2020 輔大數學

中華民國數學年會

TMS Annual Meeting

12.05 六 - 12.06 日

大會手冊

Conference Program

主辦單位 中華民國數學會 承辦單位 輔仁大學數學系

協辦單位 科技部自然司數學研究推動中心、輔仁大學

尋求最大公約數

------Math with the World!

「基礎數學能力等同於國力」是目前科學界和企業界熱議的話題。一個國家的數學基礎實力往往影響其國力和社會的進步與發展。從18世紀第一次工業革命至今，人類生產逐漸轉向新的製造過程，出現了以機器化取代人力、獸力的趨勢，利用大規模的工廠生產方式取代個體手工生產的一場科技革命，無庸置疑，幾乎所有歷史上重大的改變都與數學的發展進步息息相關。

現今數學已成為所有科學領域的基礎是不爭的事實，如：國家安全、大氣航太、仿生科技工程、資訊數據、能源探勘、海洋工程、半導體先進製造及目前多國相繼投入競爭的人工智慧等都有不可或缺的重要支持。

中華民國數學學會李瑩英理事長曾提及「現今大量數據的資訊時代及其各式應用，一方面帶給數學許多挑戰，同時也帶來一些新的契機與可能性，如何呼應外在環境並保有數學核心與優勢是我們亟需面對的課題」。因此，2020年中華民國數學年會承襲並發揚「支持基礎數學科學」、「加強科學社群和跨領域業界應用研究」、「推動和深化國內外經驗交流與合作」的對口平台上，持續深化與完善台灣數學的國際競爭力。

在邁進下一世紀的科學路上，前方是柳暗花明，或是海市蜃樓？昔有孟子的「得仁者得天下」，今有「得數學者得天下」能為這個問題提供明確的答案。

「數」業有專攻，如是而已!

2020 年 中華民國數學年會

2020 Taiwan Mathematical Society Annual Meeting

會議時間：2020年12月5日(六)至2020年12月6日(日)
會議地點：輔仁大學數學系
主辦單位：中華民國數學會
承辦單位：輔仁大學數學系
協辦單位：科技部自然司數學推動中心、輔仁大學

學術委員會

Scientific Committee

國立台灣大學數學系　李瑩英(召集人)
國立清華大學數學系　何南國
國立中央大學數學系　楊肅煜
國立臺灣大學數學系　謝銘倫
輔仁大學數學系　張茂盛(109年承辦學校)
國立臺灣大學數學系　夏俊雄
國立交通大學應用數學系　陳冠宇

承辦單位籌備人員

Organizing Committee

輔仁大學數學系　張茂盛
輔仁大學數學系　郭仲成
輔仁大學數學系　邱文齡
輔仁大學數學系　陳思勉
輔仁大學數學系　蕭鴻銘
輔仁大學數學系　楊南屏
輔仁大學數學系　李安莉
輔仁大學數學系　蘇葜欽
輔仁大學數學系　嚴健彰
輔仁大學數學系　葉乃實
輔仁大學數學系　潘俊杰
輔仁大學數學系　李勇達
輔仁大學數學系　林可軒
輔仁大學數學系　李樹政

2020 中華民國數學年會

2020 年 12 月 5 日(星期六)

領域	離散數學	最佳化	資訊數學	數論與代數	微分幾何與代數幾何	機率	統計	計算數學	動態系統與生物數學	分析	偏微分方程
教室	MA301 耕莘樓(3F)	MA306 耕莘樓(3F)	MA307 耕莘樓(3F)	MA403 耕莘樓(4F)	MA405 耕莘樓(4F)	PH116 耕莘樓(1F)	PH118 耕莘樓(1F)	LH103 理工綜合教室	LB401-402 外語學院(4F)	LB404-405 外語學院(4F)	LB406-407 外語學院(4F)
08:30 - 09:30	報到註冊										耕莘樓大廳
09:30 - 10:00	年會開幕式 主持人：李瑩英 教授兼理事長										LH108 理工綜合教室
10: 00 - 10: 50	大會演講 李元斌 教授 主持人：鄭日新 教授										LH108 理工綜合教室
10:50 - 11:05	團體照										
11:05 - 11:20	茶會										LH108 理工綜合教室
11:20 - 12:05	主持人：余冠儒 演講者：傅東山	主持人： 許瑞麟 演講者： 陳騰文	主持人：邱文齡 演講者：蘇建華	主持人：余家富 演講者：魏福村	主持人：何南國 演講者：吳思曄	主持人：許順吉 演講者：施信宏	主持人：黃禮珊 演講者：黃彥棕	主持人：薛名成 演講者：卓建宏	主持人：班榮超 演講者：莊重	主持人：李明憶 演講者：方向	主持人：郭鴻文 演講者：陳逸昆
12:05 - 14:00	午餐										LH108 理工綜合教室
	12:20-13:50 教育議題論壇										LH108 理工綜合教室
13:35 - 14:00	***	***	***	***	***	主持人：陳冠宇 演講者： Kyung-Youn Kim	13:40-14:25 主持人：黃禮珊 演講者：盧鴻興	***	***	***	***
14:00 - 14:25	主持人：羅元勳 演講者：林晉宏	主持人：陳鵬文 演講者：陳界山	主持人：潘俊杰 演講者：詹雁如	主持人：魏福村 演講者：賴俊儒	主持人：蔡忠潤 演講者：劉之中	主持人：陳冠宇 演講者：洪正猗		主持人：胡偉帆 演講者：曾昱豪	主持人：王琎彬 演講者：吳昌鴻	主持人：方向 演講者：王昆淙	主持人：陳逸昆 演講者：李俊璋
14:25 - 14:50	主持人：傅東山 演講者：羅元勳	主持人：陳鵬文 演講者：杜威仕	主持人：梅興 演講者：翁浩正	主持人：魏福村 演講者：郭容妙	主持人：蔡忠潤 演講者：賴育瑞	主持人：陳冠宇 演講者：吳政訓	主持人：黃禮珊 演講者：洪弘	主持人：胡偉帆 演講者：謝博文	主持人：王琎彬 演講者：張志鴻	主持人：方向 演講者：王國仲	主持人：陳逸昆 演講者：關汝琳
14:50 - 15:00	中場休息										
15:00 - 15:45	專題演講　臺灣大學-IBM量子電腦中心主任 張慶瑞 教授 主持人：陳宜良 教授										LH108 理工綜合教室
15:45 - 16:00	茶會										LH108 理工綜合教室
16:00-16:50	綜合座談 主持人：李瑩英 教授兼理事長										LH108 理工綜合教室
16:50 - 18:10	會員大會暨頒獎典禮										LH108 理工綜合教室
18:30	晚宴										

2020 中華民國數學年會

2020 年 12 月 6 日(星期日)

領域	離散數學	最佳化	資訊數學	數論與代數	微分幾何與代數幾何	機率	統計	計算數學	動態系統與生物數學	分析	偏微分方程
教室	MA301 耕莘樓(3F)	MA306 耕莘樓(3F)	MA307 耕莘樓(3F)	MA403 耕莘樓(4F)	MA405 耕莘樓(4F)	PH116 耕莘樓(1F)	PH118 耕莘樓(1F)	LH103 理工綜合教室	LB401-402 外語學院(4F)	LB404-405 外語學院(4F)	LB406-407 外語學院(4F)
08:30 - 09:00	報到註冊										耕莘樓大廳
09:00 - 09:50	大會演講 Wee-Teck Gan 教授 (線上視訊研討) 主持人：謝銘倫 教授										LH108 理工綜合教室
09:50 - 10:10	茶會										LH108 理工綜合教室
10:10 - 10:55	主持人：林晉宏 演講者：葉鴻國	主持人：許瑞麟 演講者：林智仁	主持人：王姿月 演講者：陳君明	主持人：賴俊儒 演講者：黃世昌	主持人：蔡忠潤 演講者：郭庭榕	主持人：黃啟瑞 演講者：李育杰	10:10-11:30 主持人：洪弘 演講者： 蔡志群 黃世豪 簡立欣	主持人：薛名成 演講者：黃聰明	主持人：王琎彬 演講者：楊定揮	主持人：李明憶 演講者：黃皓瑋	主持人：吳恭儉 演講者：吳宗芳
11:00 - 11:25	主持人：葉鴻國 演講者：陳宏賓	主持人：許瑞麟 演講者：葉啟村	主持人：蔡炎龍 演講者：魏潭人	主持人：賴俊儒 演講者：時本一樹	主持人：蔡忠潤 演講者：郭孝豪	主持人：陳隆奇 演講者： Yuki Chino		主持人：薛名成 演講者：王琪仁	主持人：王琎彬 演講者：鄭昌源	主持人：黃皓瑋 演講者：王雅書	主持人：夏俊雄 演講者：蘇承芳
11:25 - 11:50	主持人：陳宏賓 演講者：俞韋亘	主持人：陳界山 演講者：胡承方	主持人：魏澤人 演講者：蔡炎龍	主持人：賴俊儒 演講者：寺門康裕	主持人：蔡忠潤 演講者：陳正傑	主持人：陳隆奇 演講者：陳美如		主持人：林得勝 演講者：陳孟豁	主持人：王琎彬 演講者：曾睿彬	主持人：黃皓瑋 演講者： Muoi Bui Ngoc	主持人：夏俊雄 演講者：呂明杰
11:50 - 12:15	主持人：俞韋亘 演講者：蔡馬良	主持人：陳界山 演講者：孫新民	***	主持人：賴俊儒 演講者：楊策仲	主持人：蔡忠潤 演講者：傅斯緯	主持人：陳隆奇 演講者：孫立意	主持人：洪弘 演講者：楊子賢	主持人：林得勝 演講者：林佳威	主持人：王琎彬 演講者：黃志強	主持人：黃皓瑋 演講者：蔡明誠	主持人：夏俊雄 演講者：李信儀
12:15 - 14:00	午餐 Lunch										LH108 理工綜合教室
	12:15 - 13:45 女數學人論壇										MA307 耕莘樓(3F)
	13:45 - 14:00 茶會										MA413 耕莘樓(4F)
14:00 - 14:25	主持人：鄭硯仁 演講者：俞韻城	主持人：許瑞麟 演講者：林仁彥	***	主持人：魏福村 演講者： Oguz Gezmis	***	***	***	***	***	***	***
14:25 - 14:50	***	***	***	主持人：魏福村 演講者： Ryotaro Harada	***	***	***	***	***	***	***
14:50 - 15:15	***	***	***	主持人：魏福村 演講者：孫維良	***	***	***	***	***	***	***
15:15	賦歸										

2020 Taiwan Mathematical Society Annual Meeting

December 5, 2020 (Saturday)

Sessions	Discrete Mathematics	Optimization	Information Mathematics	Number Theory and Algebra	Differential and Algebraic Geometry	Probability	Statistics	Computational Mathematics	Dynamical Systems and Biomathematics	Analysis	Partial Differential Equations
Room	MA301	MA306	MA307	MA403	MA405	PH116	PH118	LH103	LB401-402	LB404-405	LB406-407
08: 30 - 09: 30	Registration										
09: 30 - 10: 00	Opening Ceremony Chair: President Yng-Ing Lee										LH108
10: 00 - 10: 50	Plenary Lecture by Professor Yuan-Pin Lee Chair: Professor Jih-Hsin Cheng										LH108
10: 50 - 11: 05	Group Photo Session										
11: 05 - 11: 20	Coffee Break										LH108
11: 20 - 12: 05	Chair: Guan-Ru Yu Speaker: **Tung-Shan Fu**	Chair: Ruey-Lin Sheu Speaker: **Pengwen Chen**	Chair: Wen-Lin Chiou Speaker: **Frank Su**	Chair: Chia-Fu Yu Speaker: **Fu-Tsun Wei**	Chair: Nan-Kuo Ho Speaker: **Siye Wu**	Chair: Shuenn-Jyi Sheu Speaker: **Hsin-Hung Shih**	Chair: Li-Shan Huang Speaker: **Yen-Tsung Huang**	Chair: Ming-Cheng Shiue Speaker: **Chien-Hong Cho**	Chair: Jung-Chao Ban Speaker: **Jonq Juang**	Chair: Ming-Yi Lee Speaker: **Xiang Fang**	Chair: Hung-Wen Kuo Speaker: **I-Kun Chen**
12: 05 - 14: 00	Lunch										LH108
	12: 20-13: 50 Forum on Education										LH108
13: 35 - 14: 00	***	***	***	***	***	Chair: Guan-Yu Chen Speaker: **Kyung-Youn Kim**	13:40-14:25 Chair: Li-Shan Huang Speaker: **Henry Horng-Shing Lu**	***	***	***	***
14: 00 - 14: 25	Chair: Yuan-Hsun Lo Speaker: **Jephian Chin-Hung Lin**	Chair: Pengwen Chen Speaker: **Jein-Shan Chen**	Chair: Jun-Jie Pan Speaker: **Joyce Jan**	Chair: Fu-Tsun Wei Speaker: **Chun-Ju Lai**	Chair: Chung-Jun Tsai Speaker: **Chih-Chung Liu**	Chair: Guan-Yu Chen Speaker: **Jyy-I Hong**		Chair: Wei-Fan Hu Speaker: **Yu-Hau Tseng**	Chair: Feng-Bin Wang Speaker: **Chang-Hong Wu**	Chair: Xiang Fang Speaker: **Kun-Chuan Wang**	Chair: I-Kun Chen Speaker: **Chiun-Chang Lee**
14: 25 - 14: 50	Chair: Tung-Shan Fu Speaker: **Yuan-Hsun Lo**	Chair: Pengwen Chen Speaker: **Wei-Shih Du**	Chair: Hsing Mei Speaker: **Allen Own**	Chair: Fu-Tsun Wei Speaker: **Jung-Miao Kuo**	Chair: Chung-Jun Tsai Speaker: **Ching-Jui Lai**	Chair: Guan-Yu Chen Speaker: **Cheng-Hsun Wu**	Chair: Li-Shan Huang Speaker: **Hung Hung**	Chair: Wei-Fan Hu Speaker: **Po-Wen Hsieh**	Chair: Feng-Bin Wang Speaker: **Chih-Hung Chang**	Chair: Xiang Fang Speaker: **Kuo-Zhong Wang**	Chair: I-Kun Chen Speaker: **Ru-Lin Kuan**
14: 50 - 15: 00	Intermission										
15: 00 - 15: 45	Special Lecture by Professor Ching-Ray Chang Chair: Professor I-Liang Chern										LH108
15: 45 - 16: 00	Coffee Break										LH108
16: 00-16: 50	General Session Chair: President Yng-Ing Lee										LH108
16: 50 - 18: 10	TMS Meeting & Award Ceremony										LH108
18:30	Banquet										

2020 Taiwan Mathematical Society Annual Meeting

December 6, 2020 (Sunday)

