# 2016中華民國數學年會
# Taiwan Mathematical Society Annual Meeting

# 大會手冊

主辦單位：中華民國數學會

承辦單位：國立東華大學應用數學系

協辦單位：科技部數學研究推動中心

會議時間：2016年12月10日(星期六)-12月11日(星期日)

大會網址：http://faculty.ndhu.edu.tw/~2016TMS/index.htm

# 2016 年中華民國數學年會

## Taiwan Mathematical Society Annual Meeting

會議時間：2016 年 12 月 10 日(星期六)-12 月 11 日(星期日)
地　　點：國立東華大學理工一館
主辦單位：中華民國數學會
承辦單位：國立東華大學應用數學系
協辦單位：科技部數學研究推動中心
贊助單位：科技部數學研究推動中心、中華民國數學會、
　　國立東華大學、國立東華大學理工學院

贊助廠商：昊青股份有限公司、Springer、璞美資訊公司

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國立台灣大學數學系　王振男
國立中央大學數學系　林欽誠
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# 2016年中華民國數學年會

**2016 Taiwan Mathematical Society Annual Meeting**

**2016年12月10日(星期六)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 8:30-9:30 | Registration 報到註冊 | | | | | | | | | 理工一館 理一講堂外側走廊 |
| 9:30-10:00 | Opening Ceremony 年會開幕式<br>Chair：President Ming-Chih Lai 主持人賴明治 理事長 | | | | | | | | | 理一講堂 |
| 10:00-10:50 | Plenary Lecture by Professor François Loeser 大會演講 François Loeser 教授<br>Chair ：Professor Jungkai Alfred Chen 主持人 陳榮凱 教授 | | | | | | | | | 理一講堂 |
| 10:50-11:10 | Group Photo 團體照 | | | | | | | | | 圖書館前廣場 |
| 11:10-11:30 | Coffee Break 茶會、討論 | | | | | | | | | 理B301、理B302 |
| Sessions | 數論與代數 | 分析 | 幾何 | 動態系統 生物數學 | 偏微分方程 | 離散數學 | 計算數學 | 機率 | 最佳化 | 數學科普 |
| | Number Theory and Algebra | Analysis | Geometry | Dynamical Systems and Biomathematics | Partial Differential Equations | Discrete Mathematics | Computational Mathematics | Probability | Optimization | Public Lecture in Mathematics |
| page | pp.9-12 | pp.15-18 | pp.23-26 | pp.29-34 | pp.41-47 | pp.53-58 | pp.67-72 | pp.83-88 | pp.95-103 | pp.113-115 |
| Room | 理A307 | 理A310 | 理A314 | 理A211 | 理A210 | 理A318 | 理A212 | 理D131 | 理D241 | 11:00-12:30 理二講堂 李國偉 Ko-Wei Lih |
| 11:30-12:20 | 林牛 Nagu Lam | 沈俊嚴 Chun-Yen Shen | 崔茂培 Mao-Pei Tsui | 王信華 Shin-Hwa Wang | 黃信元 Hsin-Yuan Huang | 符麥克 Michael Fuchs | 王偉仲 Wei-Chung Wang | Akira Sakai | 許瑞麟 Ruey-Lin Sheu | |
| 12:20-13:40 | Lunch 午餐<br>Bilateral Talk between KMS & TMS 與韓國數學會舉行雙邊會談 | | | | | | | 理B301、理B302<br>理A324 | | |
| 13:40-14:05 | 林濬璈 Jyun-Ao Lin | 黃毅青 Ngai-Ching Wong | 何忠益 Chung-I Ho | 羅主斌 Chu-Pin Lo | 王烽彬 Feng-Bin Wang | 阮夙姿 Su-Tzu Juan | 林敏雄 Min-Hsiung Lin | 徐禮虎 Li-Hu Xu | 賴漢卿 Hang-Chin Lai | 13:30-15:30 理A316 莊惟棟 Wei-Tung Chuang |
| 14:05-14:30 | | | | 張志鴻 Chih-Hung Chang | 吳昌鴻 Chang-Hong Wu | 黃明輝 Ming-Hway Huang | 蔡炎龍 Yen-lung Tsai | 洪芷漪 Jyy-I Hong | 胡承方 Cheng-Feng Hu | |
| 14:30-15:00 | Coffee Break 茶會、討論 | | | | | | | 理B301、理B302 | | |
| 15:00-15:25 | 陳昱宇 Shih-Yu Chen | 李明憶 Ming-Yi Lee | 蕭欽玉 Chin-Yu Hsiao | 黃少遠 Shao-Yuan Huang | 郭鴻文 Hung-Wen Kuo | 葉光清 Roger K. Yeh | 吳金典 Chin-Tien Wu | 劉聚仁 Gi-Ren Liu | 林炎成 Yen-Cherng Lin | |
| 15:25-15:50 | | | | 梁育豪 Yu-Hao Liang | 陳志有 Zhi-You Chen | 商珍綾 Jen-Ling Shang | 舒宇宸 Yu-Chen Shu | 陳韋達 Wei-Da Chen | 黃同瑤 Tone-Yau Huang | |
| 16:00-16:50 | Plenary Lecture by Professor Tai-Chia Lin 大會演講 林太家 教授<br>Chair：Professor Ming-Chih Lai 主持人 賴明治 教授 | | | | | | | | | 理一講堂 |
| 16:50-18:10 | 中華民國數學會會員大會暨頒獎典禮 | | | | | | | | | 理一講堂 |
| 18:30-21:00 | 2016年中華民國數學年會晚宴 | | | | | | | | | 湖畔餐廳 |

# 2016年中華民國數學年會

**2016 Taiwan Mathematical Society Annual Meeting**

**2016年12月11日(星期日)**

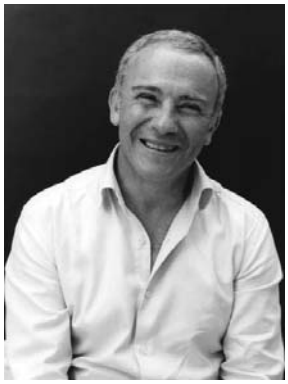
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 8:30-9:00 | Registration 報到註冊 | | | | | | | | | 理工一館 理一講堂外側 |
| Sessions | 數論與代數 | 分析 | 幾何 | 動態系統 生物數學 | 偏微分方程 | 離散數學 | 計算數學 | 機率 | 最佳化 | 統計 |
| | Number Theory and Algebra | Analysis | Geometry | Dynamical Systems and Biomathematics | Partial Differential Equations | Discrete Mathematics | Computational Mathematics | Probability | Optimization | Statictics |
| page | pp.13-14 | pp.19-22 | pp.27-28 | pp.35-39 | pp.49-52 | pp.59-66 | pp.73-81 | pp.89-94 | pp.105-111 | pp.117-123 |
| Room | 理A307 | 理A310 | 理A314 | 理A211 | 理A210 | 理A318 | 理A212 | 理D131 | 理D241 | 理A316 |
| 9:00-9:50 | Plenary Lecture by Professor Qiang Du<br>Chair：Professor Ming-Chih Lai<br>大會演講 杜強 教授<br>主持人 賴明治 教授 | | | | | | | | | 理一講堂 |
| 9:50-10:10 | Coffee Break 茶會、討論 | | | | | | | | | 理B301、理B302 |
| 10:10-11:00 | Special Invited Lecture<br>Professor Seung-Yeal Ha<br>Chair：Professor Tai-Chia Lin<br>特別邀請演講 Seung-Yeal Ha 教授<br>主持人 林太家 教授 | | | | 理二講堂 | Interdisciplinary Lecture<br>Professor Goong Chen<br>Chair：Professor Sze-Bi Hsu<br>跨領域演講 陳鞏 教授<br>主持人 許世壁 教授 | | | | 理一講堂 |
| 11:10-11:35 | 魏福村 Fu-Tsun Wei | 王雅書 Ya-Shu Wang | 黃榮宗 Rung-Tzung Huang | 王琪仁 Chi-Jen Wang | 鄭經斅 Ching-Hsiao Cheng | 董立大 Li-Da Tong | 葉立明 Li-Ming Yeh | 黃皓偉 Hao-Wei Huang | 陳界山 Jein-Shan Chen | 陳瑞彬 Ray-Bing Chen |
| 11:35-12:00 | | | | 陳怡全 Yi-Chiuan Chen | | | | | | |
| 12:00-13:30 | Lunch<br>Forum with all Chairpersons of Mathematical Departments<br>午餐<br>全國數學系系主任座談會 | | | | | | | | | 理B301、理B302<br>理A324 |
| 13:30-13:55 | | | | 洪國智 Kuo-Chih Hung | 蘇承芳 Cheng-Fang Su | 林武雄 Wu-Hsiung Lin | 曾正男 Jeng-Nan Tzeng | 黃建豪 Chien-Hao Huang | 林來居 Lai-Jiu Lin | 趙維雄 Wei-Hsiung Chao |
| 14:00-14:25 | | 王凱城 Kai-Cheng Wang | 吳思曄 Si-Ye Wu | 林伯儒 Bo-Ru Lin | 謝天長 Tien-Tsan Shieh | 鄭硯仁 Cheng-Yen Jen | 薛名成 Ming-Heng Shiue | 劉宣谷 Hsuan-Ku Liu | 張毓麟 Yu-Lin Chang | 孫立憲 Li-Hsien Sun |
| 14:25-14:50 | | | | | | 劉家安 Chia-An Liu | 劉青松 Ching-Sung Liu | 吳慶堂 Ching-Tang Wu | 陳怡州 Yi-Chou Chen | 蕭維政 Wei-Cheng Hsiao |
| 14:50-15:20 | Coffee Break 茶會、討論 | | | | | | | | | 理B301、理B302 |
| 15:20-15:45 | | 蔡明誠 Ming-Cheng Tsai | | | | 徐育鋒 Yu-Fong Hsu | 李雪甄 Hsueh-Chen Lee | 林奕伸 Yi-Shen Lin | 楊期壹 Chi-I Yang | 趙維雄 Wei-Hsiung Chao |
| 15:45-16:10 | | | | | | 李渭天 Wei-Tian Li | 廖士綱 Shih-Gang Liao | | 顏瑋郁 Wei-Yu Yen | 張志浩 Chih-Hao Chang |
| 16:10-16:35 | | | | | | 郭君逸 Jun-Yi Guo | 樂美亨 Mei-Heng Yueh | | | |
| 16:35-17:00 | | | | | | | | | | |
| | 賦歸 | | | | | | | | | |

# 目錄

# 大會演講 Professor François Loeser
## Motivic Integration: Old and New

**Abstract**

After providing a general introduction to motivic integration and its historical development, we will focus on some of its recent applications to geometry and representation theory.



