any weak entire solution with two excited intervals must be a two-facing traveling pulse solution annihilating at some time. Finally, we prove there are no weak entire solutions with m excited intervals for $m \geq 3$
This is a joint work with Professor Hirokazu Ninomiya and Professor Chang-Hong Wu.

Shih-Hsin Chen

National Center for Theoretical Sciences

On Mathematical Analysis of Synchronization for Bidirectionally Coupled Kuramoto Oscillators

Synchronization is regarded as an universal feature in real world. There are a variety of models used to demonstrate such interesting phenomena. Among these models, Kuramoto model has attracted extensive attention and been applied in various subjects. In this talk, I will briefly introduce some literature works related to the synchronization problem for Kuramoto model. Then, I will show our main results of phase synchronization and frequency synchronization for the first order bidirectionally coupled Kuramoto model. If time permits, I will provide numerical simulations as well.

Jia-Yuan Dai

National Chung Hsing University

Selective Feedback Stabilization of Ginzburg-Landau Spiral Waves in Circular and Spherical Geometries

The complex Ginzburg-Landau equation serves as a paradigm of pattern formation. Within circular and spherical geometries, the existence and stability property of Ginzburg-Landau spiral waves have been proved. However, many spiral waves are unstable and thereby rarely visible in experiments and numerical simulation. In this talk we selectively stabilize certain significant classes of unstable spiral waves. Our tool for stabilization is the control triple method, which generalizes the celebrated Pyragas control to the setting of PDEs. This is a joint work with I. Schneider and B. de Wolff.

Chi-Jen Wang

National Chung Cheng University

Schloegl's second model on a Bethe lattice

Schloegl's second model involves spontaneous particle annihilation at rate p and autocatalytic particle creation rate. We analyze this model on a Bethe lattice when the coordination number $z = 3$. Precise behavior for stochastic models on regular periodic infinite lattices is usually surmised from kinetic Monte Carlo simulation on a finite lattice with periodic boundary conditions. However, the persistence of boundary effects for a Bethe lattice complicates this process. We explored various boundary conditions and unconventional simulation ensembles on the Bethe lattice to predict behavior for infinite size. A discontinuous transition to the vacuum state on the infinite lattice occurs when the annihilation rate p around 0.053.

計算數學

COMPUTATIONAL MATHEMATICS

Organizer: 林敏雄
地點：Room 102

2022 年 1 月 17 日 (星期一)		Speaker
13:45 – 14:10	A Discontinuity Capturing Shallow Neural Network for Anisotropic Elliptic Interface Problems Chair: 林敏雄	胡偉帆 Wei-Fan Hu
14:15 – 14:40	Machine Learning to Solve Elliptic Interface Problem Chair: 胡偉帆	林得勝 Te-Sheng Lin
14:45 – 15:10	An Efficient Iteration for the Extremal Solutions of Discrete-Time Algebraic Riccati Equations Chair: 林敏雄	蔣俊岳 Chun-Yueh Chiang

2022 年 1 月 18 日 (星期二)		Speaker
11:15 – 11:40	Fluid-Structure Interactions: One-Field Monolithic Fictitious Domain Method and its Parallelization Chair: 林晉宏	陳孟豁 Meng-Huo Chen
11:45 – 12:10	The Nonnegative Least Squares Problem Chair: 林晉宏	郭岳承 Yuen-Cheng Kuo
13:45 – 14:10	On the Inverse Eigenvalue Problem for Block Graphs Chair: 林敏雄	林晉宏 Jephian C.-H. Lin

Meng-Huo Chen

National Chung Cheng University

Fluid-structure interactions: one-field monolithic fictitious domain method and its parallelization

In this research we implement the parallelization of the method: one-field monolithic fictitious domain (MFD), an algorithm for simulation of general fluid-structure interactions (FSI). In this algorithm only one velocity field is solved in the whole domain (one-field) based upon the use of an appropriate L^2 projection. "Monolithic" means the fluid and solid equations are solved synchronously (rather than sequentially). For simulation of fluid-structure interactions on 3D domain the algorithm and the solving of the linear systems arising from the discretization need to be parallelized in order to reduce the simulation time from several months to few days. At the initial stage of the research we focus on parallelizing the algorithm on uniform meshes. The implemented parallel algorithm is then extended to the simulations on nonuniform meshes, where an adaptive mesh refinement scheme is used to improve the accuracy and robustness. Our goal is to provide an efficient, robust algorithm which can handle the difficult fluid-structure interactions such as the collision of multiple immersed solids in fluid where the high resolution mesh is necessary for resolving the phenomena near the collision and fluid-structure interfaces.