Sessions	Discrete Mathematics	Optimization	Information Mathematics	Number Theory and Algebra	Differential and Algebraic Geometry	Probability	Statistics	Computational Mathematics	Dynamical Systems and Biomathematics	Analysis	Partial Differential Equations
Room	MA301	MA306	MA307	MA403	MA405	PH116	PH118	LH103	LB401-402	LB404-405	LB406-407
08: 30 - 09: 00	Registration										
09: 00 - 09: 50	Plenary Lecture by Professor Wee-Teck Gan (Online seminar) Chair: Professor Ming-Lun Hsieh										LH108
09: 50 - 10: 10	Coffee Break										LH108
10: 10 - 10: 55	Chair: Jephian Chin-Hung Lin Speaker: **Hong-Gwa Yeh**	Chair: Ruey-Lin Sheu Speaker: **Chih-Jen Lin**	Chair: Julie Tzu-Yueh Wang Speaker: **Jimmy Chen**	Chair: Chun-Ju Lai Speaker: **Shih-Chang Huang**	Chair: Chung-Jun Tsai Speaker: **Ting-Jung Kuo**	Chair: Chii-Ruey Hwang Speaker: **Yuh-Jye Lee**	10: 10-11: 30 Chair: Hung Hung Speaker: **Chih-Chun Tsai** **Shih-Hao Huang** **Li-Hsin Chien**	Chair: Ming-Cheng Shiue Speaker: **Tsung-Ming Huang**	Chair: Feng-Bin Wang Speaker: **Ting-Hui Yang**	Chair: Ming-Yi Lee Speaker: **Hao-Wei Huang**	Chair: Kung-Chien Wu Speaker: **Tsung-Fang Wu**
11: 00 - 11: 25	Chair: Hong-Gwa Yeh Speaker: **Hong-Bin Chen**	Chair: Ruey-Lin Sheu Speaker: **Chi-Tsuen Yeh**	Chair: Yen-Lung Tsai Speaker: **Tzer-jen Wei**	Chair: Chun-Ju Lai Speaker: **Kazuki Tokimoto**	Chair: Chung-Jun Tsai Speaker: **Siao-Hao Guo**	Chair: Lung-Chi Chen Speaker: **Yuki Chino**		Chair: Ming-Cheng Shiue Speaker: **Chi-Jen Wang**	Chair: Feng-Bin Wang Speaker: **Chang-Yuan Cheng**	Chair: Hao-Wei Huang Speaker: **Ya-Shu Wang**	Chair: Chun-Hiung Hisa Speaker: **Cheng-Fang Su**
11: 25 - 11: 50	Chair: Hong-Bin Chen Speaker: **Wei-Hsuan Yu**	Chair: Jein-Shan Chen Speaker: **Cheng-Feng Hu**	Chair: Tzer-jen Wei Speaker: **Yen-Lung Tsai**	Chair: Chun-Ju Lai Speaker: **Yasuhiro Terakado**	Chair: Chung-Jun Tsai Speaker: **Jheng-Jie Chen**	Chair: Lung-Chi Chen Speaker: **May-Ru Chen**		Chair: Te-Sheng Lin Speaker: **Meng-Huo Chen**	Chair: Feng-Bin Wang Speaker: **Jui-Pin Tseng**	Chair: Hao-Wei Huang Speaker: **Muoi Bui Ngoc**	Chair:Chun-Hiung Hisa Speaker: **Ming-Jiea Lyu**
11: 50 - 12: 15	Chair: Wei-Hsuan Yu Speaker: **Ma-Lian Chia**	Chair: Jein-Shan Chen Speaker: **Hsin-Min Sun**	***	Chair: Chun-Ju Lai Speaker: **Tse-Chung Yang**	Chair: Chung-Jun Tsai Speaker: **Ser-Wei Fu**	Chair: Lung-Chi Chen Speaker: **Li-Hsien Sun**	Chair: Hung Hung Speaker: **Tzu-Hsien Young**	Chair: Te-Sheng Lin Speaker: **Jia-Wei Lin**	Chair: Feng-Bin Wang Speaker: **Chih-Chiang Huang**	Chair: Hao-Wei Huang Speaker: **Ming-Cheng Tsai**	Chair: Chun-Hiung Hisa Speaker: **Hsin-Yi Lee**
12: 15 - 14: 00	Lunch										LH108
	12: 15-13: 45 Forum of Female Mathematicians										MA307
	13:45 - 14:00 Tea Time										MA413
14: 00 - 14: 25	Chair: Cheng-Yen Jen Speaker: **Tsan-Cheng Yu**	Chair: Ruey-Lin Sheu Speaker: **Jen-Yen Lin**	***	Chair: Fu-Tsun Wei Speaker: **Oguz Gezmis**	***	***	***	***	***	***	***
14: 25 - 14: 50	***	***	***	Chair: Fu-Tsun Wei Speaker: **Ryotaro Harada**	***	***	***	***	***	***	***
14: 50 - 15: 15	***	***	***	Chair: Fu-Tsun Wei Speaker: **Wei-Liang Sun**	***	***	***	***	***	***	***
15:15	Closing										

目錄
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邀請演講

論壇資訊及摘要

附錄

蕭美琪 MEI-CHI SHAW

蕭美琪教授因緊急要事取消演講

Department of Mathematics, University of Notre Dame,
Notre Dame, USA.
E-mail: mei-chi.shaw.1@nd.edu

HOLOMORPHIC APPROXIMATION IN COMPLEX ANALYSIS

Holomorphic approximation plays a fundamental role in complex analysis. In this talk we study holomorphic approximation, or more generally, approximation of $\bar{\partial}$-closed forms in one and several complex variables. The classical Runge theorem and the Mergelyan property are extended to domains in complex manifolds. We characterize the Runge and the Mergelyan property in terms of certain Dolbeault cohomology groups and geometric conditions. Holomorphic approximation is also naturally related to the mixed boundary problems for $\bar{\partial}$ on annuli and vanishing of the associated Dolbeault cohomoolgy groups actually characterizes the Runge property of the domain. (joint work with Christine Laurent-Thie´baut).

EDUCATION

National Taiwan University: 1977, B.S.
Princeton University: 1978, M.S.
Princeton University: 1981, Ph.D.
(Thesis Advisor - Joseph J. Kohn)

HONORS

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

EDITORIAL BOARD

1. Coordinating Editor for Analysis for Proceedings of American Mathematical Society (Editor since 2001, Coordinating Editor since 2009)
2. Associate Editor for the Journal of Geometric Analysis
3. Associate Editor for Complex Analysis and its Synergies

AMS COMMITTEE

Member of the American Math. Society Nominating Committee 2009-2011

Wee Teck Gan

Department of Mathematics,
National University of Singapore
E-mail: matgwt@nus.edu.sg

RECENT DEVELOPMENTS ON THE GROSS-PRASAD CONJECTURE

The Gross-Prasad conjecture was formulated almost 30 years ago by Gross and Prasad, in the context of special orthogonal groups, and was extended to all classical groups about 10 years ago in my joint work with them. It formulates precise answers to a natural restriction problem in the representation theory of classical groups over local fields, and the question of nonvanishing of period integrals in the setting of automoprhic forms. There has been some spectacular progress towards the resolution of these conjectures in the past year, and my talk will be devoted to describing these, as well as highlighting directions of work for the near future.

EDUCATION

Harvard University, Cambridge, Massachusetts.
Ph.D. in Mathematics, June 1998. Thesis title: Exceptional Theta Correspondences, written under Professor Benedict Gross.
Harvard University, Cambridge, Massachusetts.
Master Degree, June 1996.
Cambridge University, Cambridge, England.
B.A. with First Class Honours (Mathematics), June 1994.

HONORS

- Miller Fellowship, Berkeley/MSRI, 1998 (declined).
- American Math. Soc. Centennial Fellowship, 2002.
- NSF Research Grant 2002-2005, 2005-2008, 2008-2011.
- Sloan Research Fellowship, 2003-2005.
- MOE-AcRC Tier Two grant (Singapore), 2013-2016.
- Provost Chair of NUS, 2013-2016.
- ICM 2014, 45 min talk in Number Theory section.
- Outstanding Researcher Award, NUS, 2015.
- President Science Award, Singapore, 2017.

李元斌 Yuan-Pin Lee

Institute of Mathematics, Academia Sinica
E-mail: y.pleemath@gate.sinica.edu.tw

MODULI AND INVARIANT FROM THE PERSPECTIVE OF GROMOV--WITTEN THEORY

This lecture will review the definition of moduli spaces and the "modern" technique of employing moduli space to define invariants for the purpose of classification. After that, the theory of Gromov--Witten invariants will be discussed. The lecture is intended for non-specialists.

ACADEMIC POSITIONS

- Distinguished Research Fellow, Academia Sinica, 2020-present.
- Professor of Mathematics, University of Utah, 2011-.
- Associate Professor, University of Utah, 2006-2011.
- Assistant Professor, University of Utah, 2003-6.
- Visiting Research Mathematician, Princeton University, 2002-3.
- Junior Fellow, Conformal Field Theory and Applications, IPAM, Fall 2001.
- Hedrick Assistant Professor, UCLA, 1999-2002

EDUCATION

Ph.D. in mathematics: May 1999, University of California at Berkeley.
Thesis advisor: Alexander Givental

CURRENT RESEARCH INTERESTS

My current research interests are in the general areas of algebraic geometry and mathematical physics. More specifically I am working on Gromov–Witten theory and its relations with and applications to birational geometry, Hodge theory, K-theory, symplectic topology, integrable systems, representation theory, and mirror symmetry.

張慶瑞 CHING-RAY CHANG

IBM-NTU Q Hub Director
IEEE fellow, APS Fellow, RIEA member
國立台灣大學特聘教授
Email: crchang@phys.ntu.edu.tw
Website: https://goo.gl/4VHeQk

QUANTUM COMPUTATION: ALGORITHMS AND APPLICATIONS

Since the possibilities of commercial quantum computers are approaching, quantum algorithms and quantum computing have received great attention recently. Because of the strong parallelism of quantum computing in Hilbert space, there are opportunities to solve sophisticated problems beyond classical computers. However, to effectively use the parallelism of quantum computing, it is necessary to have a proper quantum algorithm to design ingenious quantum oracles according to the problems. Therefore, quantum algorithms and related applications are as important as quantum computer hardware, and a necessary protocol to realize quantum supremacy. This talk covers the basic concepts of quantum computation and then introduces some important quantum algorithms and their applications.

張慶瑞教授1979年畢業於台灣大學物理學系，1988在加州大學聖地牙哥分校取得物理博士學位並於當年返回工業技術研究院磁性組。1989年二月進入台灣大學服務，曾經擔任台大副校長並代理校長，目前擔任IBM-NTU Q hub 主任。

張教授自從1982年後就從事微磁學數值研究，他不但是此領域之創建者，並且一直持續推動在磁性產業之相關應用，無論在翻轉機制，熱擾動方面，都做出對基礎研究及應用科技的重要貢獻。近年來主要研究工作則集中在低維材料上的自旋傳輸機制。張慶瑞教授已發表280篇以上專業論文並獲得28個以上磁性相關專利。他也因學術上優秀表現同時被美國物理學會(APS)與國際工程學會(IEEE)選為會士，及俄國國際工程學會(RIAE)的院士。張教授曾擔任過亞洲磁性協會理事長，也曾任國台灣磁性協會理事長及台灣物理學會理事長。張教授近來主持NTU-IBM量子電腦計畫，並積極加速培養新興跨領域人才，應用於新材料，新藥物合成，最佳化系統與財務金融領域。近期積極推動量子計算，並創建台灣量子電腦暨資訊科技協會，擔任首任理事長。

分析

Analysis

Organizer：李明憶 國立中央大學數學系

地點：LB404-405 外語學院(4F)

2020 年 12 月 5 日 (星期六)		Speaker
11:20-12:05	Regularity of Random Analytic Functions: A Banach Space Viewpoint Chair：李明憶	方向
14:00-14:25	The Convergence of Calderón Reproducing Formulae of Two Parameters on Besov and Triebel-Lizorkin Spaces Chair：方向	王昆淙
14:25-14:50	Matrix Powers with Circular Numerical Range Chair：方向	王國仲

2020 年 12 月 6 日 (星期日)		Speaker
10:10-10:55	Some Recent Developments in Non-Commutative Probability Theory Chair：李明憶	黃皓瑋
11:00-11:25	How $P_1(G)$ determines a finite group G Chair：黃皓瑋	王雅書
11:25-11:50	Amenability of Semitopological Semigroups and Fixed Points Chair：黃皓瑋	Muoi Bui Ngoc
11:50-12:15	Maps Preserving Trace of Products of Matrices Chair：黃皓瑋	蔡明誠

Regularity of Random Analytic Functions: A Banach Space Viewpoint

Xiang Fang

Department of Mathematics, National Central University

E-mail: xfang@math.ncu.edu.tw

Abstract

The study of random analytic functions has a long history. Earlier focus includes random polynomials and gaussian analytic functions. The viewpoint is usually to study the behaviors of individual random analytic functions. We seek to study the effect of randomization acting on Banach spaces of analytic functions. In particular, we characterize the so-called "random pre-dual" of the Bergman space. Namely, we characterize analytic functions $f(z) = \sum a_n z^n$ such that $(Rf)(z) = \sum \pm a_n z^n$ is almost surely in the Bergman space $L^p(\mathbb{D})$ for any $p > 0$.

The Convergence of Calderón Reproducing Formulae of Two Parameters on Besov and Triebel-Lizorkin Spaces

Kunchuan Wang
Department of Applied Mathematics
National Dong Hwa University
kcwang@gms.ndhu.edu.tw

The Calderón reproducing formula is the most important in the study of harmonic analysis, which has the same property as the one of approximate identity in many special function spaces. In this talk, we use the idea of separation variables and molecular decomposition to extend single parameter into two-parameters and discuss the convergence of Calderón reproducing formula of two-parameters in Besov and Triebel-Lizorkin spaces of two parameters. Also we show the convergence of Calderón reproducing formula on such function space.

Keywords: atomic decomposition, Besov space, Calderón reproducing formula, Littlewood-Paley, Plancherel-Pôlya inequality, Triebel-Lizorkin spaces.

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Matrix Powers with Circular Numerical Range

Kuo-Zhong Wang

Department of Applied Mathematics, National Chiao Tung University, Taiwan

E-mail: kzwang@math.nctu.edu.tw

Abstract

Let $K_2 = \begin{bmatrix} 0 & 0 \\ 2 & 0 \end{bmatrix}$, K_n be the $n \times n$ weighted shift matrix with weights $\sqrt{2}, \underbrace{1, \ldots, 1}_{n-3}, \sqrt{2}$ for all $n \geq 3$, and K_∞ be the weighted shift operator with weights $\sqrt{2}, 1, 1, 1, \ldots$. We show that if an $n \times n$ nonzero matrix A satisfies $W(A^k) = W(A)$ for all $1 \leq k \leq n$, then $W(A)$ cannon be a (nondegenerate) circular disc. Moreover, we also show that $W(A) = W(A^{n-1}) = \{z \in \mathbf{C} : |z| \leq 1\}$ if and only if A is unitarily similar to K_n. Finally, we prove that if T is a numerical contraction on an infinite-dimensional Hilbert space H, then $\lim_{n\to\infty} \|T^n x\| = \sqrt{2}$ for some unit vector $x \in H$ if and only if T is unitarily similar to an operator of the form $K_\infty \oplus T'$ with $w(T') \leq 1$.

Co-author: Hwa-Long Gau

SOME RECENT DEVELOPMENTS IN NON-COMMUTATIVE PROBABILITY THEORY

HAO-WEI HUANG

Abstract. Non-commutative probability theory was founded by Voiculescu around 1985 with an intension to solve a yet open problem in operator algebra theory. Since then, this theory has been discovered to have broad connections and applications to other research fields, such as random matrix theory, quantum information theory, and classical probability theory. In this talk, I will first offer a concise introduction and historical development of non-commutative probability theory, and then introduce the link between this theory and other research areas. Also, our recent works with the connection to probability theory will be delivered. If time grants, some other relevant topics will be discussed.

Department of Applied Mathematics, National Sun Yat-sen University, No. 70, Lienhai Rd., Kaohsiung 80424, Taiwan, R.O.C.
E-mail address: hwhuang@math.nsysu.edu.tw

How $P_1(G)$ determines a finite group G

Ya-Shu Wang

Department of Applied Mathematics, National Chung Hsing University

E-mail: yashu@nchu.edu.tw

Abstract

Let G be a finite group and let $P_1(G)$ denote the set of all norm one positive definite functions on G. That is,

$$P_1(G) = \{\langle \pi(\cdot)\xi, \xi\rangle \mid \pi : G \to \mathcal{U}(H) \text{ unitary representation}, \xi \in H, \|\xi\| = 1\}.$$

In this talk, I will present that $P_1(G)$ determines G in many situations. We can tell if G is abelian, cyclic, simple, perfect, solvable, supersolvable, or nilpotent via $P_1(G)$. Especially when G is abelian, we can determine $G \cong \prod_j Z_{p_j^{r_j}}$ as a direct product of its cyclic subgroups of prime power orders.

Amenability of semitopological semigroups and fixed points

Muoi Bui Ngoc
Department of Applied Mathematics, National Sun Yat-sen University
E-mail: buingocmuoi@hpu2.edu.vn

Abstract

The amenability was first introduced by Johnson [1] to study the group algebra $L^1(G)$ for locally compact groups. For semitopological semigroups S, the amenability is defined as an existence of a left-invariant positive linear functional on some function spaces associated to S. This concept then is used in studying the existence of fixed points for the representation $S \times K \to K$ by $(s, x) \to T_s x$. To guarantee a common fixed point, i.e. a point $x_0 \in K$ such that $T_s x_0 = x_0, \forall s \in S$, the maps T_s need to satisfy some nonexpansiness and continuity.

This talk reports some classical results in the mentioned direction, see e.g. [2, 3]. Let LUC(S) be the space of left uniformly continuous functions on S. Assume that S is right reversible and LUC(S) has a left invariant mean. We show that there always exists a common fixed point for any jointly weakly continuous and super asymptotically nonexpansive representation of S on a weakly compact convex subset K of a Banach space. Several variances involving weak* compactness of K and other function spaces on S are also provided, see [4].

Keywords— Amenability, semitopological semigroups, fixed points.