Prof. François Loeser is a French mathematician, specialized in Algebraic Geometry, Arithmetical Geometry and, more recently, Model Theory. He is best known for his work on motivic integration, part of it in collaboration with Jan Denef. His fundamental work on arc spaces and motivic integration found great impact in algebraic geometry and arithmetic geometry. More recently, his collaboration with Ehud Hrushovski studied the topology of non-archimedean varieties. Their work was presented in 2012 by Antoine Ducros at Séminaire Bourbaki.

He is Professor of Mathematics at the Pierre-and-Marie-Curie University in Paris. From 2000 to 2010 he was Professor at École Normale Supérieure. Since 2015, he is a senior member of the Institut Universitaire de France. He was awarded the CNRS Silver Medal in 2011 and the Charles-Louis de Saulces de Freycinet Prize of the French Academy of Sciences in 2007.

# 大會演講 Professor Tai-Chia Lin

## Eigenvalue estimate of nonlinear Schrödinger equations with square root and saturable nonlinearities


### Abstract

The virial theorem is a nice property for the linear Schrödinger equation in atomic and molecular physics as it gives an elegant ratio between the kinetic and potential energies and is useful in assessing the quality of numerically computed eigenvalues. If the governing equation is a nonlinear Schrödinger equation with power-law nonlinearity, then a similar ratio can be obtained but there seems no way of getting any eigenvalue estimate. It is surprising as far as we are concerned that when the nonlinearity is either square root or saturable nonlinearity (not a power-law), one can develop a virial theorem and eigenvalue estimate of nonlinear Schrödinger (NLS) equations in R2 with square root and saturable nonlinearity, respectively. Furthermore, the eigenvalue estimate can be used to prove the 2nd order term (which is of order $\ln \Gamma$) of the lower bound of the ground state energy as the coefficient $\Gamma$ of the nonlinear term tends to infinity.


Prof. Lin 的研究領域爲非線性偏微分方程及數學物理, 其工作深受國際肯定, 近年更擴展到跨領域的生醫數學研究, 主要是建構離子通道模型。2013年至今已有14篇文章發表在傑出或等同之國際知名期刊, 期刊屬性涵蓋數學、應用數學、數學物理、數學跨領域應用、物理光學、物理化學等領域的傑出期刊, 研究成果不但深刻而且多元。林教授近年更獲得數學領域的第一個主軸計畫, 並獲得本年度科技部傑出研究獎之高度肯定。其從理論上之穩定性研究, 到建構有效率之模型描述離子間的作用力, 以及證明適當條件下離子通道開關機制的多個平衡態解, 與找到關鍵的尺度, 證實離子濃度低的情況下, 傳統 PNP 方程組描述離子通道中離子傳輸的適用性, 和非線性薛丁格方程組的介面問題等方面, 均取得重要突破。林教授研究題材多元, 兼顧理論與應用, 並發展前端之跨領域研究, 學術表現卓越, 足爲大家楷模。

# 大會演講 Professor Qiang Du
## Localization of nonlocal continuum models


### Abstract

Recent development of nonlocal vector calculus and nonlocal calculus of variations provides a systematic mathematical framework for the analysis of nonlocal continuum models in the form of partial-integral equations. In this lecture, we discuss the localization of some nonlocal models and associated nonlocal function spaces in order to study connections with traditional local models associated with partial differential equations and Sobolev spaces. In particular, we present some recent results on heterogeneous localization of nonlocal space, including a new extension of classical trace theorems to nonlocal spaces of functions having significantly weaker regularity. We also discuss their implications in nonlocal modeling of multiscale processes.

Prof. Qiang Du is the Fu Foundation Professor of Applied Mathematics in Columbia University. He is also an affiliated member of the Institute for Data Sciences. Professor Du earned his Ph.D. in Mathematics (1988) from Carnegie Mellon University, after which he has held faculty positions at University of Chicago, Michigan State University, Iowa State University, and Hong Kong University of Science and Technology. Prof. Du was most recently the Verne M. Willaman Professor of Mathematics and Professor of Materials Science and Engineering at Penn State University. His research interests are in numerical analysis, mathematical modeling and scientific computation with selected applications in physical, biological, materials, data and information sciences. Prof. Du currently serves as a Section Editor (since 2015) and an associated editor of SIAM Journal of Applied Mathematics (since 2012), SIAM Journal of Numerical Analysis (since 2003), Mathematics of Computation (since 2016) and 8 other international journals. He has been elected as the Chair of the SIAM Activity Group on Mathematical Aspects of Materials Science (2014-2016). He also serves as a representative to the U.S. National Committee on Theoretical and Applied Mechanics, the National Academies (2015-2019). Recognitions for his work include the Frame Faculty Teaching Award (1992) at Michigan State University, the Liberal Arts and Sciences Award for outreach/extension (2000), the Feng Kang prize in scientific computing (2005), the Eberly College of Science Medal (2007) from Penn State University, and his selection as a 2013 SIAM Fellow for contributions to applied and computational mathematics with applications in materials science, computational geometry, and biology.

# 特別邀請演講 Professor Seung-Yeal Ha

## Mathematical challenges for classical and quantum synchronization


### Abstract

Synchronization of oscillators denotes a phenomenon for the adjustment of rhythms among weakly coupled oscillators, and one of collective modes appearing in oscillatory complex systems such as ensembles of Josepson junctions array, pacemaker cells and fireflies etc. In this talk, I will briefly report the recent progress for synchronization and discuss some challenging open problems arising from synchronization via the Kuramoto and Lohe models.


Seung Yeal Ha is the professor of Department of Mathematical Sciences at Seoul National University in Korea. He was born in Jeonju of Jeonbuk province on April 1st of 1971. He received a B.S. degree with Summa cum Laude from Seoul National University in 1997 and Ph.D. degree from Stanford University in 2001 under the guidance of Prof. Tai-Ping Liu. Ha's primary research interests are applied nonlinear analysis such as hyperbolic conservation laws, the kinetic theory of gases and collective dynamics of many-body interacting systems, application of flocking theory to finance and sociology. To date, he has written more than one hundred research papers. He was elected as a member of the next-generation researcher group from KAS (Korea Academy of Sciences) 2013 and is currently a Kavli fellow. He has received numerous honors and awards including 14th Presidential Young Scientist Award in 2010. He has given a plenary one hour talk at AMC (Asian Mathematics Conference) in 2013, a 45 min invited talk in sessions "Mathematical Physics" and "Mathematics of Science and Technology" at ICM 2014 in Seoul, and a plenary one hour talk at HYP 2014 (the largest conference in hyperbolic PDEs).

# 跨領域演講 Professor Goong Chen

## Application of Computational Mathematics and Mechanics to Study Airplane crashes and Aerospace Engineering Problems


### Abstract

During the past two decades, rapid progress has been made in copmputational mathematics, computational mechanics and supercomputing power. Many computations for complex dynamic processes, whose software and algorithmic development took many years requiring large groups of developers previously, now can be carried out with just a small research team using open-access software and be computed on a supercomputer.

In this lecture, the speaker will use three examples to illustrate the applications of computational mathematics and mechanics to study aerospace-related "real-world" problems:

(1) the crash of Malaysia Airlines Flight MH370 into the ocean;

(2) the "pulverizing" crash of Germanwings Flight 9525 Flight in the French Alps;

(3) the design of the next generation BWB (blended-wing-body) airliners for civil aviation.

These studies require fundamental knowledge in aerodynamics, solid mechanics, impact engineering and flight dynamics and they are highly interdisciplinary. The challenges involve turbulence modeling, fracture material behavior, grid generations and software development. The research results will be shown by several video animations together with interpretations.



The research work is partially supported by Qatar National Priority Research Projects (NPRP) grants and funding from King Saud University in Riyadh, Saudi Arabia.

Prof. Chen 1972年畢業於國立清華大學數學系,1977年獲得 University of Wisconsin 數學博士。曾任教於 Southern Illinois University (1977-78)、Penn State University (1978-1987)。1987年後迄今任教於 Texas A&M University。陳教授的研究領域是應用數學與計算數學, 包括 Control Theory for PDE、Boundary element methods、Numerical Solutions of PDE、Chaotic Dynamical System、Quantum Computation、Chemical Physics and Quantum Mechanics。直到目前爲止他一共寫了7本書、編輯4本書、發表了140多篇期刊論文。目前他擔任期刊 J. Math. Analysis and Application、Elsevier | Academic Press Mathematics in Science and Engineering book series 之主編。

# 數論與代數

**Organizer:Ming-Lun Hsieh**

**謝銘倫 教授**

**地點: 理A307**

**時間:2016年12月10日 (六)**

| | |
|---|---|
| 11:30∼ | *Kazhdan-Lusztig polynomials and irreducible characters of general linear Lie superalgebra* |
| 12:20 | Nagu Lam 林牛 |
| 13:40∼ | *Higgs moduli spaces and indecomposable bundles* |
| 14:30 | Jyun-Ao Lin 林濬璈 |
| 15:00∼ | *EXPLICIT PULLBACK FORMULA FOR SAITO-KUROKAWA LIFTS* |
| 15:50 | Shih-Yu Chen |

(演講主持人由 Organizer 現場決定)

# Kazhdan-Lusztig polynomials and irreducible characters of general linear Lie superalgebra

**Nagu Lam(林牛)**
**National Cheng Kung University**
**nlam@mail.ncku.edu.tw**

**Abstract**

In 2003, Brundan formulated a Kazhdan-Lusztig type conjecture for the characters of the irreducible and tilting modules in the BGG category for the general linear Lie superalgebra for the first time. In this talk, we will discuss some backgrounds and a proof of Brundan's conjecture.
This is based on joint work with Shun-Jen Cheng and Weiqiang Wang.

# Higgs moduli spaces and indecomposable bundles

**Jyun-Ao Lin(林濬璈)**
**Academia Sinica**
**jalin@math.sinica.edu.tw**

**Abstract**

We provide an algebraic approach to compute the invariants of the moduli spaces of (parabolic) Higgs bundles over a smooth projective curve.

# EXPLICIT PULLBACK FORMULA FOR SAITO-KUROKAWA LIFTS

**Shih-Yu Chen**
**National Taiwan University**
**r98221018@ntu.edu.tw**

**Abstract**

Period integral of automorphic forms often related to critical values of L-functions. It has important application to the analytic and algebraic theory of L-functions. The main theme of this article concern with a special case, namely the pullback of Saito-Kurokawa lifts. The purpose here is to give an explicit pullback formula, generalizing the formula of Ichino to higher level modular forms and lifts the condition on weights. As an application, we prove the algebraicity of the central values of certain automorphic L-functions for $GL_2 \times GL_3$.