Chun-Yueh Chiang

National Formosa University

An efficient iteration for solving the extremal solutions of discrete-time algebraic Riccati equations

Algebraic Riccati equations (AREs) have been extensively applicable in linear optimal control problems and many efficient numerical methods were developed. The most attention of numerical solutions is the (almost) stabilizing solution in the past works. Nevertheless, it is an interesting and challenging issue in finding the extremal solutions of AREs which play a vital role in the applications. In this talk, based on the semigroup property, an accelerated fixed-point iteration (AFPI) is developed for solving the extremal solutions of the discrete-time algebraic Riccati equation. In addition, we prove that the convergence of the AFPI is at least R-suplinear with order $r > 1$ under some mild assumptions. Numerical examples are shown to illustrate the feasibility and efficiency of the proposed algorithm.

Wei-Fan Hu

National Central University

A Discontinuity Capturing Shallow Neural Network for Anisotropic Elliptic Interface Problems

In this talk, a new Discontinuity Capturing Shallow Neural Network (DCSNN) for approximating d-dimensional piecewise continuous functions and for solving anisotropic elliptic interface problems is developed. There are three novel features in the present network; namely, (i) jump discontinuity is captured sharply, (ii) it is completely shallow consisting of only one hidden layer, (iii) it is completely mesh-free for solving partial differential equations (PDEs). We first continuously extend the d-dimensional piecewise continuous function in $d+1$-dimensional space by augmenting one coordinate variable to label the pieces of discontinuous function, and then construct a shallow neural network to express this new augmented function. Since only one hidden layer is employed, the number of training parameters (weights and biases) scales linearly with the dimension and the neurons used in the hidden layer. For solving elliptic interface equations, the network is trained by minimizing the mean squared error loss that consists of the residual of governing equation, boundary condition, and the interface jump conditions. We compare the results obtained by the traditional grid-based immersed interface method (IIM) which is designed particularly for interface problems. The present results show better accuracy than the ones obtained by IIM.

Yuen-Cheng Kuo

National University of Kaohsiung

The nonnegative least squares problem

We propose an index search method (ISM) for solving nonnegative least squares problems (NNLS). This method uses inner and outer schemes to find the index set corresponding to the nonzero component of the optimal solution. The outer iteration updates the approximate index set such that the objective values of the sequence generated by ISM are monotonically decreasing. Hence, the index set generated by ISM does not repeat, and the optimal solution can be achieved with finite iteration steps. Some normal equations need to be solved in the inner iteration, which is the dominant computational complexity in ISM. Numerical experiments are provided to support the theoretical results.

Te-Sheng Lin

National Yang Ming Chiao Tung University

Machine Learning to solve elliptic interface problem

We propose a shallow neural network for solving elliptic problems with delta function singular sources on an interface. In addition, we introduce the level set function as a feature input. The loss function can be formulated using either the problem residual or the corresponding energy of the problem. We perform a series of numerical tests to demonstrate the accuracy of the present network as well as its capability for problems in irregular domains and in higher dimensions.

Jephian C.-H. Lin

National Sun Yat-sen University

On the inverse eigenvalue problem for block graphs

The inverse eigenvalue problem of a graph is asking whether a given spectrum can be realized by some matrix whose zero-nonzero pattern is prescribed by the adjacency of the graph. The strong spectral property is a matrix condition that allows one to perturb the matrix without changing its spectrum, and it is powerful in creating matrices with the same spectrum and more nonzero entries. In this talk, we will introduce some techniques where the matrix does not have the strong spectral property and provide partial solutions to the inverse eigenvalue problem for block graphs.

機率

PROBABILITY

Organizer: 黃皓瑋
地點：Room 722

2022 年 1 月 17 日 (星期一)		Speaker
13:45 – 14:10	One-Dimensional Polymers in Random Environments: The Ballistic Regime Chair: 黃皓瑋	黃建豪 Chien-Hao Huang
14:15 – 14:40	A Crossover on SAW in Random Environment Chair: 黃建豪	千野由喜 Yuki Chino
14:45 – 15:10	Dynamical Critical First-Passage Percolation in Two Dimensions Chair: 千野由喜	林偉傑 Wai-Kit Lam

2022 年 1 月 18 日 (星期二)		Speaker
11:15 – 11:40	An m-Spread Model Using Branching Process Chair: 黃皓瑋	洪芷漪 Jyy-I Hong

Yuki Chino

National Yang Ming Chiao Tung University

A crossover on SAW in random environment

Self-avoiding walk is one of statistical-mechanical models which describes behaviour of polymers in homogeneous medium. The model shows the phase transition and the asymptotic behaviour around the critical point has been studied actively. From physics point of view, by introducing a random environment, we expect that the behaviour change affected from the environment. Our interest is how much the random environment affects the original system.
In this talk we consider self-avoiding walk in random environment. This model shows us a crossover between weak and strong disorder depending on the structure of underlying graph. This crossover gives a part of the answer for our question. I will show how much we have known and what we want to know.