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Maps preserving trace of products of matrices

Ming-Cheng Tsai
General Education Center
National Taipei University of Technology
mctsai2@mail.ntut.edu.tw

Abstract

We show that two maps ϕ and ψ on the set of positive definite matrices satisfying

$$\mathrm{tr}(\phi(A)\psi(B)) = \mathrm{tr}(AB)$$

if and only if there exists a nonsingular matrix M such that $\phi(A) = M^*AM,\ \psi(A) = M^{-1}AM^{-*}$; or $\phi(A) = M^*A^tM,\ \psi(A) = M^{-1}A^tM^{-*}$. In addition, we characterize maps $\phi_1, \ldots, \phi_m$ $(m \geq 3)$ on the set of positive definite matrices satisfying

$$\mathrm{tr}(\phi_1(A_1)\cdots\phi_m(A_m)) = \mathrm{tr}(A_1\cdots A_m).$$

Moreover, the maps $\phi_1, \ldots, \phi_m$ on the set $\mathcal{S}$ preserving the similar trace equality in $\mathcal{S}$ are also characterized, where $\mathcal{S}$ denotes the set of complex, Hermitian, symmetric, positive, doubly stochastic, row stochastic, column stochastic, and diagonal matrices, respectively.

微分幾何與代數幾何

Differential and Algebraic Geometry

Organizer：蔡忠潤 國立臺灣大學數學系

地點：MA405 耕莘樓(4F)

2020 年 12 月 5 日 (星期六)		Speaker
11:20-12:05	The Geometry of “Good” Boundary Conditions Chair：何南國	吳思曄
14:00-14:25	Kapustin-Witten Equations on Closed Kahler Surfaces Chair：蔡忠潤	劉之中
14:25-14:50	Exceptional Collection of Objects on Some Fake Projective Planes Chair：蔡忠潤	賴青瑞

2020 年 12 月 6 日 (星期日)		Speaker
10:10-10:55	Momodromy of Toda System and Its Application Chair：蔡忠潤	郭庭榕
11:00-11:25	Asymptotic Behavior of Mean Curvature Flow with a Conical End Chair：蔡忠潤	郭孝豪
11:25-11:50	The Ascending Chain Condition (ACC) for the Set of 3-Fold Canonical Thresholds Chair：蔡忠潤	陳正傑
11:50-12:15	Quadratic Differentials, Circle of Foliations, and Length Rigidity Chair：蔡忠潤	傅斯緯

The geometry of "good" boundary conditions

Siye Wu

Department of Mathematics, National Tsing Hua University

E-mail: swu@math.nthu.edu.tw

Abstract

We explain how symplectic geometry helps select boundary conditions for partial differential equations from variational problems. For gauge theories, we study the interplay of boundaries conditions with discrete fluxes, higher-form symmetry and duality.

Keywords— Lagrangian submanifolds, boundary conditions, symmetries, duality

Kapustin-Witten Equations on Closed Kahler Surfaces

Chih-Chung Liu

Department of Mathematics, National Cheng Kung University

E-mail: cliu@mail.ncku.edu.tw

Abstract

Kapustin-Witten Equations are essentially the complexification of Yang-Mills Equations over 4-manifolds. I will present some interesting results when the 4-maniolfds are closed Kahler surfaces, where the equations link these gauge theoretic equations realize some well-known correspondence theorem.

EXCEPTIONAL COLLECTION OF OBJECTS ON SOME FAKE PROJECTIVE PLANES

CHING-JUI LAI

Department of Mathematics, National Cheng Kung University

E-mail: cjlai72@mail.ncku.edu.tw

SAI-KEE YEUNG

National Science Foundation

Abstract

The purpose of the article is to explain a new method to establish the existence of an exceptional collection of length three for a fake projective plane M with non-trivial automorphism group, related to a conjecture of Galkin-Katzarkov-Mellit-Shinder. Our method shows that 30 fake projective planes support such a sequence, most of which are new. In particular, this provides many new H-phantom categories.

Momodromy of Toda system and its application

Ting-Jung Kuo
Department of Mathematics
National Taiwan Normal University

Abstract: In the literature, Toda system arises in many research area such as Plucker formula in algebraic geometry or τ-function in integrable system. Our goal is to understand the geometry of the solution space of the Toda. The first step to achieve it is to study the monodromy of a third order complex ODE which is related to this Toda system. In this talk, I will classify the monnodromic representation of the Toda system and some applications to the Toda system will be mentioned.

ASYMPTOTIC BEHAVIOR OF MEAN CURVATURE FLOW WITH A CONICAL END

Siao-Hao Guo

Department of Mathematics, National Taiwan University

E-mail: shguo@ntu.edu.tw

Abstract

In this talk, we consider the long time behavior of mean curvature flow that is is asymptotic to a regular cone at infinity. The main theorem is that the flow will become asymptotically self-expanding provided that the entropy of the cone is small. Moreover, the expander that gives rise to the limiting flow is asymptotically stable as an equilibrium solution of the normalized mean curvature flow.

The ascending chain condition (ACC) for the set of 3-fold canonical thresholds

Jheng-Jie Chen

Department of Mathematics, National Central University

E-mail: jhengjie@math.ncu.edu.tw

Abstract

In this talk, I will briefly introduce Sarkisov program and some classifications of 3-fold divisorial contractions in the minimal model program. Then, I will explain how the set of 3-fold canonical thresholds satisfies the ascending chain condition (ACC) by using the classifications of these contractions.

Quadratic differentials, circle of foliations, and length rigidity

Ser-Wei Fu

National Center of Theoretical Sciences, National Taiwan University

E-mail: swfu0905@ntu.edu.tw

Abstract

Quadratic differentials are natural objects used to describe Teichmuller geodesics. Flat surfaces induced by quadratic differentials are of interest on their own as they are related to billiards and CAT(0) geometry. It is known that for a fixed topological surface, a hyperbolic metric is uniquely determined (up to isotopy) by the length of a finite set of simple closed curves but a flat metric doesn't share the same property. It is therefore of interest to restrict to subsets of flat metrics when considering the finite length rigidity property. In this talk I will consider natural subsets of quadratic differentials and discuss length rigidity and deformations.

Keywords— Quadratic differential, Measured foliation, Riemann surface, Singular flat metric

References

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動態系統與生物數學

Dynamical Systems and Biomathematics

Organizer：王烽彬 長庚通識中心

地點：LB401-402 外語學院(4F)

2020 年 12 月 5 日 (星期六)		Speaker
11:20-12:05	A Two Dimensional Hybrid Map Arising in Seasonal Influenza Models Chair：班榮超	莊重
14:00-14:25	The Formation of Spreading Front: The Singular Limit of Three-Component Lotka-Volterra Competition Models Chair：王烽彬	吳昌鴻
14:25-14:50	Topological Entropy and Dynamical Systems Chair：王烽彬	張志鴻

2020 年 12 月 6 日 (星期日)		Speaker
10:10-10:55	Global Dynamics and Existence of Traveling Wave Solutions for A Three-Species Model Chair：王烽彬	楊定揮
11:00-11:25	A Diffusive Virus Model with A Fixed Incubation Period and Drug Treatments Chair：王烽彬	鄭昌源
11:25-11:50	Global Synchronization of Coupled Reaction-Diffusion Neural Networks with General Couplings Chair：王烽彬	曾睿彬
11:50-12:15	Travelling Waves for a Scalar Reaction-Diffusion Equation with a Tristable Nonlinearity Chair：王烽彬	黃志強

A Two Dimensional Hybrid Map Arising in Seasonal Influenza Models

Jonq Juang

Department of Applied Mathematics, National Chiao Tung University

E-mail: jjuang@math.nctu.edu.tw

Abstract

We study the dynamics of a two dimensional hybrid map in the sense that the map consists of the linear and nonlinear dynamics depending on where the map acts on its domain. Such map, arising in seasonal influenza models, is capable of generating bi-stable states such as the coexistence of stable fixed point and period three points as well as the stable period three points and a chaotic attractor.

The formation of spreading front: the singular limit of three-component Lotka-Volterra competition models

Chang-Hong Wu

Department of Applied Mathematics, National Chiao Tung University

E-mail: changhong@math.nctu.edu.tw

Abstract

Mathematical models have been proposed to estimate the spreading speed of species, and the position of the spreading front is usually determined by unspecified level sets of the solution. In recent decades, it was reported that some mathematical models of population dynamics have an explicit form of the evolution equations for the spreading front, which are represented by free boundary problems such as the Stefan-like problem (e.g. Mimura-Yamada-Yotsutani(1985), Du-Lin(2010)). To understand the formation of spreading front, in this talk, we will consider the singular limit of three-component Lotka-Volterra type models and give a natural interpretation for spreading front from the viewpoint of modeling. This talk is based on joint work with Hirofumi Izuhara and Harunori Monobe.

Topological entropy and dynamical systems

Chih-Hung Chang
Department of Applied Mathematics, National University of Kaohsiung
chchang@nuk.edu.tw

Abstract

Topological entropy is an important statistical property for dynamical systems. In this talk, I will give a brief review of topological entropy for lattice dynamical systems and introduce the recent development of topological entropy for algebraic dynamical systems. Some interesting connection between topological entropy of lattice and algebraic dynamical systems are observed.

Keywords— Topological entropy, lattice dynamical system, amenable groups, hom-shifts

Global Dynamics and Existence of Traveling Wave Solutions for A Three-Species Model

Ting-Hui Yang
Department of Mathematics, Tamkang University
E-mail: thyang@gms.tku.edu.tw

Abstract

In this work, we investigate the system of three species ecological model involving one predator-prey subsystem coupling with a generalist predator with negative effect on the prey. Without diffusive terms, all global dynamics of its corresponding reaction equations are proved analytically for all classified parameters. With diffusive terms, the transitions of different spatial homogeneous solutions, the traveling wave solutions, are showed by higher dimensional shooting method, the Wazewski method. Some interesting numerical simulations are performed, and biological implications are given.

Keywords— Three Species Models, Predator Prey Systems, Global Stability, Wazewski method

A diffusive virus model with a fixed incubation period and drug treatments

Chang-Yuan Cheng
Department of Applied Mathematics, National Pingtung University
E-mail: cycheng@mail.nptu.edu.tw

Abstract

Overuse of a drug can lead to deleterious side effects, and overestimating the efficacy of a drug can result in failure to treat infection. In this talk, we will explore the viral dynamics within a treated host by incorporating the spatial heterogeneity with the intrinsic incubation period of the actively infected cells and virions. A threshold dynamics of either extinction of virus or the uniform persistence of infection will be determined by calculating the value of the basic reproduction number (Ro). In addition, by conducting numerical simulations, we will also explore the effects of various parameters on the value of Ro. The main issues include how the value of Ro affected by the incubation period, the mobility of infected cells or virions, and the spatial fragmentation of the virus environment.

Global synchronization of coupled reaction-diffusion neural networks with general couplings

Jui-Pin Tseng

Department of Mathematical Sciences, National Chengchi University

Abstract

In this talk, we present an approach to investigate the global synchronization of coupled reaction-diffusion neural networks with time delays. The coupling scheme for the coupled networks is rather general. Based on the proposed iterative approach, the problem of global synchronization is transformed into that of solving the corresponding homogeneous linear system of algebraic equations. The synchronization criterion is subsequently derived and can be verified with simple computations. Several numerical examples are presented to illustrate the effectiveness of the synchronization theory presented in this paper.

Travelling Waves for a Scalar Reaction-Diffusion Equation with a Tristable Nonlinearity

Huang, Chih-Chiang

The Department of Mathematics, National Taiwan University

E-mail: loveworldsteven@hotmail.com

Abstract

In biology, pattern formation can be modeled by reaction-diffusion equations. A important feature of these phenomenon is wave propagation. In this talk, we are concerned with the existence of traveling waves for a scalar equation with three stable steady states. By applying the maximum principle, these steady states can be ordered. Based on the variational method, we ensure the existence of traveling waves connecting two successive states. Also, we pose a sufficient and necessary condition for the existence of waves connecting two non-successive states. In particular, we give an illustration of equations with a quintic nonlinearity in a strip to verify our assumptions in the main theorem. In addition, the time map skill is involved in the study of the multiplicity of steady states in an interval. This is a joint work with Prof. Chiun-Chuan Chen and Prof. Shin-Ichiro Ei.

Keywords— Traveling Wave, Variational Method, Reaction-Diffusion Equation

References

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數論與代數

Number Theory and Algebra

Organizer：余家富 中央研究院數學所

地點：MA403 耕莘樓(4F)

2020 年 12 月 5 日 (星期六)		Speaker
11:20-12:05	On Class Number Relations and Intersections Over Function Fields Chair：余家富	魏福村
14:00-14:25	Springer Fibers Via Quiver Varieties Using Maffei-Nakajima Isomorphism Chair：魏福村	賴俊儒
14:25-14:50	Partial Group Actions and Partial Galois Extensions Chair：魏福村	郭容妙

2020 年 12 月 6 日 (星期日)		Speaker
10:10-10:55	Local-Global Conjectures in Representation Theory of Finite Groups Chair：賴俊儒	黃世昌
11:00-11:25	Local Langlands Correspondence for Regular Supercuspidal Representations of GL(n) Chair：賴俊儒	時本一樹
11:25-11:50	Hecke Eigensystems of Automorphic Forms (mod p) of Hodge Type and Algebraic Modular Forms Chair：賴俊儒	寺門康裕
11:50-12:15	SIDH and Superspecial Hyperelliptic Curves of Genus 2 with Richelot Isogenies Chair：賴俊儒	楊策仲
14:00-14:25	Trivial Multiple Zeta Values over Tate Algebras Chair：魏福村	Oguz Gezmis
14:25-14:50	On The Linear Independence of Certain Multiple Sums in Positive Characteristic Chair：魏福村	Ryotaro Harada
14:50-15:15	Multiplicative Jordan Decomposition and Nilpotent Decomposition in Integral Group Rings Chair：魏福村	孫維良

On class number relations and intersections over function fields

Fu-Tsun Wei

Department of Mathematics, National Tsing Hua University

E-mail: ftwei@math.nthu.edu.tw

Abstract

In this talk, we shall present a function field analogue of the Hirzebrush-Zagier class number formula. More precisely, we connect special combinations of class numbers of "imaginary" quadratic function fields with corresponding intersections of "Hirzebruch-Zagier-type" divisors on Drinfeld-Stuhler modular surfaces. The main bridge in our approach is a particular "harmonic" theta series on GL(2). The above connection directly comes from two different expressions of the Fourier coefficients of the theta series, which can be viewed as a geometric Siegel-Weil formula in this particular case. This is joint work with Jia-Wei Guo.

Springer fibers via quiver varieties using Maffei-Nakajima isomorphism

Chun-Ju Lai
Institute of Mathematics, Academia Sinica
E-mail: cjlai@gate.sinica.edu.tw

Abstract

It is a remarkable theorem by Maffei-Nakajima that the Slodowy variety, which consists of certain complete flags, can be realized as certain Nakajima quiver variety of type A. The isomorphism is known to be rather implicit as it takes to solve a system of equations in which variables are linear maps. In this talk, we will talk about an explicit and efficient way to realize these quiver varieties in terms of complete flags in the corresponding Slodowy varieties. As an application, we provide an explicit description of irreducible components of two-row Springer fibers in terms of a family of kernel relations via quiver representations, which allows us to formulate a characterization of irreducible components of Springer fibers of classical type. This is a joint work with Mee Seong Im and Arik Wilbert.

Keywords— Springer fibers, quiver varieties

References

[1] M.S. Im, C. Lai and A. Wilbert, *Springer fibers via quiver varieties using Maffei-Nakajima isomorphism* , arXiv:2009.08778.

Partial group actions and partial Galois extensions

Jung-Miao Kuo

Department of Applied Mathematics, National Chung-Hsing University, Taiwan

Email: jmkuo@nchu.edu.tw

We introduce the concepts of partial group action and partial Galois extension. Some results on partial orbits and partial stabilizers will be presented. We shall also show how to construct (partial) Galois extensions in a partial Galois extension.

2010 *Mathematics Subject Classification.* 13B05. 16W22.

Local-global conjectures in representation theory of finite groups

Shih-Chang Huang
Department of Mathematics, National Cheng Kung University
E-mail: shua3@mail.ncku.edu.tw

Abstract

In the past few years, several famous and long-standing local-global conjectures in finite group representation theory has been reduced to statements about simple groups. In the talk I will describe the background of these conjectures, and discuss our current work as well as some recent results.

Local Langlands correspondence for regular supercuspidal representations of GL(n)

Kazuki Tokimoto
Institute of Mathematics, Academia Sinica
E-mail: tokimoto@gate.sinica.edu.tw

Building on J.-K. Yu's construction of supercuspidal representations, Kaletha recently defined the class of regular supercuspidal representations for tamely ramified p-adic groups and made a profound study of these representations. In particular, he constructed the local Langlands correspondence for regular supercuspidal representations.