# 數論與代數

**Organizer:Ming-Lun Hsieh**

**謝銘倫 教授**

**地點: 理A307**

**時間:2016年12月11日 (日)**

| | |
|---|---|
| 11:10∼ 12:00 | *On special values of Eisenstein series over function fields*<br>Fu-Tsun Wei 魏福村 |

(演講主持人由 Organizer 現場決定)

# On special values of Eisenstein series over function fields

**Fu-Tsun Wei(魏福村)**
**National Central University**
**ftwei@math.ncu.edu.tw**

**Abstract**

Eisenstein series play a major role in various topics of number theory, and the study of their special values leads to plenty of arithmetic consequences. In this talk, I will first recall the classical story on the Siegel-Weil formula and the Kronecker limit formula, and then present analogous results of these two formulas over function fields.

# 分析

**Organizer:Lih-Chung Wang**
**王立中 教授**
**地點: 理A310**
**時間:2016年12月10日 (六)**

| | |
|---|---|
| 11:30∼ | *Nonhomogeneous T1 theorem for singular integrals* |
| 12:20 | Chun-Yen Shen 沈俊嚴 （主持人：林欽誠） |
| 13:40∼ | *Murray-von Neumann classifications of C*-algebras* |
| 14:30 | Ngai-Ching Wong 黃毅青 （主持人：沈俊嚴） |
| 15:00∼ | *Carleson measure characterization of weighted BMO associated with a family of general sets* |
| 15:50 | Ming-Yi Lee 李明憶 （主持人：黃毅青） |

# Nonhomogeneous T1 theorem for singular integrals

**Chun-Yen Shen(沈俊嚴)**
**National Central University**
**cyshen@math.ncu.edu.tw**

**Abstract**

In this talk, we will review the history of the famous two weight problems, and report our solution of two weight T1 problem for the Hilbert transform, a problem that had been open for 40 years. We will also introduce our recent advances on T1 theorems for higher dimensional singular integrals and discuss some of their main difficulties.

# Murray-von Neumann classifications of C*-algebras

**Ngai-Ching Wong(黃毅青)**
**National Sun Yat-sen University**
**wong@math.nsysu.edu.tw**

**Abstract**

The famous work of Murray and von Neumann about decomposing W*-algebras into different types (which is known as the classification theory of W*-algebras) is based on the study of projections in W*-algebras. Quite different from W*-algebras (which are generated by projections), a C*-algebra may contain no non-zero projection. Therefore, we cannot transport the classification theory of Murray and von Neumann directly to C*-algebras. In our recent works, we have developed two classifying (or decomposition) schemes of C*-algebras using the properties of their open projections and properties of their positive elements, respectively.

In this talk, after a briefing of our two classifying schemes of C*-algebras, we introduce a more general classification framework that, on top of giving many other possible schemes, can be used to obtain, compare and refine the two classification schemes mentioned above.

# Carleson measure characterization of weighted BMO associated with a family of general sets

**Ming-Yi Lee(李明憶)**
**National Central University**
**mylee@math.ncu.edu.tw**

**Abstract**

In this talk, we introduce a weighted Carleson measure $d\nu_{\mathbb{E},w}$ associated to the family $\mathbb{E}$, where $\mathbb{E} = \{E_r(x)\}_{r\in\mathcal{I},x\in X}$ is a family of open subsets of a topological space $X$ endowed with a nonnegative Borel measure $\mu$ satisfying certain basic conditions. Using Calderón-Zygmund theory, we show that the weighted BMO associated with the family $\mathbb{E}$ can be characterized by the weighted Carleson measure $d\nu_{\mathbb{E},w}$.


# 分析

**Organizer:Lih-Chung Wang**
**王立中 教授**
**地點: 理A310**
**時間:2016年12月11日 (日)**

| | |
|---|---|
| 11:10∼ | *Orthogonally additive maps on Figá-Talamanca-Herz algebras* |
| 12:00 | Ya-Shu Wang 王雅書（主持人：王立中） |
| 14:00∼ | *Wavelet frames in Lebesgue spaces and Besov spaces* |
| 14:50 | Kai-Cheng Wang 王凱城（主持人：王雅書） |
| 15:20∼ | *A quadratic operator which is a product of two positive contractions* |
| 16:10 | Ming-Cheng Tsai 蔡明誠（主持人：王凱城） |

# Orthogonally additive maps on Figá-Talamanca-Herz algebras

**Ya-Shu Wang(王雅書)**
**National Chung Hsing University**
**yashu@nchu.edu.tw**

**Abstract**

Let $G$ be a locally compact group. In this talk, we will introduce the Figá-Talamanca-Herz algebras $A_p(G)$ and the representation of linear orthogonally multiplicative maps on $A_p(G)$.

# Wavelet frames in Lebesgue spaces and Besov spaces

**Kai-Cheng Wang(王凱城)**
**Feng Chia University**
**gtotony98@gmail.com**

**Abstract**

Jackson and Bernstein inequalities are essential for Besov spaces. Smoothness based approaches are widely used in establishing the inequalities. However, little research has been carried out into characterization on function spaces from a mild decay wavelet perspective. Our study reports on the feasibility of decay (only) based approaches to the establishing Jackson and Bernstein inequalities. Moreover, we show how wavelets with decay (only) enable descriptions of Lebesgue spaces and Besov spaces. The aim has been accomplished by means of completeness of wavelet frames in Lebesgue spaces and stability of wavelet coefficients.

# A quadratic operator which is a product of two positive contractions

**Ming-Cheng Tsai(蔡明誠)**
**National Taipei University of Technology**
**mctsai2@ntut.edu.tw**

**Abstract**

Let T be a quadratic operator on a complex Hilbert space H. We give a sufficient and necessary condition on T which can be written as a product of two positive contractions. We discuss a bounded linear operator T that can be written as a product of two positive contractions. We also give some related results.

# 幾何

**Organizer:Min-Lin Yau**
**姚美琳 教授**
**地點: 理A314**
**時間:2016年12月10日 (六)**

| | |
|---|---|
| 11:30∼ 12:20 | *Stability and Uniqueness of Minimal Surface Systems*<br>Mao-Pei Tsui 崔茂培 |
| 13:40∼ 14:30 | *Minimal genus problem*<br>Chung-I Ho 何忠益 |
| 15:00∼ 15:50 | *Szegö kernel asymptotics in Complex and CR geometry*<br>Chin-Yu Hsiao 蕭欽玉 |

(演講主持人由 Organizer 現場決定)

# Stability and Uniqueness of Minimal Surface Systems

**Mao-Pei Tsui(崔茂培)**
**National Taiwan University**
**maopei@math.ntu.edu.tw**

**Abstract**

It is well-known that the solution to the Dirichlet problem for the minimal surface system may not be unique. In this talk, we explain some recent results about the stability and uniqueness of minimal surface systems.
This is joint work with Yng-Ing Lee and Yuan Shyong Ooi.

# Minimal genus problem

**Chung-I Ho(何忠益)**
**National Kaohsiung Normal University**
**ciho@nknu.edu.tw**

**Abstract**

The minimal genus of embedded surfaces within a homology class in 4-manifolds has been a study topic for a long time. It involves many important technique in 4-dimensional topology. There has a big breakthrough since the invention of Seiberg-Witten theory. In this talk, I will survey the progress in the past as well as some recent work in this problem.

# Szegö kernel asymptotics in Complex and CR geometry

**Chin-Yu Hsiao(蕭欽玉)**
**Academia Sinica**
**chsiao@math.sinica.edu.tw**

**Abstract**

The Szegö kernel is a classical subject in several complex variables, CR geometry and complex geometry. The study of the singularities of the Szegö is closely related to topics like Tian-Yau-Zelditch asymptotics , Berezin-Toeplitz quantization, CR embedding problems, CR positive mass theorem, Sasaki geometry and mathematical physics. In this talk, I will survey our result about the asymptotics of the singularities of the Szegö kernel and its applications in CR and Complex geometry.

# 幾何

**Organizer:Min-Lin Yau**
**姚美琳 教授**
**地點: 理A314**
**時間:2016年12月11日 (日)**

| | |
|---|---|
| 11:10∼ 12:00 | *Lefschetz fixed point formula on a compact Riemannian manifold with boundary for some boundary conditions*<br>Rung-Tzung Huang 黃榮宗 |
| 14:00∼ | *TBA* |
| 14:50 | Si-Ye Wu 吳思曄 |

(演講主持人由 Organizer 現場決定)

# Lefschetz fixed point formula on a compact Riemannian manifold with boundary for some boundary conditions

**Rung-Tzung Huang(黃榮宗)**
**National Central University**
**rthuang@math.ncu.edu.tw**

**Abstract**

In this talk I will first introduce a pair of new de Rham complexes on a compact oriented Riemannian manifold with boundary by using a pair of global boundary conditions. Then I will discuss the Lefschetz fixed point formula on these complexes with respect to a smooth map which is a local isometry on the boundary and has only simple fixed points. This is a joint work with Yoonweon Lee (Inha University, Korea).

# 動態系統生物數學

**Organizer:Rong-Cao Ban**

**班榮超 教授**

**地點: 理A211**

**時間:2016年12月10日 (六)**

| | |
|---|---|
| 11:30∼ | *Global bifurcation and exact multiplicity of positive solutions for the one-dimensional perturbed Gelfand problem from combustion theory* |
| 12:20 | Shin-Hwa Wang 王信華 （主持人：班榮超） |
| 13:40∼ | *Heart Modelling of Some Genetic Channelopathies* |
| 14:05 | Chu-Pin Lo 羅主斌 （主持人：梁育豪） |
| 14:05∼ | *On the topology of tree-shifts* |
| 14:30 | Chih-Hung Chang 張志鴻 （主持人：梁育豪） |
| 15:00∼ | *Exact multiplicity and bifurcation curves of positive solutions of a one-dimensional Minkowski-curvature problem and its application* |
| 15:25 | Shao-Yuan Huang 黃少遠 （主持人：張志鴻） |
| 15:25∼ | *Classification of bifurcation curves for the one-dimensional perturbed Gelfand equation with mixed boundary conditions* |
| 15:50 | Yu-Hao Liang 梁育豪 （主持人：張志鴻） |

# Global bifurcation and exact multiplicity of positive solutions for the one-dimensional perturbed Gelfand problem from combustion theory

**Shin-Hwa Wang(王信華)**
**National Tsing Hua University**
**shwang@math.nthu.edu.tw**

**Abstract**

We study global bifurcation curves and the exact multiplicity of positive solutions for the two-point boundary value problem arising in combustion theory

$$\begin{cases} u''(x) + \lambda \exp\left(\frac{au}{a+u}\right) = 0, & -1 < x < 1, \\ u(-1) = u(1) = 0, \end{cases}$$

where $\lambda > 0$ is the Frank–Kamenetskii parameter and $a > 0$ is the activation energy parameter. We prove that there exists a critical bifurcation value $a_0 \approx 4.069$ such that, on the $(\lambda, ||u||_\infty)$-plane, the bifurcation curve is S-shaped for $a > a_0$ and is monotone increasing for $0 < a \leq a_0$. That is, we prove the long-standing conjecture for the one-dimensional perturbed Gelfand problem. We also study, in the $(a, \lambda, \|u\|_\infty)$-space, the shape and structure of the bifurcation surface.
This is a joint work with Shao-Yuan Huang.