Jyy-I Hong

National Chengchi University

An m-spread model using branching process

When an infectious disease spreads among a population, it may cause different reactions in individuals. To understand and study the spread patterns is always one of the key things to do for decision making during an epidemic. In this talk, we will introduce a model to describe a spread pattern which depends on the spreading history within certain time period and construct an induced branching process to study the long term behavior of the spread pattern and the spread rate. This is a joint work with Jung-Chao Ban and Yu-Liang Wu.

Chien-Hao Huang

National Chengchi University

One-dimensional polymers in random environments: the ballistic regime

The polymer gets rewards when it visits a new site. Therefore, it tends to stretch itself. When the external force is large, the polymer goes with a speed. This result is part of the joint work with Q. Berger, N. Torri and R. Wei.

Wai-Kit Lam

National Taiwan University

Dynamical critical first-passage percolation in two dimensions

In first-passage percolation (on the triangular lattice), one puts nonnegative i.i.d. random weights (τ_v) on the vertices, and studies the induced pseudometric T. The critical case is the case when $\mathbf{P}(\tau_v = 0) = 1/2$, where $1/2$ is the critical threshold for site percolation on the triangular lattice. In this case, there are lots of large finite clusters of zero weights, and the behavior of T is very different from that in the "usual" case, namely $\mathbf{P}(\tau_v = 0) < 1/2$.

We consider a dynamical version of the model in the critical case, where weights are resampled according to Poisson processes. We study the "exceptional times", at which the model exhibits a completely different behavior. Based on joint work with M. Damron, J. Hanson and D. Harper.

統計

STATISTICS

Organizer: 陳定立
地點：Room 714

2022 年 1 月 17 日 (星期一)		Speaker
13:45 – 14:10	Perturbation Theory for Cross Data Matrix-Based PCA Chair: 陳定立	王紹宣 Shao-Hsuan Wang
14:15 – 14:40	Minimax Design for an Accelerated Life Test Chair: 陳定立	李宜真 I-Chen Lee

2022 年 1 月 18 日 (星期二)		Speaker
11:15 – 11:40	Monitoring Photochemical Pollutants for Anomaly Detection Based on Symbolic Interval-Valued Data Analysis Chair: 陳定立	林良靖 Liang-Ching Lin
11:45 – 12:10	From Linear Structural Equation Modeling to Generalized Multiple Mediation Formula Chair: 陳定立	林聖軒 Sheng-Hsuan Lin

I-Chen Lee

National Cheng Kung University

Minimax Design for an Accelerated Life Test

Due to time constraint and experimental cost, how to plan an efficient accelerated life test (ALT) to obtain more accurate lifetime information of products is an important research issue. Many literatures proposed strategies to design a locally optimal planning of an ALT under the pre-specified planning values of parameters. On the other hand, the optimal design for an ALT also depends on the model assumption, such as lognormal or Weibull distribution. However, the true parameters and the underlying model are usually unknown before the experiment. To deal with the problems, this study adopts a minimax strategy to obtain a more robust design for an ALT. To find a minimax design efficiently, this study adopts particle swarm optimization (PSO) techniques. The result shows that the minimax design can be determined as long as we specify the range of sample failure probability and provide candidate models. Compared to the locally optimal design, the minimax design is more robust and more practical.

Liang-Ching Lin

National Cheng Kung University

Monitoring Photochemical Pollutants for Anomaly Detection based on Symbolic Interval-Valued Data Analysis

This study considers monitoring photochemical pollutants for anomaly detection based on symbolic interval-valued data analysis. For this task, we construct control charts based on the principal component scores of symbolic interval-valued data. Herein, the symbolic interval-valued data are assumed to follow a normal distribution, and an approximate expectation formula of order statistics from the normal distribution is used in the univariate case to estimate the mean and variance via the method of moments. Moreover, we consider the bivariate case wherein we use the maximum likelihood estimator calculated from the likelihood function derived under a bivariate copula. In addition, we establish the procedures for the statistical control chart based on the univariate and bivariate interval-valued variables, and the procedures are potentially extendable to higher dimensional cases. Monte Carlo simulations and real data analysis using photochemical pollutants confirm the validity of the proposed method, and the results particularly show the superiority over the conventional method using the averages in identifying the date on which the abnormal maximum occurred.