In this talk, we will explain that the correspondence constructed by Kaletha coincides with the local Langlands correspondence for GL(n) previously defined by Harris–Taylor. A key fact is that regular supercuspidal representations of GL(n) are nothing but essentially tame supercuspidal representations intensively studied by Bushnell–Henniart and later by Tam.

This is a joint work with Masao Oi (Kyoto University).

Keywords— Local Langlands correspondence, regular supercuspidal representations, essentially tame supercuspidal representations

Hecke eigensystems of automorphic forms (mod p) of Hodge type and algebraic modular forms

Yasuhiro Terakado

Institute of Mathematics, Academia Sinica

E-mail: terakado@gate.sinica.edu.tw

Abstract

In his letter [1] to Tate, Serre proved that the systems of prime-to-p Hecke eigenvalues arising from mod p modular forms are the same as those arising from locally constant functions

$$f : D^{\times}\backslash(D \otimes_{\mathbb{Q}} \mathbb{A}_f)^{\times} \to \overline{\mathbb{F}}_p,$$

where D is the quaternion $\mathbb{Q}$-algebra ramified precisely at a prime p and ∞, and $\mathbb{A}_f$ is the ring of finite adèles of the rational numbers $\mathbb{Q}$. This correspondence was obtained from restricting modular forms to the supersingular locus of the modular curve modulo p, and the algebra D appeared as the endomorphism algebra of a supersingular elliptic curve. This result can be regarded as a mod p analogue of the Jacquet-Langlands correspondence.

In this talk, we give a generalization of Serre's correspondence to mod p automorphic forms on Shimura varieties of Hodge type having good reduction at p.

As an application, we also give an explicit upper bound of the number of the systems of Hecke eigenvalues arising from mod p automorphic forms on totally indefinite quaternionic PEL-Shimura varieties.

This is joint work with Chia-Fu Yu.

Keywords— Mod p automorphic forms, Hecke eigensystems, Algebraic modular forms

References

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SIDH and superspecial hyperelliptic curves of genus 2 with Richelot isogenies

Tse-Chung Yang
National Taiwan University

Abstract

The Diffie-Hellman key exchange protocol plays an important role in public cryptography. The elliptic curve cryptosystem(ECC) is a standard example and widely used now. The security of this protocol depends on the hardness of solving discrete logarithm problem(DLP). In 1994, Shor presents a quantum algorithm which solves DLP (breaks ECC) and factorization problem (breaks RSA) in polynomial time using quantum computers. In 2011, De Feo and Jao proposed supersingular isogeny Diffie-Hellman(SIDH) exchange protocol which is quantum-resistant. The secuity of this protocol is based on the hardness of computing isogenies between two supersingular elliptic curves.

In this talk, I will briefly introduce SIDH key exchange protocol and the current status as I know. Then I will talk about an extension of SIDH to genus-2 curves. That is, using superspecial genus-2 hyperelliptic curves with Richelot isogenies to construct genus-2 isogeny cryptography.

Trivial multiple zeta values over Tate algebras

Oguz Gezmis
Department of Mathematics, National Tsing Hua University
gezmis@math.nthu.edu.tw

Abstract

In 2016, Pellarin introduced the deformation of multiple zeta values over function fields defined by Thakur. In this talk, we study a special family of such values called trivial multiple zeta values. Moreover, we describe a module structure on the set of trivial multiple zeta values over a non-commutative polynomial ring and determine the generators of it under a certain condition on number of variables. Furthermore, we explain how one can detect linear relations among Thakur's multiple zeta values by using trivial multiple zeta values. This is a joint work with Federico Pellarin.

On the linear independence of certain multiple sums in positive characteristic

Ryotaro Harada
National Center for Theoretical Sciences
ryotaro@ncts.ntu.edu.tw

Abstract

In the research on number theory, it is known that there are many analogies between number fields and function fields over finite fields $\mathbb{F}_q$ (q is a power of prime number p). For example, $\mathbb{F}_q[\theta], \mathbb{F}_q(\theta), \mathbb{F}_q((1/\theta))$ and $\mathbb{C}_\infty$ are the analogues of $\mathbb{Z}, \mathbb{Q}, \mathbb{R}$ and $\mathbb{C}$ respectively. In this talk, we introduce the $\mathbb{F}_q(\theta)$-linear independence results of the deformation series which recover the positive characteristic analogues of multizeta values, alternating multizeta values and multiple polylogarithms at algebraic points. These results are shown by generalizing the idea in [C16] with the fiber coproduct of t-motives.

As a consequence, we establish some $\mathbb{F}_q(\theta)$-linearly independent sets of those three kinds of special values with indices of the same weight and give a lower bound of the dimension of the space generated by the depth one and higher depth multizeta values of the same weight in positive characteristic.

This talk is based on a joint work ([CH]) with Yen-Tsung Chen in National Tsing Hua University.

Keywords— multizeta values, t-module, t-motive

References

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[CH] Y.-T. Chen and R. Harada, *On the linear independence of certain special values in positive characteristic*, in preparation.

Multiplicative Jordan Decomposition and Nilpotent Decomposition in Integral Group Rings

Wei-Liang Sun

Mathematics Department, National Taiwan Normal University

E-mail: wlsun@ntnu.edu.tw

Abstract

In this talk, we will survey the development of the multiplicative Jordan decomposition (MJD) problem in integral group rings of finite groups. This problem was proposed by Alfred W. Hales and Inder Bir S. Passi in 1991. The purpose is to classify finite groups such that every unit in the integral group ring can be decomposed into a product of a semisimple unit and a unipotent unit. This classification has not been completed. We will also present positive and negative results for the group $Q_8 \times C_p$ for primes p (joint work with Wentang Kuo, University of Waterloo).

The study of MJD problem leads to a concept of the nilpotent decomposition in integral group rings. A nilpotent element in an integral group ring is said to have the nilpotent decomposition property (ND) if all its Wedderburn components still have integer coefficients. It is interesting but hard to classify integral group rings of finite groups such that all nilpotent elements have ND. We will present some results for integral group rings of finite SSN groups with such property (joint work with Eric Jespers, Vrije Universiteit Brussel).

Keywords— multiplicative Jordan decomposition, nilpotent decomposition, SN group, SSN group

References

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離散數學

Discrete Mathematics

Organizer：王彩蓮 國立中山大學應用數學系

地點：MA301 耕莘樓(3F)

2020 年 12 月 5 日 (星期六)		Speaker
11:20-12:05	Signed Mahonian Polynomials on Colored Permutations Chair：余冠儒	傅東山
14:00-14:25	The Strong Spectral Property for Graphs Chair：羅元勳	林晉宏
14:25-14:50	On the Study of Optical and Forwarding Indices of Graphs Chair：傅東山	羅元勳

2020 年 12 月 6 日 (星期日)		Speaker
10:10-10:55	Electrical Networks Chair：林晉宏	葉鴻國
11:00-11:25	Hamiltonicity on Graphs of Numbers Chair：葉鴻國	陳宏賓
11:25-11:50	Four Points Semidefi nite Programming Bounds for Spherical Codes Chair：陳宏賓	俞韋亘
11:50-12:15	Transferable Domination Number of Graphs Chair：俞韋亘	蔡馬良
14:00-14:25	Asymptotic Normality for Shape Parameters of Graph Tries Built from M-Regular Labeled trees Chair：鄭硯仁	俞讚城

Signed Mahonian polynomials on colored permutations

Tung-Shan Fu
Department of Applied Mathematics, National Pingtung University
E-mail: tsfu@mail.nptu.edu.tw

Abstract

The enumeration of the major index with sign over the symmetric group studied by Gessel and Simion (see [6, Corollary 2]) yields a remarkable factorization formula, called *signed Mahonian polynomial*. Adin, Gessel and Roichman [1] extended the polynomial to the signed permutation group, using the *flag major index* defined by Adin and Roichman [2]. We study the generating polynomial of the flag major index with each one-dimensional character over the colored permutation group, the wreath product of a cyclic group with the symmetric group. Using the insertion lemma of Haglund–Loehr–Remmel and a signed extension established by Eu *et al.* [5], we derive the signed Mahonian polynomial over the quotients of parabolic subgroups of the colored permutation group, for a variety of systems of coset representatives in terms of subsequence restrictions. This generalizes the related work over parabolic quotients of the symmetric group due to Caselli [4] as well as to Eu *et al.* [5]. We also derive a product formula that generalizes Biagioli's result about the signed Mahonian on the even signed permutation groups [3]. This talk is based on joint work with Sen-Peng Eu and Yuan-Hsun Lo.

Keywords— signed Mahonian polynomial, flag major index, colored permutation

References

[1] R.M. Adin, I. Gessel, Y. Roichman, *Signed Mahonians*, J. Combin. Theory Ser. A 109 (2005) 25–43.

[2] R.M. Adin, Y. Roichman, *The flag major index and group actions on polynomial rings*, European J. Combin. 22 (2001) 431–446.

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The strong spectral property for graphs

Jephian C.-H. Lin
Department of Applied Mathematics, National Sun Yat-sen University
E-mail: jephianlin@gmail.com

Abstract

A symmetric matrix A is said to have the strong spectral property if $X = O$ is the only symmetric matrix that satisfies $A \circ X = O$, $I \circ X = O$, and $AX - XA = O$. Here the operation $\circ$ is the entrywise product. If a matrix has the strong spectral property, then one may perturb the matrix slightly to create more nonzero entries without changing its spectrum. This behavior has been used widely for constructing matrices in the inverse eigenvalue problem of a graph. In this talk, we will show that if the nonzero pattern of the matrix is described by certain graphs, then it always has the strong spectral property.

Keywords— symmetric matrix, inverse eigenvalue problem, strong spectral property, graph

On the study of optical and forwarding indices of graphs

Yuan-Hsun Lo

Department of Applied Mathematics
National Pingtung University

yhlo@mail.nptu.edu.tw

The optical index is the minimum number of wavelengths needed to solve the routing and wavelength assignment problem, which arises from the investigation of optimal wavelength allocation in an optical network that employs Wavelength Division Multiplexing (WDM). The arc-forwarding index is known to be a natural lower bound of the optical index. In this talk, I will give a brief survey and some recent progress on the optical and arc-forwarding indices, as well as their undirected version: undirected optical and edge-forwarding indices.

Electrical Networks

Hong-Gwa Yeh

Department of Mathematics, National Central University

E-mail: hgyeh@math.ncu.edu.tw

Abstract

In this talk we give special focus on combinatorial applications of electrical networks. Fundamental results for calculation of electrical networks are reviewed in a didactic way. Then essentially known or more deeper results are introduced and proved under algebraic graph techniques combined with random walk methods in a more systematic way.

Hamiltonicity on Graphs of Numbers

Hong-Bin Chen

Department of Applied Mathematics, National Chung Hsing University

E-mail: andanchen@gmail.com

Abstract

Antonio Filz was the first (1982) noticing the prime circle phenomenon, that is, the numbers $1, 2, \cdots, 2n$ can be rearranged in a circle such that the sum of any two adjacent numbers is a prime number. Filz calculated how many prime circles are there for $2n \leq 10$ and posed an interesting question that "are there prime circles for all $2n$?" This conjecture is also collected by the mathematician Richard K. Guy, who passed away on 9 March 2020, in his well-known book 'Unsolved Problems in Number Theory'. However, to the best of our knowledge, it has been attracted little attention and still open for almost 40 years. In this talk, some recent developments related to this conjecture will be introduced. The content is based on joint work with Professor Hung-Lin Fu and Professor Jun-Yi Guo.

Keywords— prime sum graph, Filz's conjecture

References

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Four points semidefinite programming bounds for spherical codes

Wei-Hsuan Yu

National Central University
E-mail:**whyu@math.ncu.edu.tw**

Abstract

In this talk, we will introduce the four points semidefinite programming method applying on the estimation of the size of spherical codes. We improve the upper bounds for equiangular lines and spherical two-distance sets for several dimension. We will also like to discuss such approach to classical hard problems : kissing number problems.

Transferable domination number of graphs

Ma-Lian Chia
Department of Statistical Information and Actuarial Science, Aletheia University
E-mail: au4439@au.edu.tw

Abstract

Let G be a connected graph, and let $\mathcal{D}(G)$ be the set of all dominating (multi-)sets for G. For D_1 and D_2 in $\mathcal{D}(G)$, we say that D_1 is single-step transferable to D_2 if there exist $u \in D_1$ and $v \in D_2$, such that $uv \in E(G)$ and $D_1 - \{u\} = D_2 - \{v\}$. We write $D_1 \xrightarrow{*} D_2$ if D_1 can be transferred to D_2 through a sequence of single-step transfers. We say that G is k-transferable if $D_1 \xrightarrow{*} D_2$ for any D_1, $D_2 \in \mathcal{D}(G)$ with $|D_1| = |D_2| = k$. The transferable domination number of G is the smallest integer k to guarantee that G is l -transferable for all $l \geq k$. We study the transferable domination number of graphs in this talk, and give an upper bound for the transferable domination number of graphs.

Keywords— dominating set, domination number, transferable domination number

References

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Asymptotic normality for shape parameters of graph tries built from M-regular labeled trees

Tsan-Cheng Yu

Department of Mathematical Sciences, National Chengchi University

tsanchen@nccu.edu.tw

Abstract

Tries (from data reTRIEval) are one of the most popular data structures on words. They were first proposed by de la Briandais [1] in the late 1950s for information processing and are nowadays intensively used in data storage, IP routing, and DNA sequencing. In 2014, Philippe Jacquet [2] introduced a generalization of classical tries which he called graph tries (G-tries). Jacquet considered mean and variance of shape parameters of G-tries and conjectured a normal limiting distribution, as the number of independent label functions approaches infinity [3]. In this talk, we will explain our recent resolution of this conjecture. This is joint work with Michael Fuchs.

Keywords— G-tries, normal limiting distribution, shape parameters

References

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計算數學

Computational Mathematics

Organizer：薛名成 國立交通大學數學系

地點：LH103 理工綜合教室

2020 年 12 月 5 日 (星期六)		Speaker
11:20-12:05	Numerical Algorithms for Blow-Up Problems Chair：薛名成	卓建宏
14:00-14:25	Numerical Simulations for Interfacial Dynamics in Viscoelastic Fluids Chair：胡偉帆	曾昱豪
14:25-14:50	Adaptive Variational Model for Image Dehazing Chair：胡偉帆	謝博文

2020 年 12 月 6 日 (星期日)		Speaker
10:10-10:55	Structure-Preserving Eigensolvers for Large Sparse Structured Eigenvalue Problems Chair：薛名成	黃聰明
11:00-11:25	Mean Field and Parir Approximations in Schloegl's Second Model on a Bethe Lattice Chair：薛名成	王琪仁
11:25-11:50	Fluid-Structure Interactions: One-Field Monolithic Fictitious Domain Method and Its Parallelization Chair：林得勝	陳孟豁
11:50-12:15	Structure-Preserving Methods for Computing Complex Band Structures of Three Dimensional Photonic Crystals Chair：林得勝	林佳威

Numerical algorithms for blow-up problems

Chien-Hong Cho*

Dept. of Math., National Chung Cheng University, Chia-Yi, 621, Taiwan

** chcho20@ccu.edu.tw*

In many evolution equations, the solutions may become unbounded in a finite time. Such a phenomenon is known as blow-up and the finite time is called the blow-up time. Questions of particular interests for blow-up problem are whether a solution blows up or not and, if it does blow up, when, where and how a solution blows up. Blow-up problems are widely investigated in recent decades and analytical results are abundant. In this talk, we will put our attention on the numerical aspects for such problems. There are many numerical methods constructed to compute blow-up solutions. Some of them are known to be very effective in numerically resolving the concentration of singularities of a solution of PDEs, such as moving mesh for PDEs, rescaling algorithms and so on. However, to prove the convergence mathematically for those schemes are very difficult, as far as we know. There are also schemes supported by a convergence proof: strategies of adaptive temporal meshes and uniform temporal meshes. The first one is proposed by Nakagawa (1976), while we (2013) proposed the latter one. It is also remarkable that Matsue *et al.* (2019) provided a numerical validation procedure based on interval arithmetics for calculating blow-up profiles and blow-up times. We will briefly review these algorithms and report our recent results.