# Heart Modelling of Some Genetic Channelopathies

**Chu-Pin Lo(羅主斌)**
**Providence University**
**cplo@kimo.com**

**Abstract**

I will introduce some arrhythmia caused by genetic mutations, in particular related to the Ca2+ handling proteins of cardiac myocyte. For example, the Catecholaminergic polymorphic ventricular tachycardia (CPVT) is a malignant arrhythmogenic disorder linked to mutations in the cardiac ryanodine receptor (RyR2), calsequestrin (CASQ2), and CaMKII$\cdots$predisposing the young to syncope and cardiac arrest. I will introduce some models related to CPVT. Since Beta-adrenergic receptor (BAR) stimulation is closely related to CPVT, I will also introduce some BAR modeling issues.

# On the topology of tree-shifts

**Chih-Hung Chang(張志鴻)**
**National University of Kaohsiung**
**chchang@nuk.edu.tw**

**Abstract**

Topological behavior, such as chaos, irreducibility, and mixing of a one-sided shift of finite type, is well elucidated. Meanwhile, the investigation of multidimensional shifts, for instance, textile systems is difficult and only a few results have been obtained so far. This paper studies shifts defined on infinite trees, which are called tree-shifts. Infinite trees have a natural structure of one-sided symbolic dynamical systems equipped with multiple shift maps and constitute an intermediate class in between one-sided shifts and multidimensional shifts. We have shown not only an irreducible tree-shift of finite type, but also a mixing tree-shift that are chaotic in the sense of Devaney. Furthermore, the graph and labeled graph representations of tree-shifts are revealed so that the verification of irreducibility and mixing of a tree-shift is equivalent to determining the irreducibility and mixing of matrices, respectively. This extends the classical results of one-sided symbolic dynamics. A necessary and sufficient condition for the irreducibility and mixing of tree-shifts of finite type is demonstrated. Most important of all, the examination can be done in finite steps with an upper bound.

# Exact multiplicity and bifurcation curves of positive solutions of a one-dimensional Minkowski-curvature problem and its application

**Shao-Yuan Huang(黃少遠)**
**National Tsing Hua University**
**syhuang@math.nthu.edu.tw**

**Abstract**

In this paper, we discuss exact multiplicity and bifurcation curves of positive solutions of the one-dimensional Minkowski-curvature problem

$$\begin{cases} \left[-u'/\sqrt{1-u'^2}\right]' = \lambda f(u), & -L < x < L, \\ u(-L) = u(L) = 0, \end{cases}$$

where $\lambda > 0$ is a bifurcation parameter, $L > 0$ is an evolution parameter, $f \in C[0,\infty) \cap C^2(0,\infty)$, $f(u) > 0$ for $u > 0$, and $f''(u)$ is not sign-changing on $(0,\infty)$. Under some suitable hypotheses on $f(u)$, we find that the bifurcation curves on the $(\lambda, \|u\|_\infty)$-plane may change with varying $L > 0$. Also, we study, in the $(\lambda, L, \|u\|_\infty)$-space, the shape and structure of the bifurcation surface. Finally, we give an application for this problem with a nonlinear term $f(u) = u^p + u^q$ where $q \geq p > 0$ satisfy some conditions.

# Classification of bifurcation curves for the one-dimensional perturbed Gelfand equation with mixed boundary conditions

**Yu-Hao Liang(梁育豪)**
**National Chiao Tung University**
**yhliang@nctu.edu.tw**

**Abstract**

In this talk, we study the classification of bifurcation curves of positive solutions for the one-dimensional perturbed Gelfand equation with mixed boundary conditions given by

$$\begin{cases} u''(x) + \lambda \exp\left(\frac{au}{a+u}\right) = 0, \ 0 < x < 1, \\ u(0) = 0, \quad u'(1) = -c < 0. \end{cases}$$

We prove that, for positive $a \leq a_0 \, (\approx 0.501)$ and $c > 0$, the bifurcation curve is strictly increasing on the $(\lambda, \|u\|_\infty)$-plane. While, for $a \geq a_1 \, (\approx 4.107)$, there exists $c_1 \, (= c_1(a)) > 1.057$ such that, on the $(\lambda, \|u\|_\infty)$-plane, (i) when $0 < c < c_1$, the bifurcation curve is $S$-shaped; (ii) when $c \geq c_1$, the bifurcation curve is $\subset$-shaped.

# 動態系統生物數學

**Organizer:Rong-Cao Ban**

**班榮超 教授**

**地點: 理A211**

**時間:2016年12月11日 (日)**

| | |
|---|---|
| 11:10∼ | *STRUCTURAL AND DYNAMICAL ANALYSIS OF MULTIMODE SOCIAL NETWORKS* |
| 11:35 | Chi-Jen Wang 王琪仁 （主持人：洪國智） |
| 11:35∼ | *From Cantor to Misiurewicz along parameter rays* |
| 12:00 | Yi-Chiuan Chen 陳怡全 （主持人：洪國智） |
| 13:30∼ | *Exact multiplicity of positive solutions of a one-dimensional prescribed curvature problem* |
| 13:55 | Kuo-Chih Hung 洪國智 （主持人：張菁華） |
| 14:00∼ | *A numerical study of a dengue model with changing proportion of patients hospitalized* |
| 14:25 | Bo-Ru Lin 林伯儒 （主持人：張菁華） |

# STRUCTURAL AND DYNAMICAL ANALYSIS OF MULTIMODE SOCIAL NETWORKS

**Chi-Jen Wang(王琪仁)**
**Tunghai University**
**cjwang@thu.edu.tw**

**Abstract**

We employ the recently developed theory of isospectral network reductions to analyze multi-mode social networks. This procedure allows us to uncover the hierarchical structure of each mode of the networks we considered. Additionally, by performing a dynamical analysis of these networks we are able to find a number of other network features. We apply both of these approaches to the Southern Women Data Set, one of the most studied social networks and demonstrate that these techniques provide new information, which complement previous findings.

# From Cantor to Misiurewicz along parameter rays

**Yi-Chiuan Chen(陳怡全)**
**Academia Sinica**
**YCChen@math.sinica.edu.tw**

**Abstract**

We consider degeneration process from a Cantor Julia set to a Misiurewicz one in the family of complex quadratic maps. We give an estimate of the speed of the holomorphic motion when the parameter moves along a pre-periodic parameter ray of the Mandelbrot set. Then we conclude that such a particular motion dynamically converges.
A joint work with Tomoki Kawahira of Tokyo Institute of Technology.

# Exact multiplicity of positive solutions of a one-dimensional prescribed curvature problem

**Kuo-Chih Hung(洪國智)**
**National Chin-Yi University of Technology**
**kchung@ncut.edu.tw**

**Abstract**

We study the exact multiplicity and bifurcation diagrams of positive solutions $u \in C^2(-L, L) \cap C[-L, L]$ of the one-dimensional multiparameter prescribed curvature problem with nonlinearity $f(u) = u^p + u^q$. We prove that the problem has at most two positive solutions for any $0 \leq p < q, \infty$ and $\lambda, L > 0$.

# A numerical study of a dengue model with changing proportion of patients hospitalized

**Bo-Ru Lin(林伯儒)**
**National Kaohsiung Normal University**
**snell109@gmail.com**

**Abstract**

According the 2009 revised World Health Organization (WHO) dengue case classification for the diagnosis and management, we propose a deterministic model which includes the proportion of patients hospitalized, the time from bitten to case classified, recruitment rate and death rate of mosquitoes. The basic reproductive number ($R0$) with reasonable biological meaning is obtained. We also prove that the disease-free equilibrium is locally asymptotically stable if $R0 < 1$. Numerical investigations demonstrate decreasing of that basic reproduction number ($R0$), human data of infected cases and accumulative deaths after intervention.

# 偏微分方程

**Organizer:Cheng-Hsiung Hsu**
**許正雄 教授**
**地點: 理A210**
**時間:2016年12月10日 (六)**

| | |
|---|---|
| 11:30∼ | *On the the bubbling phenomenon of rank two Gauge theory* |
| 12:20 | Hsin-Yuan Huang 黃信元（主持人：許正雄） |
| 13:40∼ | *A reaction-diffusion-advection system modeling the growth of phytoplankton consuming inorganic carbon with internal storage* |
| 14:05 | Feng-Bin Wang（主持人:Ching-Hsiao Cheng） |
| 14:05∼ | *Absolute stability and synchronization in neural field models with transmission delays* |
| 14:30 | Chang-Hong Wu 吳昌鴻（主持人:Ching-Hsiao Cheng） |
| 15:00∼ | *Asymptotic behavior for Rayleigh's problem based on kinetic theory* |
| 15:25 | Hung-Wen Kuo 郭鴻文（主持人：吳宗芳） |
| 15:25∼ | *Classification of Standing Wave Solutions to a Coupled Schrödinger System* |
| 15:50 | Zhi-You Chen 陳志有（主持人：吳宗芳） |

# An inextensible vesicle interacting with Navier-Stokes equations

**Ching-Hsiao Cheng**
**National Central University**
**cchsiao@gmail.com**

**Abstract**

In this talk, we study the dynamics of inextensible vesicles inside viscous Newtonian fluids. I will first talk about how to derive a mathematical model describing the underlying physics and then talk about the a priori estimates in order to capture the possible solution spaces in which we look for possible solutions. Some new information which may enhance the accuracy in numerical simulations will be provided.

# On the the bubbling phenomenon of rank two Gauge theory

**Hsin-Yuan Huang(黃信元)**
**National Sun Yat-sen University**
**hsinyuanh@gmail.com**

**Abstract**

In this talk, I will survey the recent developments of the system arising from the Chern-Simons Model with two Higgs Particles.