Keywords: Anomaly detection; Control chart; Monitoring photochemical pollutants; Principal component analysis; Symbolic data analysis.

Sheng-Hsuan Lin

National Yang Ming Chiao Tung University

From linear structural equation modeling to generalized multiple mediation formula

Causal mediation analysis is advantageous for mechanism investigation. In settings with multiple causally ordered mediators, path-specific effects (PSEs) have been introduced to specify the effects of certain combinations of mediators. However, most PSEs are unidentifiable. Interventional analogue of PSE (iPSE) is adapted to address the non-identifiability problem. Moreover, previous studies only focused on cases with two or three mediators due to the complexity of the mediation formula in large number of mediators. In this study, we provide a generalized definition of traditional PSEs and iPSEs with a recursive formula, along with the required assumptions for nonparametric identification. This work has three major contributions: First, we developed a general approach (that includes notation, definitions, and estimation methods) for causal mediation analysis with an arbitrary number of multiple ordered mediators and with time-varying confounders. Second, we demonstrate identified formula of iPSE is a general form of previous mediation analysis. It is reduced to linear structural equation model under linear or log-linear model, to causal mediation formula when only one mediator. Third, a flexible algorithm built based on g-computation algorithm is proposed along with a user-friendly software online. This approach is applied to a Taiwanese cohort study for exploring the mechanism by which hepatitis C virus infection affects mortality through hepatitis B virus infection, abnormal liver function, and hepatocellular carcinoma. All methods and software proposed in this study contribute to comprehensively decompose a causal effect confirmed by data science and help disentangling causal mechanisms when multiple ordered mediators exist, which make the natural pathways complicated.

Shao-Hsuan Wang

National Central University

Perturbation Theory for Cross Data Matrix-based PCA

Principal component analysis (PCA) has long been a useful and important tool for dimension reduction. Cross data matrix (CDM)-based PCA is another way to estimate PCA components, through splitting data into two subsets and calculating singular value decomposition for the cross product of the corresponding covariance matrices. It has been shown that CDM- based PCA has a broader region of consistency than ordinary PCA for leading eigenvalues and eigenvectors. In this talk, I will introduce the finite sample approximation results as well as the asymptotic behavior for CDM-based PCA via matrix perturbation. Moreover, I introduce a comparison measure for CDM-based PCA vs. ordinary PCA. This measure only depends on the data dimension, noise correlations, and the noise-to-signal ratio (NSR). Using this measure, we develop an algorithm, which selects good partitions and integrates results from these good partitions to form a final estimate for CDM-based PCA. Numerical and real data examples are presented for illustration. This joint work is with Prof. Su-Yun Huang.

新 鋭 演 講

Video Talks

新　銳　演　講

前　言

今年的數學會，我們進行了一個實驗性質的新活動。我們邀請了全台灣各個學校的新進教授與博士後，提供五分鐘短講的錄影。在這五分鐘內，我們不強調技術細節，講者會以宏觀的角度分享他的視角，讓不是這個領域的專家也可以欣賞、受到啟發，說不定還有促進合作的可能。

主　持　人

中興大學　戴佳原

講 者 名 單

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製　　作

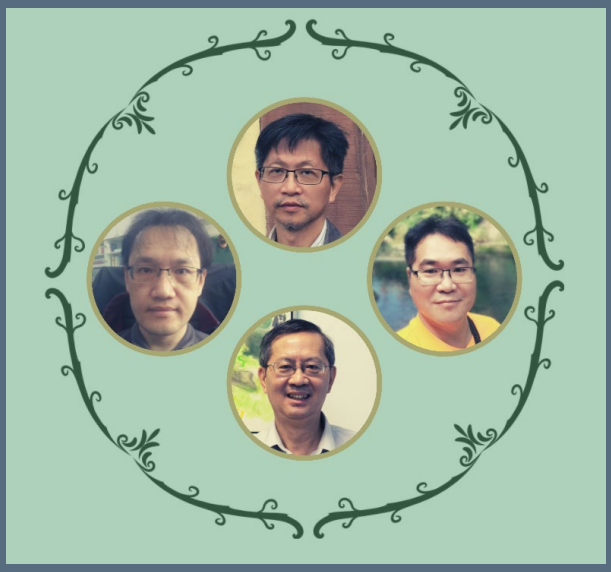
中 研 院 數 學 所

發　　行

中 華 民 國 數 學 會

公共議題論壇

Forum of Public Issues in Math Community



2021 公共議題論壇

時 間：1/17（一）16:40 – 18:00

地 點：1F 國際會議廳

開場主題：The role of Math Community in STEM

台灣產業面臨長期性跨領域人才短缺的問題，近年教育部針對半導體、AI、機械領域系所的人才培育有諸多因應措施，積極鼓勵發展各學校 STEM 學程。這樣的趨勢也將衝擊現有的大學各系所的課程與資源，在此一背景下，未來數學在跨領域人才培育上可以扮演的角色更重要，然而數學系所究竟該如何看待與因應這個趨勢是最近許多人關心的議題。誠摯邀請您加入我們的論壇，共同發想、討論未來數學發展的展望。