Numerical simulations for interfacial dynamics in viscoelastic fluids

Yu-Hau Tseng

Department of Applied Mathematics, National University of Kaohsiung

E-mail: yhtseng@nuk.edu.tw

Abstract

Viscoelastic fluids have broad applications in the industry and clinics, such as petroleum activities and blood flows. Understanding the fundamental mechanisms and phenomena behind such a complex fluid is intriguing and significant. We present a series of numerical simulations for the coaxial-viscoelastic-jets problem in three-dimensional axis-symmetrical space in this talk. The interfacial dynamics under different flow rates, capillary number, and Weissenberg number are studied accordingly. Furthermore, we also systematically present the instabilities of the interface configuration subject to small perturbations.

Keywords— Viscoelastic fluids, capillary number, Weissenberg number

Adaptive variational model for image dehazing

Po-Wen Hsieh

Department of Applied Mathematics, National Chung Hsing University

E-mail: pwhsieh@nchu.edu.tw

Abstract

Image dehazing plays an important role in image/video processing and computer vision applications. Its purpose is to eliminate haze to improve the visibility and quality of the image. However, due to the lack of scene information, including depth, transmission, and atmospheric light, haze removal essentially becomes a very challenging inverse problem. In this talk, we will introduce a simple and efficient enhancement model for image dehazing. The proposed method mainly utilizes a new idea of joint contrast and saturation enhancement. Several experiments are conducted to demonstrate the good performance of the proposed method.

Keywords— dehazing/defogging, image enhancement, variational image processing

References

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Structure-preserving eigensolvers for large sparse structured eigenvalue problems

Tsung-Ming Huang
Department of Mathematics,
National Taiwan Normal University
E-mail: min@ntnu.edu.tw.

September 21, 2020

Abstract

Consider the $\top$-palindromic quadratic eigenvalue problem ($\top$-PQEP)

$$\mathcal{Q}_p(\lambda)\mathbf{x} = \left(\lambda^2 A^\top - \lambda Q + A\right)\mathbf{x} = 0$$

with $Q^\top = Q$ and the gyroscopic quadratic eigenvalue problem (GQEP)

$$\mathcal{Q}_g(\lambda)\mathbf{x} = \left(\lambda^2 M + \lambda G + K\right)\mathbf{x} = 0$$

with $M^\top = M$, $G^\top = -G$ and $K^\top = K$. We see the important properties of the spectrums of $\top$-PQEP and GQEP that

$$\begin{aligned}\lambda \in \sigma(\mathcal{Q}_p(\lambda)) &\Leftrightarrow \lambda^{-1} \in \sigma(\mathcal{Q}_p(\lambda)),\\ \lambda \in \sigma(\mathcal{Q}_g(\lambda)) &\Leftrightarrow -\lambda, \bar{\lambda}, -\bar{\lambda} \in \sigma(\mathcal{Q}_g(\lambda)).\end{aligned}$$

λ, λ^{-1} are the eigenvalues of $\mathcal{Q}_p(\lambda)$ The numerical simulation of the band structure of three-dimensional photonic crystals leads to large-scale generalized eigenvalue problems (GEPs). For large sparse $\top$-PQEP and GQEP, the generalized $\top$-skew-Hamiltonian implicitly restarted shift-and-invert Arnoldi (G$\top$SHIRA) algorithm has been proposed to structurally compute the target eigenpairs. The novel non-equivalence deflation is also proposed to avoid as much as possible duplication of nearby known eigenvalues when a new shift of G$\top$SHIRA is determined. In this talk, we will introduce our developing friendly matlab codes for solving large sparse $\top$-PQEP and GQEP by using G$\top$SHIRA with/without non-equivalence deflation. Users can download and easily use these codes to solve their problems without any backgrounds of G$\top$SHIRA and non-equivalence deflation.

Algorithm 1 Structure-Preserving Doubling Algorithm for (SF1)

Require: $X_0 = H$, $Y_0 = -G$, $E_0 = A$, $F_0 = B$.
Ensure: X_∞ as the limit of X_i if it converges.
1: **for** $i = 0, 1, \ldots,$ until convergence **do**
2: compute E_{i+1}, F_{i+1}, X_{i+1}, Y_{i+1}:

$$\begin{aligned} E_{i+1} &= E_i(I_m - Y_i X_i)^{-1} E_i, \\ F_{i+1} &= F_i(I_n - X_i Y_i)^{-1} F_i, \\ X_{i+1} &= X_i + F_i(I_n - X_i Y_i)^{-1} X_i E_i \\ Y_{i+1} &= Y_i + E_i Y_i (I_n - X_i Y_i)^{-1} F_i. \end{aligned}$$

3: **end for**
4: **return** X_i at convergence as the computed solution.

Algorithm 2 Structure-Preserving Doubling Algorithm for (SF2)

Require: $X_0 = Q$, $Y_0 = 0$, $E_0 = A$, $F_0 = -B$.
Ensure: X_∞ as the limit of X_i if it converges.
1: **for** $i = 0, 1, \ldots,$ until convergence **do**
2: compute E_{i+1}, F_{i+1}, X_{i+1}, Y_{i+1}:

$$\begin{aligned} E_{i+1} &= E_i(X_i - Y_i)^{-1} E_i, \\ F_{i+1} &= F_i(Y_i - X_i)^{-1} F_i, \\ X_{i+1} &= X_i + F_i(X_i - Y_i)^{-1} E_i, \\ Y_{i+1} &= Y_i + E_i(Y_i - X_i)^{-1} F_i. \end{aligned}$$

3: **end for**
4: **return** X_i at convergence as the computed solution.

Mean field and parir approximations in Schloegl's second model on a Bethe lattice

Chi-Jen Wang

Department of Mathematics
National Chung Cheng University

cjwang@ccu.edu.tw

Schloegl's second model on a lattice involves spontaneous particle annihilation at rate p, and autocatalytic particle creation at empty sites with two or more occupied neighbors. Stochastic Kinetic Monte Carlo simulation with periodic boundary conditions is used to surmise the model. However, the persistence of boundary effects for a Bethe lattice complicates this process.

We present the hierarchical version of the master equations to analyze the behavior of the stochastic model. Analysis of this hierarchy of equations generally requires application of some type of hierarchical truncation approximation, where probabilities of larger ensembles or sites are written to terms of probabilities for smaller ensembles. We focus on lattice coordination number $z = 3$ for Bethe lattice, and predict a discontinuous transition to the vacuum state when p exceeds a critical value.

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

Meng-Huo Chen

Department of Mathematics, National Chung Cheng University

Abstract

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.

Structure-Preserving Methods for Computing Complex Band Structures of Three Dimensional Photonic Crystals

Jia-Wei Lin

Department of Applied Mathematics, National Chiao Tung University

E-mail: jiawei.am05g@g2.nctu.edu.tw

Abstract

This work is devoted to the numerical computation of complex band structure $\mathrm{k} = \mathrm{k}(\omega) \in \mathbb{C}^3$ for positive ω of three dimensional isotropic dispersive or non-dispersive photonic crystals from the perspective of structured quadratic eigenvalue problems (QEPs). Our basic strategy is to fix two degrees of freedom in $\mathrm{k} \in \mathbb{C}^3$ and to view the remaining one as the eigenvalue of a quadratic operator pencil derived from Maxwell's equations. Then Yee's scheme is employed to discretize $\nabla\times$ and $\mathrm{k}\times$ operators in this quadratic operator pencil. Distinct from the others' works which either ignore or directly exploit the Hamiltonian structure of the spectrum of the resulting QEP, we reformulate this QEP into an equivalent $\top$-palindromic QEP for which we have established the structure-preserving algorithm. Ultimately we rely on the generalized $\top$-skew-Hamiltonian implicitly restarted shift-and-invert Arnoldi (G$\top$SHIRA) algorithm to compute eigenvalues of a $\top$-skew-Hamiltonian pair which are near or in $[-2, 2]$, a much narrower region than the whole positive real axis in the origin problem. Moreover, to accelerate the inner iterations of the G$\top$SHIRA algorithm, we propose the preconditioning technique, making most of the eigenmatrix, which can essentially be seen as the Kronecker product of three discrete Fourier transformation matrices, of the commutative discretized $\partial_x, \partial_y, \partial_z$ operators. The advantage of our method is discussed in detail and corroborated by several numerical results.

Keywords— dispersive permittivity, complex band structure, gyroscopic quadratic eigenvalue problem, $\top$-palindromic quadratic eigenvalue problem, G$\top$SHIRA, FFT

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PROBABILITY

Organizer：須上苑 國立中央大學數學系

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2020 年 12 月 5 日 (星期六)		Speaker
11:20-12:05	Analysis of Poisson Space Noise Functionals Chair：許順吉	施信宏
13:35-14:00	Heat Kernel Bounds for Nonlocal Operators with Singular Kernels Chair：陳冠宇	Kyung-Youn Kim
14:00-14:25	Maximal Position in Discounted Branching Random Walks Chair：陳冠宇	洪芷漪
14:25-14:50	The Optimal Limit Prices of Limit Orders under an Extended Geometric Brownian Motion with Bankruptcy Risk Chair：陳冠宇	吳政訓

2020 年 12 月 6 日 (星期日)		Speaker
10:10-10:55	Distributed Consensus Learning for PCA and Support Vector Machines Chair：黃啟瑞	李育杰
11:00-11:25	A Crossover on Random Walk in Cooling Random Environment: Homogeneous vs Static Chair：陳隆奇	Yuki Chino
11:25-11:50	On generalized PóLya Urn Models and Stochastic Approximation Chair：陳隆奇	陳美如
11:50-12:15	Mean Field Games with Heterogeneous Groups: Application to Banking Systems Chair：陳隆奇	孫立憲

Analysis of Poisson Space Noise Functionals

Hsin-Hung Shih

Department of Applied Mathematics, National University of Kaohsiung

E-mail: hhshih@nuk.edu.tw

Abstract

Recently, Hida et al. [1, 2] introduced a noise of new type, which is called the Poisson space noise. It depends only on the space parameter, quite different from the time derivative of a Poisson process. Without applying the Bochner-Minlos theorem, in this talk, we will reconstructed Poisson space noise from the view of its path behavior. We study the existence Poisson space noise measure and its measurable support. In addition, we also establish the Segal-Bargmann transform of Poisson space noise functionals, and give an orthogonal decomposition of square-integrable Poisson space noise functionals.

Keywords— Poisson space noise, measurable support, Segal-Bargmann transform

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Heat kernel bounds for nonlocal operators with singular kernels

Kyung-Youn Kim

Department of Mathematical Sciences, National Chengchi University

E-mail: kykim@nccu.edu.tw

Abstract

We consider d-dimensional Markov processes which are written as d independent copies of 1-dimensional jump processes so that the jumping measures are singular with respect to the d-dimensional Lebesgue measures. We obtain the sharp two-sided bounds of the fundamental solution for the integro-differential operators corresponding to the Markov processes. This talk is based on the joint work with Moritz Kassmann and Takashi Kumagai for the α-stable processes, and the joint work with Lidan Wang for Markov processes with weakly scaling condition.

Keywords— Markov process, heat kernel, non-isotropic process

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Maximal Position in Discounted Branching Random Walks

Jyy-I Hong
National Chengchi University

Abstract

We consider a Galton-Watson branching random walk $\{Z_n, \zeta_n\}_{n\geq 0}$, where Z_n is the population of the nth generation and ζ_n is a collection of the positions on $\mathbb{R}$ of the the Z_n individuals in the nth generation. Let M_n be the maximal position in ζ_n. In this talk, we will discuss the limit behavior of M_n, as $n \to \infty$, for the explosive discounted branching random walks.

Keywords: branching random walks, branching processes, explosive

The optimal limit prices of limit orders under an extended geometric Brownian motion with bankruptcy risk

Cheng-Hsun Wu
Department of Financial Engineering and Actuarial Mathematics,
Soochow University
Email: chsunwu@scu.edu.tw

T[No.7]_[Cheng-Hsun Wu]_Abstract.

In the Black and Scholes system, the underlying asset price model follows a geometric Brownian motion (GBM) with no risk of bankruptcy. While GBM is a common-used model in the financial market, bankruptcy risk should be considered in the case of a severe economic crisis, such as that caused by the COVID-19 pandemic. The omission of bankruptcy risk could bring up greatly influence for setting trading strategies. In this article, we adopt an extended model of GBM with taking the bankruptcy risk into consideration and study its optimal limit price problem. The limit order is a classical trading strategy for investing the stock. First we construct the expected profit functions for the sell and buy limit orders and then derive their optimal limit prices. Furthermore, via sensitivity analysis, we discuss the influence of omission of bankruptcy risk in executing limit orders. This work is joint with Yu-Sheng Hsu and Pei-Chun Chen.

Keywords: geometric Brownian motion, limit orders, optimal limit prices

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Distributed Consensus Learning for PCA and Support Vector Machines

Yuh-Jye Lee
Department of Applied Mathematics, National Chiao Tung University
E-mail: yuhjye@math.nctu.edu.tw

Abstract

Nowadays, machine learning performs astonishingly in many different fields. The more data we have, our machine learning methods show better results. However, in some cases, the data owners may not want to or not allow to share the data they have. On the other hand, we may encounter extremely large data sets that even cannot be stored in a single machine. In order to deal with these two problems, we propose the distributed consensus framework and apply this framework to principal component analysis, PCA and linear and nonlinear Support Vector Machines. This framework is known as Federated Learning. Imagine that we have many local working units and a central master, and each working unit owns its data. The framework allows each local working unit works on its own data and submits the machine learning model to the central master. The central master will fuse the models collected from the local working units and then broadcast to the local working units. After certain iterations, we will have a model like the one generated by pooling all data together. Thus, the framework includes the following two merits. First, it keeps the privacy of data, for the local working units never share their data are to the central master or other local working units. Besides, when we confront a large dataset, which is hard to store in a single server, this framework may utilize many computational servers to work together to train the machine learning model using the entire dataset.

A crossover on random walk in cooling random environment: homogeneous vs static

Yuki Chino
Department of Applied Mathematics,
National Chiao Tung University

One-dimensional Random Walk in Cooling Random Environment (RWCRE) is obtained as a patchwork of one-dimensional Random Walk in Random Environment (RWRE) by resampling the environment along a sequence of deterministic times. The RWCRE model can be seen as a model that interpolates between the classical static model and the model with i.i.d. resamplings every unit of time. In this talk, we will see a crossover on asymptotic behavior of RWCRE between homogeneous and static cases.

On generalized Pólya urn models and stochastic approximation

May-Ru Chen

Department of Applied Mathematics, National Sun Yat-sen University

E-mail: mayru@faculty.nsysu.edu.tw

Abstract

Eggenberger and Pólya (1923) proposed an urn model, which is well-known as the Pólya urn and described as follows. An urn initially contains w white and r red balls. At each stage, one ball is drawn at random from the urn and then replaced in the urn along with c balls of the same color, where c is a fixed positive integer. Repeat the above procedure *ad infinitum*. It is known that the sequence of the proportions of white balls converges almost surely to a beta distributed random variable with parameters w/c and r/c.

In this talk, we first give a survey of urn models and stochastic approximation. Then we will show the asymptotic behavior of generalized Pólya urn models by using the stochastic approximation.

Keywords— urn model; martingale; atoms; absolutely continuous, stochastic approximation

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Mean Field Games with Heterogeneous Groups: Application to Banking Systems

Li-Hsien Sun

Graduate Institute of Statistics, National Central University

Abstract

We study the system of heterogeneous lending and borrowing based on the relative average of log-capitalization given by the linear combination of the average within groups and the ensemble average and describe the evolution of log-capitalization by a system of coupled diffusions. The model incorporates a game feature with homogeneity within groups and heterogeneity between groups where banks search for the optimal lending or borrowing strategies through minimizing the heterogeneous linear quadratic costs in order to avoid to approach the default barrier. Owing to the importance of relative concerns, the critical level of lending and borrowing is the relative ensemble average. The existence of the closed- and open-loop Nash equilibria for the two-group case is guaranteed by the solvability for the coupled Riccati equations. Both equilibria consist of the mean-reverting term identical to the homogeneous game and all group averages owing to heterogeneity. The comparison of the open-and closed loop Nash equilibria is also discussed. In addition, the existence of the approximate Nash equilibrium of the mean field games in the general d heterogeneous groups is also verified. Finally, in financial implications, we study the influence of the relative parameters and the number of banks on the corresponding liquidity rate through the numerical analysis.

Keywords— Systemic risk · inter-bank borrowing and lending system · heterogeneous group · relative ensemble average · Nash equilibrium · Mean Field Game.