# A reaction-diffusion-advection system modeling the growth of phytoplankton consuming inorganic carbon with internal storage

**Feng-Bin Wang**
**Chang Gung University**
**fbwang0229@gmail.com**

**Abstract**

This talk presents a PDE system modeling the growth of single species population consuming inorganic carbon that is stored internally in a partially mixed habitat. Inorganic carbon takes the forms of "CO2" (dissolved CO2 and carbonic acid) and "CARB" (bicarbonate and carbonate ions), which are substitutable in their effects on algal growth. We first establish a threshold type result on the extinction/persistence of the species in terms of the sign of a principal eigenvalue associated with a nonlinear eigenvalue problem. If the habitat is the unstirred chemostat, we add biologically relevant assumptions on the uptake functions and prove the uniqueness and global attractivity of the positive steady state when the species persists.
This talk is based on my recent work joint with Drs. Sze-Bi Hsu and King-Yeung Lam.

# Absolute stability and synchronization in neural field models with transmission delays

**Chang-Hong Wu(吳昌鴻)**
**National University of Tainan**
**changhong@mail.nutn.edu.tw**

**Abstract**

Neural field models can be seen as the continuous networks of cortical units. Since the pioneering works of Wilson and Cowan, and Amari, there have been tremendous efforts towards developing mathematical tools to investigate neural field models. In this talk, we would like to introduce the background briefly and discuss the stability and synchronization for some neural field models with delays.
This talk is based on the joint work with Chiu-Yen Kao and Chih-Wen Shih.

# Asymptotic behavior for Rayleigh's problem based on kinetic theory

**Hung-Wen Kuo(郭鴻文)**
**National Cheng Kung University**
**hwkuo@mail.ncku.edu.tw**

**Abstract**

We investigate Rayleigh's problem at small Mach numbers in rareed gas dynamics. We show that the asymptotic behavior of the gas represents a perturbation to the free molecular gas when the time is much less than the mean free time. On the other hand, if the time is much greater than the mean free time, we show that the gas dynamics is governed by the linearized Navier-Stokes equation with a slip flow on the boundary and establish a boundary layer correction with thickness of the order of the mean free path.

# Classification of Standing Wave Solutions to a Coupled Schrödinger System

**Zhi-You Chen(陳志有)**
**National Changhua University of Education**
**zhiyou@cc.ncue.edu.tw**

**Abstract**

In this talk, we consider a nonlinear elliptic system which is an extension of the single equation derived by investigating the stationary states of the nonlinear Schrödinger equation. We establish the uniqueness of solutions to the Dirichlet problem on the ball and entire space as the parameters within certain regions. In addition, a complete structure of different types of solutions for the radial case is also provided.

# 偏微分方程

**Organizer:Cheng-Hsiung Hsu**

**許正雄 教授**

**地點: 理A210**

**時間:2016年12月11日 (日)**

| | |
|---|---|
| 11:10∼ | *An inextensible vesicle interacting with Navier-Stokes equations* |
| 12:00 | Ching-Hsiao Cheng（主持人：洪盟凱） |
| 13:30∼ | *Asymptotic limit for rotational compressible magnetohydrodynamic flows* |
| 13:55 | Cheng-Fang Su 蘇承芳（主持人：許正雄） |
| 14:00∼ | *Asymptotic behavior of equilibrium states of reaction-diffusion systems with mass conservation* |
| 14:25 | Tien-Tsan Shieh 謝天長（主持人：楊智烜） |

# An inextensible vesicle interacting with Navier-Stokes equations

**Ching-Hsiao Cheng**
**National Central University**
**cchsiao@gmail.com**

**Abstract**

In this talk, we study the dynamics of inextensible vesicles inside viscous Newtonian fluids. I will first talk about how to derive a mathematical model describing the underlying physics and then talk about the a priori estimates in order to capture the possible solution spaces in which we look for possible solutions. Some new information which may enhance the accuracy in numerical simulations will be provided.

# Asymptotic limit for rotational compressible magnetohydrodynamic flows

**Cheng-Fang Su(蘇承芳)**
**National Central University**
**dododo@url.com.tw**

**Abstract**

In this talk we consider the compressible models of magnetohydrodynamic flows giving rise to a variety of mathematical problems in many areas. First, we will introduce the asymptotic limit for the compressible rotational magnetohydrodynamic flows with the well-prepared initial data such that a rigorous quasi-geostrophic equation with diffusion term governed by the magnetic field from a compressible rotational magnetohydrodynamic flows is derived. Finally, we will show the two results: the existence of the unique global strong solution of quasi-geostrophic equation with good regularity on the velocity and magnetic field and the derivation of quasi-geostrophic equation with diffusion.

# Asymptotic behavior of equilibrium states of reaction-diffusion systems with mass conservation

**Tien-Tsan Shieh(謝天長)**
**National Center for Theoretical Sciences**
**ttshieh@ncts.ntu.edu.tw**

**Abstract**

We deal with a stationary problem of a reaction-diffusion system with a conservation law under the Neumann boundary condition. It is shown that the stationary problem turns to be the Euler-Lagrange equation of an energy functional with a mass constraint. When the domain is the finite interval $(0, 1)$, we investigate the asymptotic profile of a strictly monotone minimizer of the energy as $d$, the ratio of the diffusion coefficient of the system, tends to zero. In view of a logarithmic function in the leading term of the potential, we get to a scaling parameter $\kappa$ satisfying the relation $\epsilon := \sqrt{d} = \sqrt{\log \kappa}/\kappa^2$. The main result shows that a sequence of minimizers converges to a Dirac mass multiplied by the total mass and that by a scaling with $\kappa$ the asymptotic profile exhibits a parabola in the nonvanishing region. We also prove the existence of an unstable monotone solution when the mass is small.


# 離散數學

**Organizer:David Kuo**

**郭大衛 教授**

**地點: 理A318**

**時間:2016年12月10日 (六)**

| | |
|---|---|
| 11:30∼ | *The Profile of Random Digital Trees* |
| 12:20 | Michael Fuchs 符麥克 （主持人：傅恆霖） |
| 13:40∼ | *Basic WK-recursive Pyramid Networks and Triangular Pyramid Networks* |
| 14:05 | Su-Tzu Juan 阮夙姿 （主持人：顏經和） |
| 14:05∼ | *Strongly Balanced (m,n)-Tadpole Systems* |
| 14:30 | Ming-Hway Huang 黃明輝 （主持人：顏經和） |
| 15:00∼ | *Pair L(2,1)-labelings of graphs* |
| 15:25 | Roger K. Yeh 葉光清 （主持人：李渭天） |
| 15:25∼ | *P2,P3-free linear forests are antimagic* |
| 15:50 | Jen-Ling Shang 商珍綾 （主持人：李渭天） |

# The Profile of Random Digital Trees

**Michael Fuchs(符麥克)**
**National Chiao Tung University**
**mfuchs@math.nctu.edu.tw**

**Abstract**

Random digital trees are an important class of random trees due to their usage as data structures in Computer Science. Properties of their shape have direct relevance in the analysis of the complexity of algorithms performed on these trees. Thus, the analysis of their shape has attracted a lot of attention over the last few decades. Recently, a more universal view started to emerge via the introduction of the so-called (node) profile which encodes the whole silhouette of the tree. Apart from allowing one to re-prove and strengthen previous results, the investigation of the profile is also interesting in its own right. In this talk, we will review some of the results obtained so far for the profile of digital trees. IN particular, we will present some of our recent results for the profile of symmetric digital search trees which fill one of the major holes in the theory.
The talk is based on joint work with Michael Drmota (Technical University of Vienna), Hsien-Kuei Hwang (Academia Sinica) and Ralph Neininger (Goethe Universitaet).

# Basic WK-recursive Pyramid Networks and Triangular Pyramid Networks

**Su-Tzu Juan(阮夙姿)**
**National Chi Nan University**
**jsjuan@ncnu.edu.tw**

**Abstract**

在互聯網路的設計與實作上, 有許多的拓樸學上的特性被廣泛地用在測量或分析一個網路的好壞。包含連通度、直徑、路由演算法、被嵌入性、可擴充性、容錯度、對稱度、傳輸延遲與超大型積體電路的設計等。一般來說, 我們以設計一個對稱的、規則的、彈性且確實的網路爲目標, 並同時希望此網路擁有較高的聯通度與較低的直徑和簡易的路由演算法。不幸地, 同時擁有以上性質的拓樸結構是困難的。因此設計一個可在這些特性間找到平衡的互聯網路, 是相當重要的工作。金字塔網路 (pyramid network) 是一個長期以來在平行演算法、電腦視覺和影像處理都被大量討論的拓樸結構。爲了提高金字塔網路的彈性, 我們討論兩個金字塔網路的變形: 其一基礎 WK 遞迴金字塔網路 (basic WK-recursive pyramid network); 另外一個則是三角金字塔網路 (triangular pyramid network)。我們試圖證明此兩類網路圖型擁有較傳統金字塔網路更好的拓樸性質。

# Strongly Balanced (m,n)-Tadpole Systems

**Ming-Hway Huang(黃明輝)**
**Yuanpei University**
**rudin86@yahoo.com.tw**

**Abstract**

The (m, n)-tadpole is a graph obtained by joined a cycle $C_m$ to a path $P_n$ with a bridge. An (m, n)-tadpole system of order v is a pair $Simga = (X, B)$, where X is a finite set of v vertices and B is a collection of edge disjoint (m, n)-tadpoles (called blocks) which partitions the edge set of the complete graph $K_v$, defined in X. In this talk, we will determine the spectrum of all types of balanced (4, 2)-tadpole systems.

# Pair L(2,1)-labelings of graphs

**Roger K. Yeh(葉光清)**
**Feng Chia University**
**rkyeh@math.fcu.edu.tw**

**Abstract**

An $L(2,1)$-labeling of a graph $G = (V, E)$ is an assignment of non-negative integers to $V$ such that two adjacent vertices must receive numbers (labels) at least two apart and further, if two vertices are in distance 2 then they receive distinct labels. This article studies a generalization of the $L(2,1)$-labeling. We assign sets with at least one element to vertices of $G$ under some conditions.

# P2,P3-free linear forests are antimagic

**Jen-Ling Shang(商珍綾)**
**Kainan University**
**jlshang@mail.knu.edu.tw**

**Abstract**

A graph with q edges is called antimagic if its edges can be labeled with 1, 2, ... , q such that the sums of the labels of the edges incident to each vertex are distinct. A linear forest is a graph of which each component is a path of order greater than one. A Pk-free linear forest is a linear forest without any path Pk as its components. Recently it was shown that P2,P3,P4-free linear forests are antimagic. And conjectured that P2,P3-free linear forests are antimagic. This paper settles this conjecture and shows that P2,P3-free linear forests are antimagic.