16:40　林俊吉 主持人開場

16:50　林惠文 / 因應AI時代東吳大學數學系之分享（17:00 QA時間）

17:05　鄭經斅 / 高等數學教育所面對的困境以及我們的解決之道（17:15 QA時間）

17:20　崔茂培 / 台大特殊選才、榮譽課程及數學沙龍介紹（17:30 QA時間）

17:35　綜合 QA 及討論

女數學人Gathering

Gathering of Female Mathematicians

主辦 / 協辦單位

主辦單位：中華民國數學會、中央研究院數學研究所
協辦單位：科技部自然司科學推展中心數學組

時間與地點

舉辦時間：111年1月18日（二） 12:15~13:45
舉辦地點：國立臺灣大學天文數學館9樓

議程

11:45 ~ 12:15	報到
12:15 ~ 12:30	相見歡
12:30 ~ 12:35	李瑩英理事長開場
12:35 ~ 12:45	高欣欣老師分享
12:45 ~ 12:55	許瑞麟老師分享
12:55 ~ 13:25	與會者交流時間
13:25 ~	自由分享

附　錄

Appendix

防疫措施

2021 中華民國數學年會 防疫措施

防疫基本措施

1. 活動前及活動中加強場地環境消毒，針對來賓經常接觸之表面（如：電梯按鍵、手把、門把、桌椅等）定時消毒擦拭。
2. 所有來賓及工作人員皆需於入口量測體溫、掃描 1922 實聯制 QR code 並以酒精消毒雙手後，始可入館辦理報到及簽到手續。
   P.S. 體溫高於 37度（含）以上者謝絕入場。
3. 所有活動參與人員聯絡資料皆會造冊留存備查；另因應防疫考量，活動前及活動中將持續提醒來賓配戴識別證（相關措施皆會於行前通知信中說明）
4. 服務台、報到桌、國際會議廳及演講教室等公共空間皆會提供酒精；室內空間之門窗不關閉以維持通風。
5. 活動現場將設立防疫公告，如：除飲食外請全程配戴口罩、若需飲食請維持 1.5 米社交距離、若參與人員身體不適應立即反映等，以加強衛教訊息宣導。
6. 預計供應之茶點採個別包裝，以利防疫；午間用餐採餐券制，透過引導來賓至三處校內建築（六間學生餐廳）用餐以利分流。

將根據中央流行疫情指揮中心發布之「嚴重特殊傳染性肺炎因應指引」及即時疫情狀況進行滾動式修正

會場位置 Venue Map

演講樓層位置示意圖


女數學人Gathering 901
統計 714
機率 722
7&9F
Gathering of Female Mathematicians 901
Statistics 714
Probability 722
最佳化 609
分析 617
偏微分方程 638
離散數學 639
補助申請
11:00 ~ 14:00
6F
Optimization 609
Analysis 617
Partial Differential Equations 638
Discrete Mathematics 639
SUBSIDY
11:00 ~ 14:00
大會演講 ..... 國際會議廳 / 202
動態系統與生物數學 201
數論與代數 202
同步轉播
2F
Plenary Talks Auditorium.202
Dynamical Systems & Biomathematics 201
Number Theory and Algebra 202
Synchronous Meeting
大會演講 ..... 國際會議廳 / 202
茶會 1F大廳
公共議題論壇 ..... 國際會議廳
微分幾何與代數幾何 101
計算數學 102
服務台
失物招領
1F
Plenary Talks Auditorium.202
Coffee Break ..... Lounge
Forum ..... Auditorium
Differential & Algebraic Geometry 101
Computational Mathematics 102
INFORMATION
LOST&FOUND

午餐資訊 Lunch Info

因應防疫分流，午間需請來賓持餐券至以下餐廳用餐：

(1) 活大（第一學生活動中心） (2) 小福2F（台大合作社） (3) 女九2F（宿舍餐廳）

晚宴資訊 Banquet

la marée 水源 福利會館 公館店

晚宴地點：水源會館 海芋廳
餐廳地址：台北市中正區思源街16號
晚宴時間：1/17（一）18:30～21:00