偏微分方程

Partial Differential Equations

Organizer：吳恭儉 國立成功大學數學系

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2020 年 12 月 5 日 (星期六)		Speaker
11:20-12:05	A Revisit of the Velocity Averaging Lemma: on the Regularity of Stationary Boltzmann Equation in a Bounded Convex Domain Chair：郭鴻文	陳逸昆
14:00-14:25	Boundary-Layer Solutions of Kirchhoff Equations Chair：陳逸昆	李俊璋
14:25-14:50	The Encloure Method for the General Complex Conductivity Equation Chair：陳逸昆	關汝琳

2020 年 12 月 6 日 (星期日)		Speaker
10:10-10:55	Nodal Solutions for the Non-Autonomous Schrdinger-Poisson Systems in $\mathbb{R}^3$ Chair：吳恭儉	吳宗芳
11:00-11:25	The Existence of Solutions of 2-D Incompressible Navier-Stokes Equations with Surface Tension Chair：夏俊雄	蘇承芳
11:25-11:50	Relativistic Boltzmann Equation: Large time Behavior and Finite Speed of Propagation Chair：夏俊雄	呂明杰
11:50-12:15	L^1 Convergences and Convergence Rates of Approximate Solutions for Compressible Euler Equations near Vacuum Chair：夏俊雄	李信儀

A revisit of the velocity averaging lemma: on the regularity of stationary Boltzmann equation in a bounded convex domain

I-Kun Chen

Institute of Applied Mathematical Science
National Taiwan University
E-mail:**ikun.chen@gmail.com**

Abstract

We adopt the idea of velocity averaging lemma to establish regularity for stationary linearized Boltzmann equations in a bounded convex domain. Considering the incoming data, with three iterations, we establish regularity in fractional Sobolev space in space variable up to order 1^-. This talk is based on the joint work with Ping-Han Chaung, Chun-Hsiung Hsia, and Jhe-Kuan Su.

Boundary-layer solutions of Kirchhoff equations

Chiun-Chang Lee
Institute for Computational and Modeling Science, National Tsing Hua University
E-mail: chlee@mail.nd.nthu.edu.tw

Abstract

This talk introduce Kirchhoff equations of logistic type with small parameters on its nonlocal term. We show that the solution develops thin boundary layers. Moreover, the boundary concentration phenomena and the dependence of the thickness of boundary layer on those parameters are described. A remarkable idea is to combine the Pohozaev's identity with the Minkowski formula, which consequently derives the precise leading term of its nonlocal influence with respect to the model parameter. Moreover, much more refined asymptotics involving the boundary mean curvature effect is established.

Keywords— Kirchhoff equation, Singular perturbation, Boundary layers, Concentration phenomenon, Domain geometry

The encloure method for the general complex conductivity equation

Rulin Kuan
Math Department, National Cheng Kung University
E-mail: rkuan@ncku.edu.tw

Abstract

We use the enclosure-type method to reconstruct the convex hull of the unknown inclusions in a medium with a general anisotropic complex conductivity in $\mathbb{R}^n$. The main difficulty in this problem with anisotropic medium is that there are no complex geometrical optics solutions in general. Therefore, we construct another type of special solutions, called oscillating decaying solutions, for the anisotropic complex conductivity equations and adopt them as probing utilities. In our main theorem, the assumption on the boundary regularity of the unknown inclusion is only continuous.

Keywords— enclosure method, complex conductivity equations, oscillating decaying solutions, Runge approximation property

Nodal solutions for the non-autonomous Schrödinger–Poisson systems in $\mathbb{R}^3$

Tsung-fang Wu

Department of Applied Mathematics, National University of Kaohsiung, Taiwan

E-mail: tfwu@nuk.edu.tw

Abstract

In this talk, we will study the non-autonomous Schrödinger–Poisson system in the form:

$$\begin{cases} -\Delta u + u + \lambda K(x)\phi u = f(x)|u|^{p-2}u & \text{in } \mathbb{R}^3, \\ -\Delta \phi = K(x)u^2 & \text{in } \mathbb{R}^3, \end{cases} \tag{SP_λ}$$

where $\lambda > 0$, $2 < p < 6$ and the functions $f(x)$ and $K(x)$ are nonnegative continuous functions. In general, the existence of nodal solution for Schrödinger–Poisson systems with $4 \leq p < 6$ can be established by using the nodal Nehari manifold method. However, for the case of $2 < p < 4$, such an argument is not applicable because Palais-Smale sequences restricted on the nodal Nehari manifold can be not bounded. In this talk, we will introduce a novel constraint method to prove the existence of nodal solution to a class of non-autonomous Schrödinger–Poisson systems in the case of $2 < p < 4$. We conclude that such solution changes sign exactly once in $\mathbb{R}^3$ and is bounded in $H^1(\mathbb{R}^3) \times D^{1,2}(\mathbb{R}^3)$. Moreover, the existence of least energy nodal solution is obtained in the case of $\frac{1+\sqrt{73}}{3} < p < 4$, which remains unsolved in the existing literature. This work joint with Juntao Sun.

Keywords— Schrödinger–Poisson system, Nehari manifold, Nodal solutions.

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The existence of solutions of 2-D incompressible Navier-Stokes equations with surface tension

Cheng-Fang Su

Department of Applied Mathematics, National Chiao Tung University

E-mail: scf1204@nctu.edu.tw

Abstract

In our previous study, we established a solution to the Navier-Stokes equations on a moving domain with surface tension in an optimal Sobolev space. The primary key is how to use the penalty method to construct a solution to the penalty problem. In this talk, we provide another way to prove the existence of a solution in the same system. A particular system with artificial terms will be introduced, and then the Galerkin method can be used to construct a solution more relatively easy to understand. My talk bases on joint work with Professor Ching-Hsiao Cheng.

Keywords— the Navier-Stokes equations, surface tension, the free boundary problem, well-posedness problem

Relativistic Boltzmann Equation: Large time behavior and finite speed of propagation

Ming-Jiea Lyu
Department of Mathematics, National Cheng Kung University
mjlyu1978@gmail.com

Abstract

In this talk, we will study the asymptotic behavior of the relativistic Boltzmann equation in the whole space $\mathbb{R}^3_x$ under the closed to equilibrium setting. We obtained the existence, uniqueness, and large time behavior of the solution without imposing any Sobolev regularity (both the spatial and velocity variables) on the initial data. Moreover, we recognize the finite speed of propagation of the solution, which reflects the difference, in essence, between the relativistic Boltzmann equation and the classical Boltzmann equation. This work is jointed with Prof. Yu-Chu Lin and Kung-Chien Wu.

Keywords— relativistic Boltzmann equation, large time behavior, finite speed of propagation

L^1 Convergences and Convergence Rates of Approximate Solutions for Compressible Euler Equations near Vacuum

Hsin-Yi Lee

Department of Mathematics, National Central University

E-mail:apostol2000@hotmail.com

Abstract

In this talk, we introduce the rarefaction-wave case of the regularized Riemann problem [1] for compressible Euler equations with a small parameter ν. The solutions ρ_ν and v_ν of such problems stand for the density and velocity of gas flow near vacuum, respectively. We show that as ν approaches 0, the solutions ρ_ν and v_ν converge to the solutions ρ and v, respectively, of pressureless compressible Euler equations in L^1 sense. In addition, the L^1 convergence rates of these physical quantities in terms of ν are also investigated. The L^1 convergences and convergence rates are proved by two facts. One is to invent an a priori estimate coupled with the iteration method so that we obtain the uniform boundedness of $\partial_x^i \rho_\nu$ $(i = 0, 1, 2)$ and $\partial_x^j v_\nu$ $(j = 0, 1, 2, 3)$ on the requisite regions. The other is about convexity of characteristic curves, which is used to estimate the distances among characteristic curves in terms of ν. These theoretic results are also supported by numerical simulations. This is a joint work with Jay Chu, John M. Hong, and Ying-Chieh Lin.

Keywords— compressible Euler equations; vacuum; hyperbolic systems of conservation laws; Riemann invariants; regularized Riemann problem; convergence rate; method of characteristics; a priori estimate.

References

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[3] Li, T.T.: Global Classical Solutions for Quasilinear Hyperbolic Systems, volume 32 of RAM: Research in Applied Mathematics. Wiley, Chichester (1994)

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最佳化

Optimization

Organizer：許瑞麟 國立成功大學數學系

地點：MA306 耕莘樓(3F)

2020 年 12 月 5 日 (星期六)		Speaker
11:20-12:05	Algorithms in Phase Retrieval Chair：許瑞麟	陳鵬文
14:00-14:25	Two Approaches for Absolute Value Equations by Using Smoothing Functions Chair：陳鵬文	陳界山
14:25-14:50	Existence and Uniqueness of Zeros for Vector-Valued Functions with *K*-Adjustability Convexity and Their Applications Chair：陳鵬文	杜威仕

2020 年 12 月 6 日 (星期日)		Speaker
10:10-10:55	Optimization Techniques for Deep Learning Chair：許瑞麟	林智仁
11:00-11:25	Chair：許瑞麟	葉啟村
11:25-11:50	A Slacks-Based Measure Approach for Eciency Measurement of Recycling Production Systems with Feedback Factors Chair：陳界山	胡承方
11:50-12:15	Fast Algorithm for Minimum Variance Allocation among Constrained Intervals Chair：陳界山	孫新民
14:00-14:25	A Pseudo-polynomial Algorithm for the Joint Replenishment Problem with Box Constraints under the Power-of-Two Policy Chair：許瑞麟	林仁彥

Algorithms in phase retrieval

Pengwen Chen [1]

1. Applied Mathematics, National Chung Hsing University,
Taichung, Taiwan
E-mail:**pengwen@nchu.edu.tw**

Abstract

Phase retrieval aims to recover one unknown vector from its magnitude measurements, e.g., coherent diffractive imaging, where phase information is unavailable. The recovery of phase information can be formulated as one minimization problem subject to a non convex high-dimensional torus set. In theory, uniqueness of solutions can be obtained under random masks. The introduction of random masks actually breaks the symmetry of Fourier matrices and creates spectral gap for the local convergence of many phase retrieval algorithms, including alternative projection methods and Fourier Douglas-Rachford algorithm[1], which is one special case of Relaxed averaged alternating reflections(RAAR)[2, 3]. The spectral gap is related to the local convergence rate, which is related to RAAR parameter. In this talk, we introduce one max-min problem with variables (λ, z) to characterize the behavior of RAAR iterations. The limits of RAAR iterations are local max-min points. The key observation is that not every local minimizer z yields a local Nash equilibrium or a local max-min point (λ, z) in the higher dimensional space. By tuning the RAAR parameter, we can screen out local max-min points with smaller " curvature". In this way, undesired local minimizers can be excluded from the limits of RAAR.

References

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Two approaches for absolute value equations by using smoothing functions

Jein-Shan Chen
Department of Mathematics
National Taiwan Normal University
Taipei 11677, Taiwan
E-mail: jschen@math.ntnu.edu.tw

Abstract. In this talk, we present two approaches for solving absolute value equation. These two approaches are based on using some smoothing function. In particular, there are several systematic ways of constructing smoothing functions. Numerical experiments with comparisons are reported, which suggest what kinds of smoothing functions work well along with the proposed approaches.

Existence and Uniqueness of Zeros for Vector-Valued Functions with K-Adjustability Convexity and Their Applications

Wei-Shih Du

Department of Mathematics, National Kaohsiung Normal University, Kaohsiung 82444, Taiwan

E-mail: wsdu@mail.nknu.edu.tw

Abstract

In this talk, we introduce the new concepts of K-adjustability convexity and strictly K-adjustability convexity which respectively generalize and extend the concepts of K-convexity and strictly K-convexity. We establish some new existence and uniqueness theorems of zeros for vector-valued functions with K-adjustability convexity. As their applications, we obtain existence theorems for the minimization problem and fixed point problem which are original and quite different from the known results in the existing literature.

Keywords— K-convexity, strictly K-convexity, K-adjustability convexity, strictly K-adjustability convexity, nonlinear scalarization function, (e, K)-lower semicontinuous, zero for a vector-valued function, minimization problem, fixed point problem

Optimization techniques for deep learning

Chih-Jen Lin
Department of Computer Science and Information Engineering, National Taiwan University
E-mail: cjlin@csie.ntu.edu.tw

Abstract

Deep learning involves a difficult non-convex optimization problem. In this talk we explain how large-scale networks are currently being trained. In particular, we show that many past developments in numerical analysis such as fast matrix-matrix multiplications and automatic differentiation are heavily employed. We further discuss issues of existing approaches and possible research directions.

A Slacks-based Measure Approach for Efficiency Measurement of Recycling Production Systems with Feedback Factors

Cheng-Feng Hu

Department of Applied Mathematics, National Chiayi University

E-mail: cfhu@mail.ncyu.edu.tw

Abstract

Resources scarcity and environmental degradation have made sustainable resource utilization and environmental protection worldwide. In this work, a slack-based measure approach is proposed for the efficiency measurement of the circular economy system with feedback factors. A property that the system efficiency is a weighted average of the process efficiencies is derived. The proposed method is applied to assess the circular economy system of Euro state countries. Our results show that there are great disparities in the recycling production systems of Euro states, which reveals the source that causes the low efficiency of the circular economy system.

Fast Algorithm for Minimum Variance Allocation among Constrained Intervals

Hsin-Min Sun (孫新民)
Department of Applied Mathematics, National University of Tainan
E-mail: sunhm@mail.nutn.edu.tw

Abstract

In this talk I will present a fast algorithm for solving the following weighted minimum variance allocation model:

$$\text{(WMVA)} \qquad \begin{aligned} \min \quad & \sum_{i=1}^{n} c_i \left(x_i - \frac{c}{m} \right)^2 \\ \text{s.t.} \quad & \sum_{i=1}^{n} c_i x_i = c, \\ & a_i \le x_i \le b_i, \ i \in I = \{1, 2, \ldots, n\}, \end{aligned}$$

where $c_i > 0, i \in I$, $m = \sum_{i=1}^{n} c_i$, and $\frac{c}{m}$ is the weighted average.

Keywords— singly constrained quadratic program, quadratic knapsack problem, resource distribution

References

[1] Hsin-Min Sun and Ruey-Lin Sheu, *Minimum variance allocation among constrained intervals*, Journal of Global Optimization **74(1)** (2019), 21–44.

A PSEUDO-POLYNOMIAL ALGORITHM FOR THE JOINT REPLENISHMENT PROBLEM WITH BOX CONSTRAINTS UNDER THE POWER-OF-TWO POLICY

JEN-YEN LIN*

Abstract. The jointly replenishment problem (JRP) models concern how to determine lot sizes and to schedule replenishment times for n products so as to minimize the total costs per unit time. In real world, in order to share the common setup cost, to replenish some items together is an important issue. On the other hand, a lot of researchers try to add some constraints to their inventory systems. For example, power-of-two (PoT) policy for a smaller whole schedule, the minimum order quantity from the commitment, the maximum shipment size from the capacity constraints, etc. In this paper, we consider the JRP models with PoT policy and bounds for the replenishment time. We discuss the theoretical analysis for the models, propose a search algorithm for the global optimal solutions, compute the complexity of the proposed search algorithm and conduct some random experiments. Finally, there is a pseudo-polynomial-time algorithm proposed for solving the models in this paper.

(Jen-Yen Lin) Department of Applied Mathematics, National Chiayi University, No.300 Syuefu Road, Chiayi, 60004 Taiwan, R.O.C.
Email address: jylinor@gmail.com

Key words and phrases. JRP; PoT Policy; Resource Constraints; Complexity.
*Presenting author.

統計

STATISTICS

Organizer：黃禮珊 國立清華大學統計所

地點：PH118 耕莘樓(1F)

2020 年 12 月 5 日 (星期六)		Speaker
11:20-12:05	Causal Mediation of Semi-Competing Risks Chair：黃禮珊	黃彥棕
13:40-14:25	Statistical Learning for AI Assisted Clinics Chair：黃禮珊	盧鴻興
14:25-14:50	A Generalized Information Criterion for High-Dimensional PCA Rank Selection Chair：黃禮珊	洪弘

2020 年 12 月 6 日 (星期日)		Speaker
10:10-11:30	Optimal Design for Accelerated-Stress Acceptance Test Chair：洪弘	蔡志群
	Testing Independence Between Two Spatial Random Fields Chair：洪弘	黃世豪
	A Bayesian Variable Selection Approach to Genome-Wide Association Studies with Survival Outcome Chair：洪弘	簡立欣
11:50-12:15	Detection of Change Points for Weibull Distributed Time Series Data Chair：洪弘	楊子賢

Causal mediation of semi-competing risks

Yen-Tsung Huang
Institute of Statistical Science, Academia Sinica

Abstract

The semi-competing risk problem arises when one is interested in the effect of an exposure or treatment on both intermediate (e.g., having cancer) and primary events (e.g., death) where the intermediate event may be censored by the primary event, but not vice versa. Here we propose a nonparametric approach casting the semi-competing risks problem in the framework of causal mediation modeling. We set up a mediation model with the intermediate and primary events, respectively as the mediator and the outcome, and define indirect effect (IE) as the effect of the exposure on the primary event mediated by the intermediate event and direct effect (DE) as that not mediated by the intermediate event. A Nelson-Aalen type of estimator with time-varying weights is proposed for direct and indirect effects where the counting process at time t of the primary event $N_{2n_1}(t)$ and its compensator $A_{n_1}(t)$ are both defined conditional on the status of the intermediated event right before t, $N_1(t^-) = n_1$. We show that $N_{2n_1}(t) - A_{n_1}(t)$ is a zero-mean martingale. Based on this, we further establish the asymptotic unbiasedness, consistency and asymptotic normality for the proposed estimators. Numerical studies including simulation and data application are presented to illustrate the finite sample performance and utility of the proposed method.