# 離散數學

**Organizer:David Kuo**

**郭大衛 教授**

**地點: 理A318**

**時間:2016年12月11日 (日)**

| | |
|---|---|
| 11:10∼ | *Acyclic orientation and circular coloring* |
| 12:00 | Li-Da Tong 董立大（主持人：嚴志弘） |
| 13:30∼ | *Relaxed distance-two colorings on wireless* |
| 13:55 | Wu-Hsiung Lin 林武雄（主持人：郭君逸） |
| 14:00∼ | *A matrix realization of upper bounds of spectral radius of non-negative matrix* |
| 14:25 | Cheng-Yen Jen 鄭硯仁（主持人：郭君逸） |
| 14:25∼ | *Designs over binary field with constant block sum* |
| 14:50 | Chia-An Liu 劉家安（主持人：郭君逸） |
| 15:20∼ | *Decomposing Kn - Qt into 4-Cycles* |
| 15:45 | Yu-Fong Hsu 徐育鋒（主持人：張飛黃） |
| 15:45∼ | *The Nested Chain Decompositions of Some Normalized Graded Posets of Rank Three* |
| 16:10 | Wei-Tian Li 李渭天（主持人：張飛黃） |
| 16:10∼ | *Optimal Solution for Lights Out and its Application to Twisty Puzzle* |
| 16:35 | Jun-Yi Guo 郭君逸（主持人：張飛黃） |

# Acyclic orientation and circular coloring

**Li-Da Tong(董立大)**
**National Sun Yat-sen University**
**ldtong@math.nsysu.edu.tw**

**Abstract**

An (m,k)-coloring f of a graph $G = (V, E)$ is a function from V to $\{0, 1, \cdots, m-1\}$ such that if uv is an edge of $G$ then $k \leq |f(u) - f(v)| \leq m - k$. The circular chromatic number $cc(G)$ of a graph $G$ is $\min\{m/k : G \text{ has an (m,k)-coloring}\}$. Let $C = (v1, v2, \cdots, vt, v1)$ be a cycle of a digraph $D$, $c+$ be the number of arcs $(x, y)$ in $D$ with $(x, y)$ being $(vi, vi+1)$ or $(vt, v1)$ for some $i$ and $c- = t - c+$, and $r(C) = \max\{t/c-, t/c+\}$. Then the flow-ratio $r(D)$ of an acyclic orientation $D$ is $\max\{r(C) : C \text{ is a cycle of } D\}$. Goddyn, Taris, and Zhang proved that if $G$ is a simple graph with cycles, then the circular chromatic number $cc(G)$ of $G$ is $\min\{r(D) : D \text{ is an acyclic orientation of } G\}$. In the talk, we will discuss the relations between acyclic orientations and circular colorings in a graph.

# Relaxed distance-two colorings on wireless

**Wu-Hsiung Lin(林武雄)**
**National Chiao Tung University**
**wuhsiunglin@nctu.edu.tw**

**Abstract**

Distance-two colorings of graphs provide a solution to the interference problem for communication in a wireless sensor network (WSN), which prohibit a node from using the same time slot as those of its 1-hop and 2-hop neighbors. The interference problem of data collection in a dense duty-cycle wireless sensor and sink network (DC-WSN) has been studied by Navarra, Pinotti and Formisano in 2012. In 2009, Wu and Tesng proved that when performing data collection in a WSN, the set of the interference neighbors can be relaxed with respect to the data-collection tree. By proposing a distributed relaxed distance-two 6-coloring algorithm, we solve the interference problem for tree-based data collection in a dense DC-WSN with the concept of the relaxed interference set; and by proving the lower bound is 6, we confirm the optimality of our algorithm.

# A matrix realization of upper bounds of spectral radius of nonnegative matrix

**Cheng-Yen Jen(鄭硯仁)**
**National Chiao Tung University**
**yjc7755@gmail.com**

**Abstract**

In this talk, I will introduce a general way to express upper bounds of the spectral radius of a given nonnegative matrix in terms of the spectral radii of $2 \times 2$ matrices, which extends the Perron-Frobenius Theorem and gives matrix realization of new and many previous known results.

# Designs over binary field with constant block sum

**Chia-An Liu(劉家安)**
**I-Shou University**
**liuchiaan8@gmail.com**

**Abstract**

Several balanced incomplete block designs (BIBDs) and group divisible designs (GDDs) over binary field with constant block sum are proposed in this research. The parameters of each design are also provided.

# Decomposing Kn - Qt into 4-Cycles

**Yu-Fong Hsu(徐育鋒)**
**Tamkang University**
**joliwugy@gmail.com**

**Abstract**

A decomposition of a graph G into subgraphs H1,H2,...,Hn of G is a partition of the edge-set of G into the union of edge sets of H1,H2,...,Hn and Hi and Hj are edge disjoint subgraphs of G. If each Hi is isomorphic to a k-cycle, then we say G can be decomposed into k-cycles. A quartic graph of order t is a graph which is 4-regular, denoted by Qt. In this talk, we show that for each $t \geq 5$ and $n \geq t + 3$, if (1) $n \equiv 5 \pmod 8$ when t is odd or (2) $n \equiv 1 \pmod 8$ when t is even, then Kn - Qt can be decomposed into 4-cycles.

# The Nested Chain Decompositions of Some Normalized Graded Posets of Rank Three

**Wei-Tian Li(李渭天)**
**National Chung Hsing University**
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**Abstract**

A graded poset $P$ is a normalized matching if the normalized matching property holds for any two levels of $P$. It is conjectured by Griggs in 1975 that every finite normalized matching rank-unimodal poset has a nested chain decomposition. This conjecture is widely open and is only verified for posets of rank 2. In this talk, we will learn the early results of Shahriar et al. on some normalized matching posets of rank 3. Moreover, we will modify their approach to show more posets satisfying the Griggs's conjecture.
Joint work with Mr. Yu-Lun Chang

# Optimal Solution for Lights Out and its Application to Twisty Puzzle

**Jun-Yi Guo(郭君逸)**
**National Taiwan Normal University**
**junyiguo@gmail.com**

**Abstract**

This talk introduces the minimal solution of Light-out games and other similar commutative puzzles. In 1998, Anderson and Feil used algebric approach to find a solution. In 2009, Goldwasser et al. proved the lit-only restriction is not different for the sigma game. In 2014, Schicho and Top discussed many variation of Lights Out. Those results heavily rely on computer. In this talk, we use mathematical methods to find an upper bound of minimal solutions, and furthermore, give an estimation algorithm to the upper bound.

# 計算數學

**Organizer:Tsung-Min Hwang**

**黃聰明 教授**

**地點: 理A212**

**時間:2016年12月10日 (六)**

| | |
|---|---|
| 11:30∼ | *Some of the Recent Developments of High-Performance Matrix Computations for Big Data Analysis and Large-scale Numerical Simulations* |
| 12:20 | Wei-Chung Wang 王偉仲（主持人：黃聰明） |
| 13:40∼ | *Iterative Method for Space-Time Fractional Advection-Diffusion Equations* |
| 14:05 | Min-Hsiung Lin 林敏雄（主持人：王偉仲） |
| 14:05∼ | *Toward Deep Learning for Application in Finance* |
| 14:30 | Yen-lung Tsai 蔡炎龍（主持人：王偉仲） |
| 15:00∼ | *3D image morphing by large deformation diffeomorphic metric map in conformal parametric domain* |
| 15:25 | Chin-Tien Wu 吳金典（主持人：林敏雄） |
| 15:25∼ | *The Scientific Computing Journey for the 2015 Dengue Epidemics in Tainan* |
| 15:50 | Yu-Chen Shu 舒宇宸（主持人：林敏雄） |

# Some of the Recent Developments of High-Performance Matrix Computations for Big Data Analysis and Large-scale Numerical Simulations

**Wei-Chung Wang(王偉仲)**
**National Taiwan University**
**wwang@ntu.edu.tw**

**Abstract**

The latest CPU and GPU equip advanced features and perform efficiently. More and more co-processors such as GPU and Xeon Phi have also been installed in the major parallel systems. On the other hand, a fast growing size of data sets is collected, censored or derived ubiquitously in almost all fields. To fully take advantages of these modern and powerful computer systems to conduct large-scale data analysis and scientific computations, we need to design novel algorithms that explore and utilize the properties of the target data or simulation problems, the matrix structures, and the hardware architectures. In this talk, we focus on a direct linear system solver and a truncated singular value decomposition to show how we design new algorithms along the trend of fast-evolving processors and computer systems. First, the direct solver is a GPU-accelerated compressed hierarchical Schur algorithm (G-CHiS), and it is used to solve ill-conditioned linear systems arising in 3D photonic device simulations. Second, the integrated singular value decomposition (iSVD) is designed to decompose large matrices, which broadly arising in data analytics, by using multiple random projections and equipped with several variants on parallel computers. Numerical results will be presented to show the advantages of the proposed algorithms.

# Iterative Method for Space-Time Fractional Advection-Diffusion Equations

**Min-Hsiung Lin(林敏雄)**
**National Cheng Kung University**
**mhlin@mail.ncku.edu.tw**

**Abstract**

In this talk, we discuss practical numerical methods for solving a class of initial-boundary value problems of space-time fractional advection-diffusion equations. First, we propose an implicit method based on two-sided Gru?nwald formulae and discuss its stability and consistency. Then, we develop the preconditioned generalized minimal residual (preconditioned GMRES) method with easily constructed preconditioners. Importantly, because resulting systems are Toeplitz-like, fast Fourier transform can be applied to significantly reduce the computational cost. We perform numerical experiments to demonstrate the efficiency of our preconditioners, even in cases with variable coefficients.

# Toward Deep Learning for Application in Finance

**Yen-lung Tsai(蔡炎龍)**
**National Chengchi University**
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**Abstract**

Deep learning has seen many successful applications in various domains. We survey different methods and structures for deep learning, and how could we apply these techniques to financial problems. There are several reasons why deep learning has much potential to deal with complex financial problems. For instance, the feature engineering can be done almost automatically, and deep learning is less prone to overfitting.