Statistical Learning for AI Assisted Clinics

Henry Horng-Shing Lu
Institute of Statistics, National Chiao Tung University
E-mail: hslu@stat.nctu.edu.tw

Abstract

This study reports the co-developments of artificial intelligence (AI) assisted clinics with Taipei Veterans General Hospital. The designs of computer assisted diagnosis systems with deep learning techniques by multi-modalities of medical images are discussed for specific clinical applications. The related issues are investigated for the integration of statistical models, computational algorithms and domain knowledge. The current developments are summarized and the future potential studies are discussed.

Keywords— statistical learning, deep learning, artificial intelligence (AI)

A generalized information criterion for high-dimensional PCA rank selection

Hung Hung

Institute of Epidemiology and Preventive Medicine, National Taiwan University, Taiwan

Abstract

Principal component analysis (PCA) is a commonly used statistical procedure for dimension reduction. An important issue for PCA is to determine the rank, which is the number of dominant eigenvalues of the covariance matrix. Among information-based criteria, Akaike information criterion (AIC) and Bayesian information criterion (BIC) are two most common ones. Both use the number of free parameters for assessing model complexity, which may suffer the problem of model misspecification. To alleviate this difficulty, we propose using the generalized information criterion (GIC) for PCA rank selection. The resulting GIC model complexity takes into account the sizes of eigenvalues and, hence, is more robust to model misspecification. The asymptotic properties and selection consistency of GIC are derived under the high-dimensional setting. Compared to AIC and BIC, the proposed GIC is better capable than AIC in excluding noise eigenvalues, and is more sensitive than BIC in detecting signal eigenvalues. Moreover, we discuss an application of GIC to selecting the number of factors for factor analysis. Our numerical study reveals that GIC compares favorably to the methods based on (deterministic) parallel analysis.

Optimal Design for Accelerated-Stress Acceptance Test

Chih-Chun Tsai*, Chien-Tai Lin
Department of Mathematics, Tamkang University, Tamsui, Taiwan

N. Balakrishnan
Department of Mathematics and Statistics, McMaster University,
Hamilton, Ontario, Canada

Abstract

Acceptance test is widely used to assess whether a product meets the expectations of customers. Yet, traditional acceptance tests based on time-to- failure data will not be practical, because today's highly reliable products may take a long time to fail. It may be good in this case to base a test on a suitable quality characteristic (QC) whose degradation over time is related to the reliability of the product. Motivated by resistor data, we first propose a degradation model to describe the degradation paths of the resistors. Next, we present an accelerated-stress acceptance test to cut down the acceptance testing time, and then derive the optimal accelerated-stress acceptance testing time for a product, and the probability of acceptance of the batch. A model incorporating cost is also used to determine the optimal design for an accelerated-stress acceptance experiment, and a motivating example is then presented to illustrate the proposed procedure. Finally, we examine the performance of the estimators, and the effect of misspecification of the parameters on the optimal test plan through a Monte Carlo simulation study, and a detailed sensitivity analysis.

Keywords— Quality characteristic, optimal accelerated-stress acceptance testing time, optimal test plan, parameter misspecification, cost function, sensitivity analysis.

Testing Independence Between Two Spatial Random Fields

Shih-Hao Huang

Department of Mathematics, National Central University, Taiwan

Abstract

We consider testing independence between two spatial Gaussian random fields evaluated respectively at p and q locations with sample size n, where p and q are allowed to be larger than n. Our approach is based on canonical correlation analysis (CCA), without imposing any spatial stationarity and parametric structure for the two random fields. Instead of applying CCA directly to the two random fields, which is not feasible for high-dimensional testing considered, we adopt a dimension-reduction approach using a special class of multiresolution spline basis functions. These functions are ordered in terms of their degrees of smoothness. By projecting the data to the function space spanned by a few leading basis functions, the spatial variation of the data can be effectively preserved. The test statistic is constructed from the first sample canonical correlation coefficient in the projected space and is shown to have an asymptotic Tracy-Widom distribution under the null hypothesis. Our proposed method automatically detects the signal between the two random fields and is designed to handle irregularly spaced data directly. In addition, we show that our test is consistent under mild conditions and provide simulation experiments to demonstrate its powers. Moreover, we apply our method to investigate whether the precipitation in continental east Africa is related to the sea surface temperature (SST) in the Indian Ocean, and whether the precipitation in west Australia is related to the SST in the North Atlantic Ocean. (Work done jointly with H.-C. Huang, R. S. Tsay, and G. Pan.)

Keyword: canonical correlation analysis, dimension reduction, high-dimensional test, irregularly spaced data, multiresolution spline basis functions, teleconnection, Tracy-Widom distribution.

A Bayesian Variable Selection Approach to Genome-Wide Association Studies with Survival Outcome

Li-Hsin Chien[1], I-Shou Chang[2], Chao A. Hsiung[1]

[1]Institute of Population Health Sciences, National Health Research Institutes

[2]National Institute of Cancer Research, National Health Research Institutes

E-mail: lihsinchien@nhri.edu.tw

Abstract

Genome-wide association studies (GWAS) using survival time as phenotype deserve attention. Important examples include time to progression or recurrence free survival of a cancer patient underwent a specific treatment and onset time of certain disease or biological event. Most existing GWAS utilize single SNP analysis that does not model the problem properly and hence is not statistically efficient. Moreover, while GWAS results are often reproducible, the discoveries can explain only small amount of heritability. We propose a Bayesian variable selection approach to GWAS with survival outcome by utilizing Weibull regression model, in which the parameter describing the proportion of the variance of the survival phenotype explained by the covariates (PVE) admits an analytic form. Treating GWAS as a Bayesian variable selection problem, we extend Bayesian variable selection regression (BVSR) for GWAS using multiple linear regression. In particular, we compute posterior distribution of PVE and posterior inclusion probability of each SNP for inference. The former is useful in planning future genetic studies. The latter describes the confidence of the association results. A carefully designed MCMC algorithm is used to sample the posterior distribution. Simulation studies show that both PVE and PIP (posterior inclusion probability) can be studied successfully and this method outperforms the single SNP analysis methods in terms of the plot of the number of true positive findings versus the number of false positive findings. We illustrate the method by studying the association between SNPs and the progression-free survival in never-smoking lung adenocarcinoma patients treated with first-line Tyrosine Kinase Inhibitors.

Keywords— Bayesian variable selection, GWAS, Survival

Detection of Change Points for Weibull Distributed Time Series Data

Tzu-Hsien Young,
Department of Applied Mathematics, National Chiao Tung University, HsinChu, Taiwan,
E-mail: yhps910454.am08g@nctu.edu.tw
Pi-Wen Tsai,
Department of Mathematics, National Taiwan Normal University, Taipei 106, Taiwan,
Chih-Yu Kuo,
Research Center for Applied Sciences, Academia Sinica, Taipei 115, Taiwan,
Wen-Yi Chang,
National Center for High-Performance Computing,
National Applied Research Laboratories, Hsinchu, Taiwan

Abstract

Wind power is a valuable sustainable energy that many countries have been agreesively developing. In energy resource assessments, understanding the regional wind properties is a crucial problem. A common way of the assessments is to model the wind speed data with a two-parameter Weibull distribution, in which the scale and shape parameter are estimated from the measurement data. This process succeeds when the data follow a unique specific Weibull distribution. However, if there are change points, at which the wind speed distribution changes, the changes in wind properties cause the statistical error margins in the energy resource assessments. To address the issue more accurately, one approach is to identify the change points and perform the assessments on the dissected sectional data. For this purpose, we propose to use the prune exact linear time (PELT, Killick *et al.*,2012) algorithm, combining with detection of changes of Weibull distribution parameters. The PELT algorithm has an excellent linear complexity, $O(n)$, which is particularly suitable for large amount of time series data. The change point detection is based on the maximum-likelihood method. To demonstrate the method, we first construct a synthesized wind speed time series, containing three sets of Weibull distributions, i.e. with two deliberately added change points. The detection result indicates that the present method resolves the change points more accurately than the classical change point detection scheme with normal distributions. Finally, we apply the method to the real Fuhai offshore wind mast data, taken between 2017/11/18 and 2018/10/26.

The present method identified two significant change points occurring on 2018/02/26 and 2018/09/23, and they agree precisely with the transitional periods between the winter and summer monsoon seasons in Taiwan.

This research is supported in parts under MOST, 109-2218-E-001 -003.

Keywords— time series, Weibull distribution, change points, PELT

References

[1] R. Killick and P. Fearnhead and I. A. Eckley, *Optimal Detection of Changepoints With a Linear Computational Cost*, J. Am. Stat. Assoc., **107** (500), 1590-1598

資訊數學

INFORMATION MATHEMATICS

Organizer：潘俊杰 輔仁大學數學系

地點：MA307 耕莘樓(3F)

2020 年 12 月 5 日 (星期六)		Speaker
11:20-12:05	從 [資訊 , 數學] 到 [創造力 , 創新] 的分享 Chair：邱文齡	蘇建華
14:00-14:25	如何為你夢想的工作 準備最好的自己！ Chair：潘俊杰	詹雁如
14:25-14:50	透過框架優先緩解真實威脅 Chair：梅興	翁浩正

2020 年 12 月 6 日 (星期日)		Speaker
10:10-10:55	密碼學實務中的數學 Chair：王姿月	陳君明
11:00-11:25	Image Generation with Structure Information of the Latent Chair：蔡炎龍	魏澤人
11:25-11:50	數學能在深度學習發揮什麼樣的功用？ Chair：魏澤人	蔡炎龍

從 [資訊，數學] 到 [創造力，創新] 的分享

From [Math] to [Creativity and Innovation] Sharing

蘇建華

NOVAtime創辦人

Abstract

Part one: About Myself…

Connecting the “dots”

Part two: 3 Good News

1. 數位轉型— 第四次工業革命 商機
2. 2020 世界經濟論壇 －技能再造
3. 數學家在 職場的快樂指數是 前 27%

Part three: 3 Stories to share

1. 2004 PUSH -> 2007 SaaS story
2. 2008 Security penetration testing story
3. 2013 S.M.A.R.T. roadmap to drive team innovation

如何為你夢想的工作
準備最好的自己！
Landing Your Dream Job

NOVAtime 共同創辦人 詹雁如

Abstract

- About Myself
- Begin with the End in Mind – Set Your Goal
- Preparation – Resume & Interview

透過框架優先緩解真實威脅

翁浩正
戴夫寇爾股份有限公司

摘要

任何企業要達到適切的安全都須仰賴正確的資安策略。但資安策略的困境往往不夠明確、難以實踐、脫離真實，除了難以幫助企業減緩資安威脅、也無法達成有限預算的投放。

資安策略的制訂很困難，但參考框架的話就可以事半功倍，像是 NIST Cybersecurity Framework (CSF)、MITRE ATT&CK、CIS 等等。而這麼多框架到底是什麼？彼此間的關係為何？怎麼選用才能避免淪為紙上談兵？而面對真實威脅時，如何以更完整的角度去緩解一連串的脆弱的環節？我們期待透過這場議程，幫助企業理解資安策略的訂定方式。選擇適合自己的框架項目，更可明確制訂每個階段的目標，讓企業推動資安實踐的過程更為具體並且正確應對真實威脅。

密碼學實務中的數學

陳君明

摘要

由於網路與無線通訊的普及，資訊安全的重要性遠高於過往。密碼學為資安防護的基石，演算法設計與密碼系統攻防皆需要大量數學工具。呼應近年量子電腦的發展，我們除了說明現今密碼學的數學基礎，也將介紹可抵抗量子電腦攻擊之「後量子密碼」(PQC, Post-Quantum Cryptography) 數學背景。

Image generation with structure information of the latent space

Tzer-jen Wei
College of Artificial Intelligence, NCTU
E-mail: tjw@nctu.edu.tw

Abstract

In this talk, we discuss our approach of deep learning image generation models that exploit the structure information of the latent space. Image generation is one of the most active research field in deep learning. GAN(generative adversarial networks) and VAE(variational autoencoder) are among the most popular ones. Typical unconditional deep image generative models use deep neural networks map points in the latent space to generated images. The latent spaces have no predefined meanings and may vary time to time during the training. There are also conditional variations of these generative models, but typically require training images to be labeled beforehand. However, even unlabeled image datasets may have certain known structues. For instance, we may use certain method to measure the distance between any pair of these images and can assume the distance is very close to their distance in the latent space. Or we can assume the latent space can be decomposed in to a few orthogonal subspaces. We expolit this property to design our generative models, which yields models with nice quality comparable to GAN, but are much easier and faster to train. We will also demostrate a few real world applications based on this research.

Keywords— Deep learning, Generative model, GAN

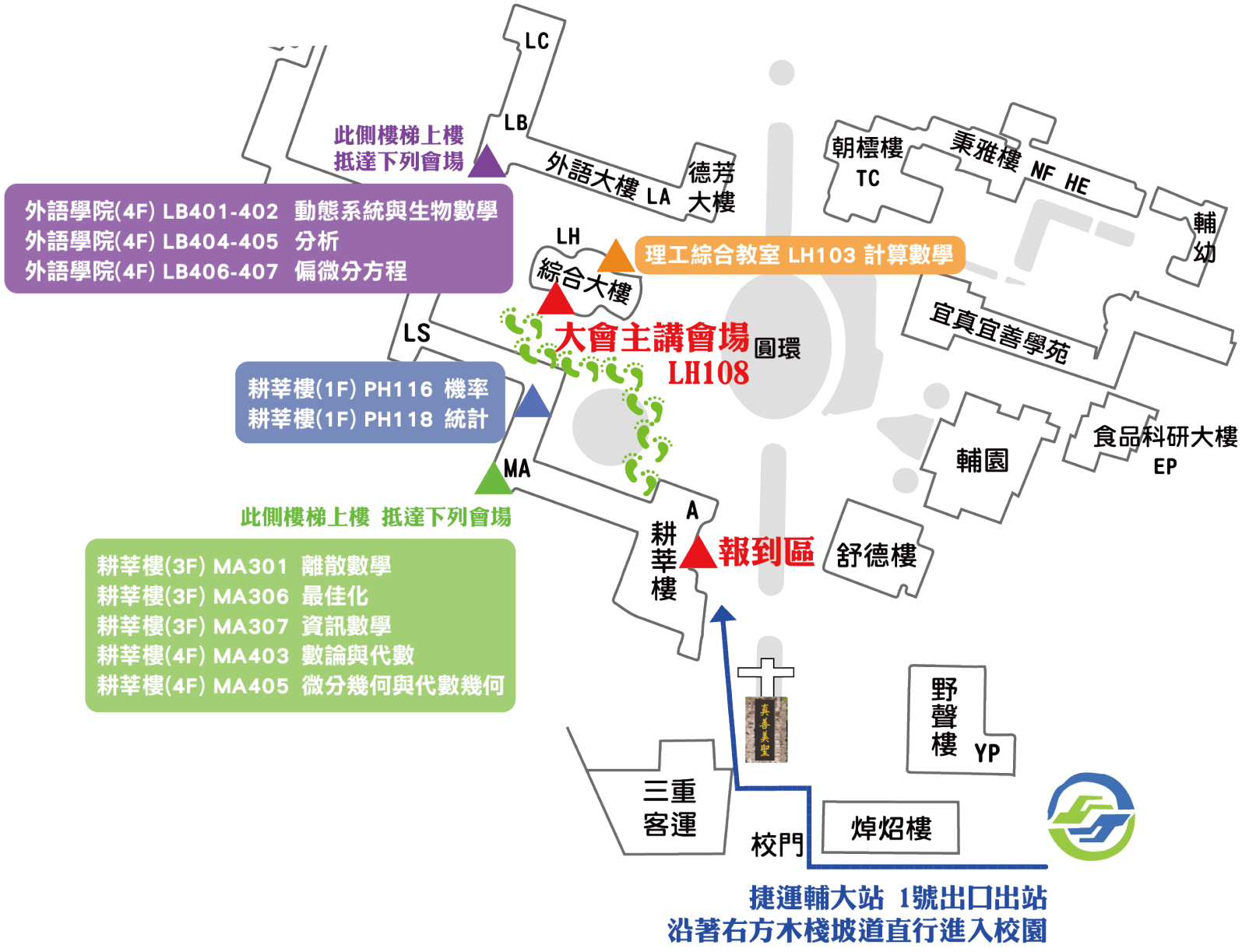
數學能在深度學習發揮什麼樣的功用?

政治大學應用數學系 蔡炎龍

大綱

深度學習近年來可以說成為人工智慧的主流技術。我們以為一個深度學習的問題, 在領域專家、資訊專家、還有具良好數學訓練的專家, 可以提供不同層面的幫助。這個演講之中, 我們很快介紹深度學習的原理是什麼, 而具有數學背景的人, 可以怎麼樣發揮別人難以取代的角色。

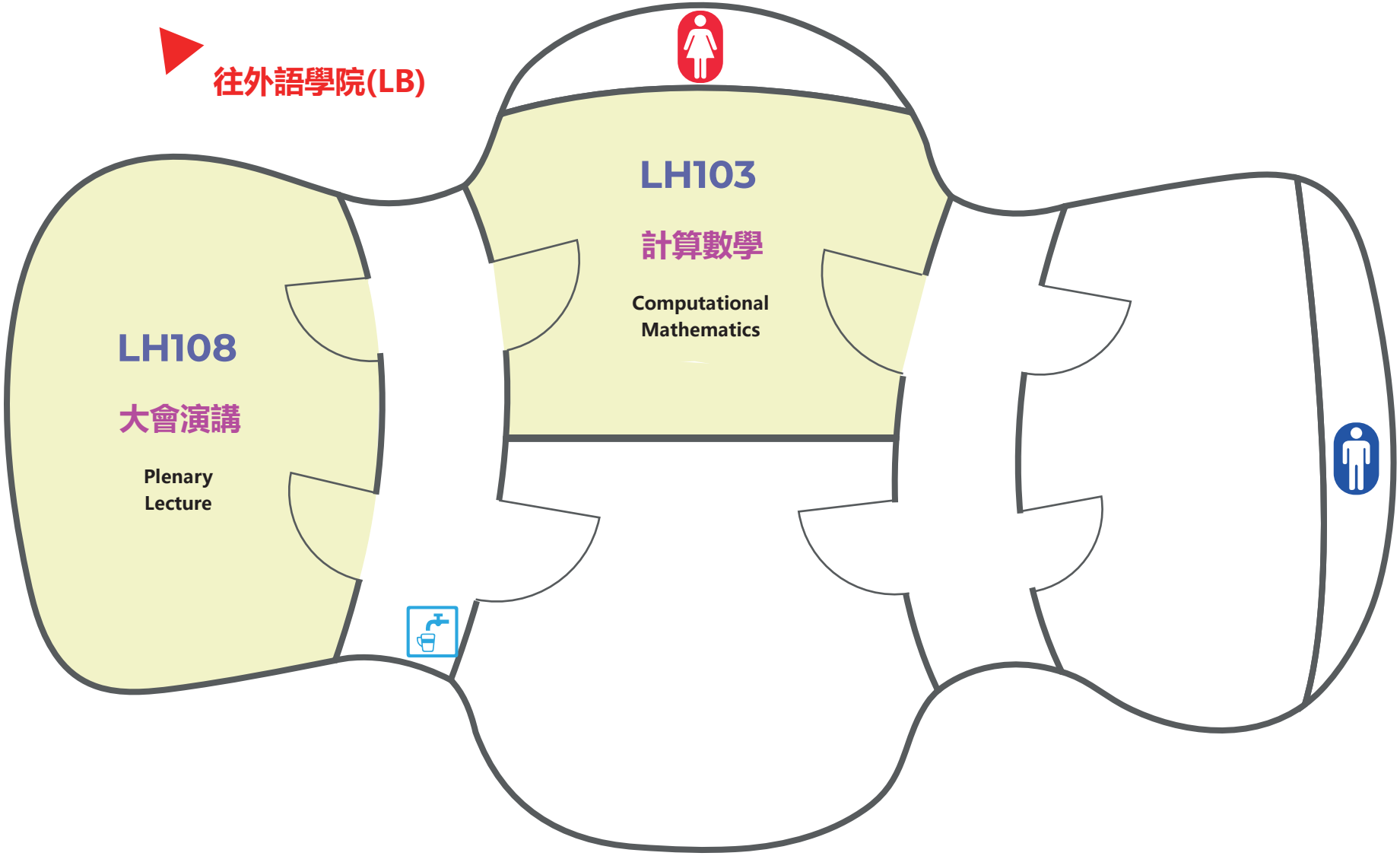
會場地圖


LC
LB
此側樓梯上樓
抵達下列會場
外語學院(4F) LB401-402 動態系統與生物數學
外語學院(4F) LB404-405 分析
外語學院(4F) LB406-407 偏微分方程
外語大樓 LA
德芳大樓
朝標樓 TC
秉雅樓 NF HE
輔幼
LH
綜合大樓
理工綜合教室 LH103 計算數學
大會主講會場 LH108
圓環
宜真宜善學苑
LS
耕莘樓(1F) PH116 機率
耕莘樓(1F) PH118 統計
輔園
食品科研大樓 EP
MA
此側樓梯上樓 抵達下列會場
耕莘樓(3F) MA301 離散數學
耕莘樓(3F) MA306 最佳化
耕莘樓(3F) MA307 資訊數學
耕莘樓(4F) MA403 數論與代數
耕莘樓(4F) MA405 微分幾何與代數幾何
A
耕莘樓
報到區
舒德樓
野聲樓 YP
三重客運
校門
焯炤樓
捷運輔大站 1號出口出站
沿著右方木棧坡道直行進入校園

報到區 – 耕莘樓大廳


往會場
方向
線上註冊完成者報到區
學生
大學生
學生
碩博士生
研究助理
含其他/在職
學者
非會員
學者
會員
數學會
會費
繳交處
櫃臺開放時間
12/5 08:30-18:00
12/6 08:30-15:30
現場報名繳費區
非會員
會員
碩博生
繳費
有誤
行李寄放
交通補助
與會證明
報到處
入口

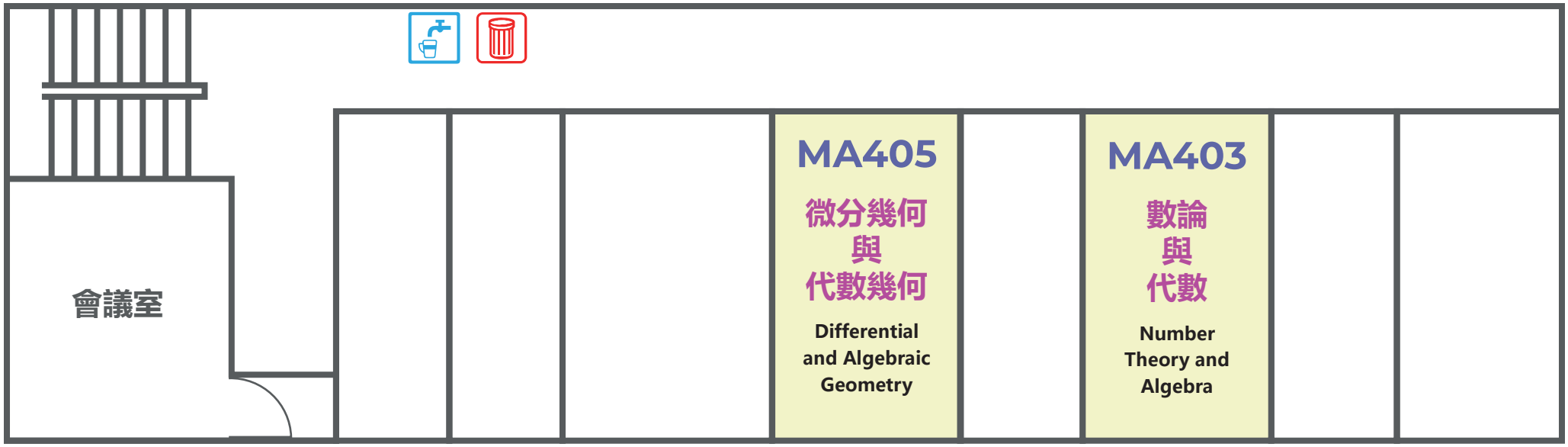
理工綜合大樓平面圖


往外語學院(LB)
LH103
計算數學
Computational Mathematics
LH108
大會演講
Plenary Lecture
往數學系

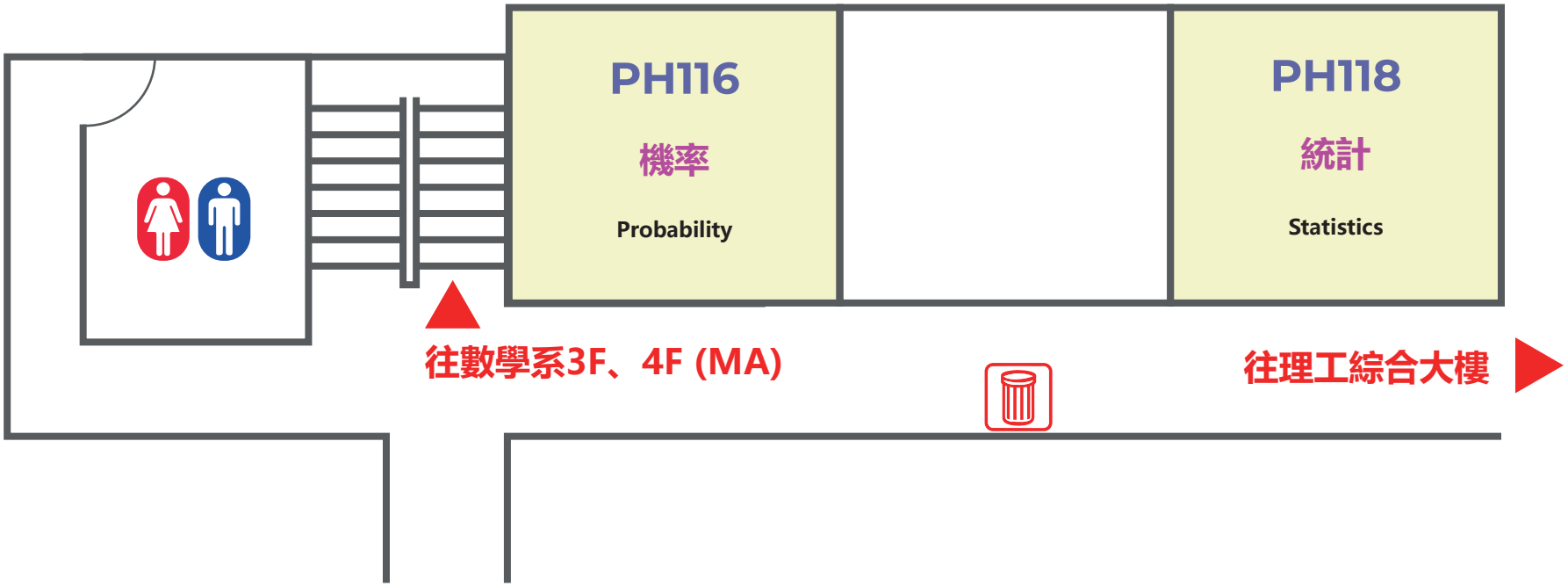
耕莘樓三樓平面圖


MA307
資訊數學
Information Mathematics
MA306
最佳化
Optimization
MA301
離散數學
Discrete Mathematics

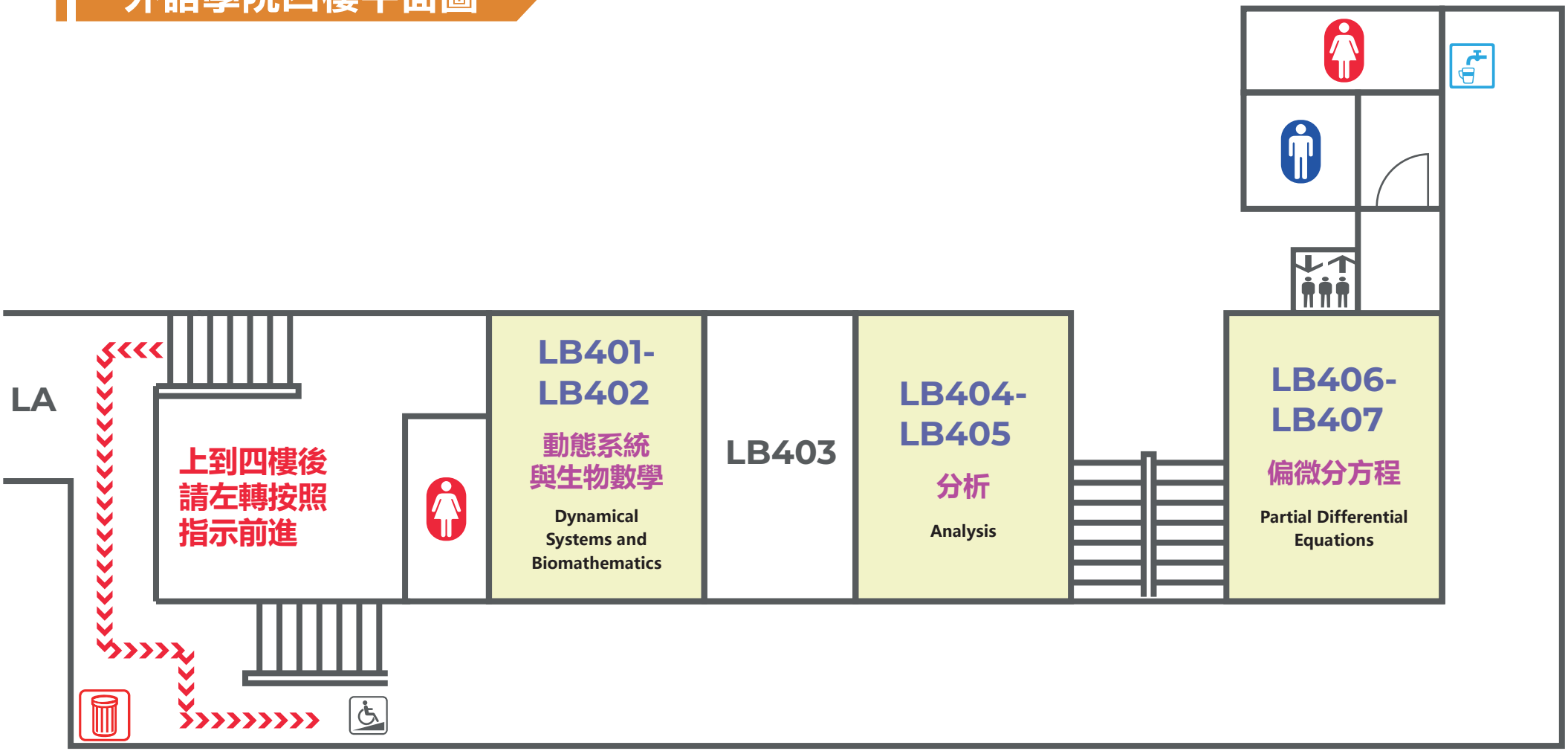
耕莘樓四樓平面圖


會議室
MA405
微分幾何
與
代數幾何
Differential
and Algebraic
Geometry
MA403
數論
與
代數
Number
Theory and
Algebra

耕莘樓一樓平面圖


PH116
機率
Probability
PH118
統計
Statistics
往數學系3F、4F (MA)
往理工綜合大樓

外語學院四樓平面圖


LA
上到四樓後
請左轉按照
指示前進
LB401-
LB402
動態系統
與生物數學
Dynamical
Systems and
Biomathematics
LB403
LB404-
LB405
分析
Analysis
LB406-
LB407
偏微分方程
Partial Differential
Equations

取得 Wi-Fi 帳密步驟

1. 開啟無線網路並連線『FJU-Guest』，並打開瀏覽器，點選頁面下方 "請由此取得訪客帳號" 連結
2. 活動代碼：89413625
3. 產生帳號密碼後，即可使用此組帳密連線學校無線網路

Android, iOS, Mac 連線請選 『FJU-802.1X』

Windows 連線請選 『FJU-PEAP』

連線相關可參考以下說明：

http://www.cc.fju.edu.tw/networkServices.jsp?labelID=5