# 3D image morphing by large deformation diffeomorphic metric map in conformal parametric domain

**Chin-Tien Wu(吳金典)**
**National Chiao Tung University**
**ctw@math.nctu.edu.tw**

**Abstract**

In this talk, we will introduce some of our recent works on 3D images. Brief reviews on global parametrization using conformal mapping, point cloud registrations and mesh completion will be shown. One of the major challenge on 3D animation is to efficiently manage huge amount of data generated by scanner. To overcome this difficulty, recently, Gu and Yau propose to compress the data using mean curvature $H$ and conformal factor $\lambda$. In this work, we follow Gu and Yau's idea and further apply it to video compression. Details include extracting key frames from the video, matching landmark points on parametric domains, interpolating $(H, \lambda)$ for the remaining frames, and finally reconstructing 3D geometric and texture. The corner stones in our frame works include (i) a robust energy-minimized conformal parameterization by Yueh for building the Riemann map (ii) Finite element method combined with multigrid method for multi-resolution surface reconstruction and (iii)Computation of large deformation diffeomorphic metric map via landmarks matching. We shall briefly address the above key steps and show some of our numerical results.

# The Scientific Computing Journey for the 2015 Dengue Epidemics in Tainan

**Yu-Chen Shu(舒宇宸)**
**National Cheng Kung University**
**ycshu@mail.ncku.edu.tw**

**Abstract**

Dengue, an infectious tropical disease, has recently emerged as one of the most important mosquito-borne viral diseases in the world. In 2015, Tainan experienced severe dengue epidemics. According the open data, we found some interesting issues. First, we show the distance between a new patients and an existed patient obeys exponential distribution. Second, we use SEIR model and a smooth effective contact rate to fit historical data. The effective contact rate decays after the epidemic prevention works by the government. Third, we perform a Monte Carlo simulation to estimate temporal prevalence of asymptomatic dengue viremia (ADV) among people aged 20-64. A very high prevalence of asymptomatic dengue viremia was found in Tainan. We also recommend that measures to ensure blood safety should be evaluated and implemented during dengue epidemics, even in non-endemic areas.

# 計算數學

**Organizer:Tsung-Min Hwang**

**黃聰明 教授**

**地點: 理A212**

**時間:2016年12月11日 (日)**

| | |
|---|---|
| 11:10∼ | *Regularity for elliptic equations in heterogeneous media* |
| 12:00 | Li-Ming Yeh 葉立明（主持人：黃聰明） |
| 13:30∼ | *Use Linear Regression to Minimize the Total Error of the Numerical Differentiation* |
| 13:55 | Jeng-Nan Tzeng 曾正男（主持人：葉立明） |
| 14:00∼ | *Geophysical fluid models with time periodic forcing* |
| 14:25 | Ming-Heng Shiue 薛名成（主持人：葉立明） |
| 14:25∼ | *Newton–Noda iteration for finding the Perron pair of a weakly irreducible nonnegative tensor* |
| 14:50 | Ching-Sung Liu 劉青松（主持人：葉立明） |
| 15:20∼ | *Maximum shear stress in finite element method for viscoelastic fluid flows past a transverse slot problem* |
| 15:45 | Hsueh-Chen Lee 李雪甄（主持人：劉青松） |
| 15:45∼ | *Analytic and Numerical Solutions of Cerebrospinal Fluid with Poroelastic Theory* |
| 16:10 | Shih-Gang Liao 廖士綱（主持人：劉青松） |
| 16:10∼ | *Algorithms for Conformal Parameterizations with Applications* |
| 16:35 | Mei-Heng Yueh 樂美亨（主持人：劉青松） |

# Regularity for elliptic equations in heterogeneous media

**Li-Ming Yeh(葉立明)**
**National Chiao Tung University**
**liming@math.nctu.edu.tw**

**Abstract**

In this talk, we introduce some regularity results for elliptic equations in heterogeneous media. The problem has applications in oil recovering industry, transport in superconducting multifilamentary composites, the stress in composite materials, and so on.

First we consider a periodic case. The medium consists of a periodic connected sub-region with high permeability and a periodic disconnected matrix block subset with low permeability. Let $\varepsilon \in (0,1)$ denote the size ratio of the period to the whole domain and let the permeability ratio of the disconnected matrix block subset to the connected sub-region be of the order $\omega 2 \in (0,1)$. For elliptic equations with diffusion depending on the permeability, the elliptic solutions are smooth in the connected sub-region but vary rapidly in the matrix block subset. Indeed, in the connected sub-region the elliptic solutions can be bounded uniformly in $\varepsilon, \omega$ in Hölder norm, but not the case for the solutions in the matrix block subset. It is well-known that the elliptic solutions converge to a solution of some homogenized elliptic equation as $\varepsilon, \omega$ converge to 0.In this talk, we explain that the $L\infty$ convergence estimate can be derived as $\varepsilon, \omega$ converge to 0. More results on W1,p and Lipschitz norms will also be presented.

Next we consider a random case. The medium is separated by a random ensemble of simply closed interfaces into a connected sub-region with high conductivity and a disconnected subset with low conductivity. The elliptic equations, whose diffusion coefficients depend on the conductivity, have fast diffusion in the connected sub-region and slow diffusion in the disconnected subset. Without a stationary-ergodic assumption, a uniform Hölder estimate in $\omega, \varepsilon, \lambda$ for the elliptic solutions can be derived, where $\omega$ is a realization of the random ensemble, $\varepsilon \in (0,1)$ is the length scale of the interfaces, and $\lambda 2 \in (0,1)$ is the conductivity ratio of the disconnected subset to the connected sub-region. W also note that if external sources are small enough in the disconnected subset, the uniform Hölder estimate in $\omega, \varepsilon, \lambda$ holds in the whole domain. If not, it holds only in the connected sub-region. Meanwhile,

the elliptic solutions change rapidly in the disconnected subset.

# Use Linear Regression to Minimize the Total Error of the Numerical Differentiation

**Jeng-Nan Tzeng(曾正男)**
**National Chengchi University**
**jengnan@gmail.com**

**Abstract**

It is well known that numerical derivative contains two types of errors. One is truncation error and the other is rounding error. By evaluating variables with rounding error, together with step size and the unknown coefficient of the truncation error, the total error can be determined. We also know that the step size affects the truncation error very much, especially when the step size is large. On the other hand, rounding error will dominate numerical error when the step size is too small. Thus, to choose a suitable step size is an important task in computing the numerical differentiation. If we want to reach an accuracy result of the numerical difference, we had better estimate the best step size. We can use Taylor Expression to analyze the order of truncation error, which is usually expressed by the big O notation, that is, $E(h) = Chk$. Since the leading coefficient C contains the factor $f(k)(\xi)$ for high order k and unknown $\xi$, the truncation error is often estimated by a roughly upper bound. If we try to estimate the high order difference $f(k)(\xi)$, this term usually contains larger error. Hence, the uncertainty of $\xi$ and the rounding errors hinder a possible accurate numerical deviative. We will introduce the statistical process into the traditional numerical difference. The new method estimates truncation error and rounding error at the same time for a given step size. When we estimate these two types of error successfully, we can reach much better modified results. We also propose a genetic approach to reach a confident numer- ical derivative.

# Geophysical fluid models with time periodic forcing

**Ming-Heng Shiue(薛名成)**
**National Chiao Tung University**
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**Abstract**

In this talk, several mathematical models related to geophysical fluid dynamics including two-dimensional Navier-Stokes equations and three-dimensional viscous primitive equations are considered. In particular, time periodic motions of the fluid are studied. Depending on the smallness assumption of the applied time periodic force, the existence and uniqueness of the time periodic strong solution hold and this time periodic solution is globally asymptotically stable in the some sense. Without smallness assumption of the force term, the stability is unknown. It is expected that when the size of the force term is increasing, the time periodic solution may no longer asymptotically stable. For 2D Navier-Stokes equations, the numerical experiments to study the bifurcation of the time periodic solutions with increasing amplitude of the force are presented. The bifurcation diagram is presented to conjecture that the time periodic fluid patterns are asymptotically stable when the earth receives a relatively small amount of solar energy regularly, ; However, it will lose its stability when the earth receives too much solar energy even though in a time periodic way.
This presentation is based on a joint work with Dr. Chun-Hsiung Hsia, Dr. Chang-Yeol Jung and Dr. Thien Binh Nguyen.

# Newton–Noda iteration for finding the Perron pair of a weakly irreducible nonnegative tensor

**Ching-Sung Liu(劉青松)**
**National University of Kaohsiung**
**chingsungliu@nuk.edu.tw**

**Abstract**

In this talk, we present a Newton–Noda iteration (NNI) for computing the Perron pair of a weakly irreducible nonnegative $m$th-order tensor $\mathcal{A}$, by combining the idea of Newton's method with the idea of the Noda iteration. The method requires the selection of a positive parameter $\theta_k$ in the $k$th iteration, and produces a scalar sequence approximating the spectral radius of $\mathcal{A}$ and a positive vector sequence approximating the Perron vector. We propose a halving procedure to determine the parameters $\theta_k$, starting with $\theta_k = 1$ for each $k$, such that the scalar sequence is monotonically decreasing. Convergence of this sequence to the spectral radius of $\mathcal{A}$ (and convergence of the vector sequence to the Perron vector) is guaranteed for any initial positive unit vector, as long as the sequence $\{\theta_k\}$ so chosen is bounded below by a positive constant. In this case, we always have $\theta_k = 1$ near convergence and the convergence is quadratic. Very often, the halving procedure will return $\theta_k = 1$ (i.e., no halving is actually used) for each $k$. If the tensor is semisymmetric, $m \geq 4$, and $\theta_k = 1$, then the computational work in the $k$th iteration of NNI is roughly the same as that for one iteration of the Ng–Qi–Zhou algorithm, which is linearly convergent for the smaller class of weakly primitive tensors.

# Maximum shear stress in finite element method for viscoelastic fluid flows past a transverse slot problem

**Hsueh-Chen Lee(李雪甄)**
**Wenzao Ursuline University of Languages**
**87013@mail.wzu.edu.tw**

**Abstract**

The work concerns least-squares finite element solutions of the PTT viscoelastic fluid using adaptively refined grids. Model problems considered are the flow past a planar channel and transverse slot problems. Results of the adaptive refined meshes generated by the maximum shear stress are presented, along with comparisons using a velocity gradient refinement for the least-squares functional. In addition, adaptive grids using the maximum shear stress outperform those using velocity functions, and satisfactory results are obtained using a lower total number of elements. Numerical results indicate that the refinement results of the stress are effective for analyzing viscoelastic fluid flows. Finally, the effects of polymer parameters are also investigated.

# Analytic and Numerical Solutions of Cerebrospinal Fluid with Poroelastic Theory

**Shih-Gang Liao(廖士綱)**
**National Cheng Kung University**
**L18021010@mail.ncku.edu.tw**

**Abstract**

Poromechanics has been widely applied for the biomechanics, e.g. cerebromechanics. In this talk, we focus on the simplified coupled u-p formulation which was derived by O. C. Zienkiewicz who originally used it to depict liquefaction phenomena in geomechanical engineering. The main difficulties are the non-linear boundary condition and extra force term. First, we give a numerical analytical steady state solution via Maple. In addition, we introduce the additional force term to conquer the difficulty caused by the external force which breaks the CFL condition. Stagger grid and scaling analysis are used to eliminate the numerical rounding errors. Numerical results show the first order convergence of the steady state solution. At last, we will show a pressure wave induced by sudden change at the boundary from steady state.

# Algorithms for Conformal Parameterizations with Applications

**Mei-Heng Yueh(樂美亨)**
**National Chiao Tung University**
**henryyueh@gmail.com**

**Abstract**

Surface parameterizations have been widely applied to digital geometry processing. In this talk, I will introduce an efficient algorithm for computing conformal parameterizations of simply-connected open surfaces, and demonstrate some applications on 3D animations.

# 機率

**Organizer:Lung-Chi Chen**
**陳隆奇 教授**
**地點: 理D131**
**時間:2016年12月10日 (六)**

| | |
|---|---|
| 11:30∼ | *Mean-field bound on the 1-arm exponent for Ising ferromagnets in high dimensions* |
| 12:20 | Akira Sakai（主持人: 黃啓瑞） |
| 13:40∼ | *Large deviation of a stochastic processes in magnetic fields* |
| 14:05 | Li-Hu Xu 徐禮虎（主持人:Akira Sakai） |
| 14:05∼ | *Generalizations of Weierstrass's polynomial approximation* |
| 14:30 | Jyy-I Hong 洪芷漪（主持人:Akira Sakai） |
| 15:00∼ | *Diffusion Map with Application to Sleep Stage Assessment* |
| 15:25 | Gi-Ren Liu 劉聚仁（主持人: 徐禮虎） |
| 15:25∼ | *Martin Boundary for Brownian Motion and Some Applications* |
| 15:50 | Wei-Da Chen 陳韋達（主持人: 徐禮虎） |

# Mean-field bound on the 1-arm exponent for Ising ferromagnets in high dimensions

**Akira Sakai**
**Hokkaido University**
**sakai@math.sci.hokudai.ac.jp**

**Abstract**

The Ising model is a statistical-mechanical model for magnets. It is now known that, if the spin-spin coupling is non-negative and reflection-positive (e.g., the nearest-neighbor model is reflection-positive), then it exhibits a continuous phase transition: the critical 1-spin expectation at the center of a ball of radius $r$ vanishes as $r$ goes to infinity. It is believed to decay in powers of $r$, with an exponent $\rho$ called the 1-arm exponent. Presumably this exponent takes on the mean-field value 1 in high dimensions, but the best possible bound so far is $(d-2)/2$, due to a hyperscaling inequality.

I will show how we may achieve the mean-field bound on the Ising 1-arm exponent, i.e., $\rho \leq 1$.
This is ongoing joint work with Satoshi Handa and Markus Heydenreich.

# Large deviation of a stochastic processes in magnetic fields

**Li-Hu Xu(徐禮虎)**
**University of Macau**
**xulihu2007@gmail.com**

**Abstract**

Fluctuation theorem is one of the major achievements in the field of nonequilibrium statistical mechanics during the past two decades. Steady-state fluctuation theorem of sample entropy production rate in terms of large deviation principle for diffusion processes have not been rigorously proved yet due to technical difficulties. Here we give a proof for the steady-state fluctuation theorem of a diffusion process in magnetic fields, with explicit expressions of the free energy function and rate function. The proof is based on the Karhunen-Loève expansion of complex-valued Ornstein-Uhlenbeck process.

# Generalizations of Weierstrass's polynomial approximation

**Jyy-I Hong(洪芷漪)**
**National Sun Yat-sen University**
**hongjyyi@gmail.com**

**Abstract**

The celebrated Weierstrass's theorem characterizes the set of continuous functions on a compact interval via uniform approximation by algebraic polynomials. Among many proofs and generalizations established, Berstein (1912) provided a constructive probabilistic approach using binomial distribution. In this work, we generalize the Weierstrass's polynomial approximation to continuous functions defined on the k-dimensional unit simplex, the k-dimensional "unit cube", and a general metric space (S,d) with a family of probability measures.

# Diffusion Map with Application to Sleep Stage Assessment

**Gi-Ren Liu(劉聚仁)**
**National Cheng Kung University**
**f96221004@gmail.com**

**Abstract**

I would like to talk about how to use the respiration signals, including the thoracic (THO) and abdominal (ABD) movement signals during sleep, to capture the time-dependent sleep stages, consisting of Awake, Rapid-Eye-Movement (REM), N1, N2, and N3. Traditionally, the identification of the sleep stage within each time slot relies on expensive and labor-intensive Polysomnography (PSG). This limitation motivates the development of an objective and automatic identification system about the sleep stages. The diffusion map with the features extracted from respiration signals is applied to re-parameterize the time slots during sleep. Our simulation results show that the time slots with the same sleep stage are roughly clustered together. After getting the clusters, we apply the support vector machine to separating them into five regions and use the cross validation to assess the performance of prediction. In summary, our simulation results show that the accuracy of prediction can reach around 80% at least.
This is a joint work with Hautieng Wu (University of Toronto) and Yuan-Chung Sheu (National Chiao Tung University).

# Martin Boundary for Brownian Motion and Some Applications

**Wei-Da Chen(陳韋達)**
**National Central University**
**dxdydzdtds@gmail.com**

**Abstract**

In this note, we study the Martin boundary for some Gaussian diffusion processes $X_t$. General theory of Martin boundary for Markov process has been well developed in the literature. See Kunita-Watanabe (1965), Dynkin (1969), Salminen (1981). One of its important applications is to give the unique representation of harmonic functions in terms of minimal Martin functions. There are very few concrete examples that properties of Martin boundary are studied, such as Brownian motion. Martin bounday for $2D$ Gaussian transient diffusion process were studied in Cranston-Orey-Rosler (1983). They studied the space time Martin boundary for such diffusion process. As a result, they obtained the representaion for positive harmonic functions. The space-time Martin boundary is to consider the Martin boundary for $\widetilde{X}_t = (t, X_t) \in (0, \infty) \times \mathbb{R}^d$ as a Markov process. In this note, we show how to generalize this idea to the high dimensional space. We will discuss the convergence of some h-diffusion process, the diffusion process under h-transform, where $h$ is a positive space time harmonic function. We also consider the relation between a positive space time harmonic function and limiting distribution of h-diffusion process. Finally, we will use the representation of the space-time harmonic function to get the Boundary-Crossing probability.

# 機率

**Organizer:Lung-Chi Chen**
**陳隆奇 教授**
**地點: 理D131**
**時間:2016年12月11日 (日)**

| | |
|---|---|
| 11:10∼ | *Infinite divisibility in classical and bi-free probability* |
| 12:00 | Hao-Wei Huang 黃皓偉 （主持人：許順吉） |
| 13:30∼ | *Scaling limits for one-dimensional parabolic Anderson model* |
| 13:55 | Chien-Hao Huang 黃建豪 （主持人：陳隆奇） |
| 14:00∼ | *The properties of the American volatility in time-homogeneous diffusion processes* |
| 14:25 | Hsuan-Ku Liu 劉宣谷 （主持人：陳隆奇） |
| 14:25∼ | *Moments' thoughts about martingale with independent increments and its applications* |
| 14:50 | Ching-Tang Wu 吳慶堂 （主持人：陳隆奇） |
| 15:20∼ | *The Mabinogion sheep problem* |
| 15:45 | Yi-Shen Lin 林奕伸 （主持人：陳隆奇） |

# Infinite divisibility in classical and bi-free probability

**Hao-Wei Huang(黃皓偉)**
**National Sun Yat-sen University**
**hwhuang@math.nsysu.edu.tw**

**Abstract**

In 2013, D. Voiculescu introduced the notion of bi-free independence as a generalization of free independence in order to simultaneously study the left and right random variables in a vector space. This research field is later on called bi-free probability. In this talk, we will provide an analytic approach to bi-free probability and bi-freely infinite divisibility . Specifically, we will begin with basic definitions and results, and then introduce bi-free limit theorems, bi-free infinitely divisible distributions, and bi-free stable laws.

# Scaling limits for one-dimensional parabolic Anderson model

**Chien-Hao Huang(黃建豪)**
**National Center for Theoretical Sciences**
**chhuang@ncts.ntu.edu.tw**

**Abstract**

We consider the statistical mechanics model with Hamiltonian described by one-dimensional random walk in random scenery. In the continuum and weak disorder regime, the partition function as a random variable converges weakly to a Wiener Chaos expansion.

# The properties of the American volatility in time-homogeneous diffusion processes

**Hsuan-Ku Liu(劉宣谷)**
**National Taipei University of Education**
**hkliu.ntue@gmail.com**

**Abstract**

This paper studies the parabolic free-boundary problem arising from the valuation of American-style volatility options. With the volatility index following the mean-reverting 3/2 volatility process, we propose the initial value for the early exercise boundary of the finite-time horizon American volatility option and the closed-form expression for the price of the perpetual American power option.

# Moments' thoughts about martingale with independent increments and its applications

**Ching-Tang Wu(吳慶堂)**
**National Taitung University**
**ctwu@nttu.edu.tw**

**Abstract**

In this talk we study the cross moment of martingale with independent increments. Applying this result we can give an alternative proof of an identity between quadratic functionals of Brownian motion holds in law, which plays some role in given an explanation of the Ciesielski-Taylor identities.

# The Mabinogion sheep problem

**Yi-Shen Lin(林奕伸)**
**Academia Sinica**
**yslin@stat.sinica.edu.tw**

**Abstract**

In this talk, we will introduce an optimal control problem for the Mabinogion sheep model, which was first considered by D. Williams. There is a magical flock of sheep, some black and some white. At each stage t=1,2,..., a randomly chosen sheep bleats; if the bleating sheep is white, one black sheep instantly becomes white; if the bleating sheep is black, one white sheep instantly becomes black. Suppose that this system can be controlled by removing any number of white sheep at (the end of) each stage. The goal is to find a control strategy to maximize the expected final number of black sheep. By applying the martingale optimality principle, D. Williams shows that the problem is solvable and admits a simple solution. We propose a more general model M(p,q), in which at each stage, when the bleating sheep is white (black, resp.), a black (white, resp.) sheep (if any remain) instantly becomes white (black, resp.) with probability p (q, resp.) and nothing changes with probability 1-p (1-q, resp.). Note that the original model corresponds to (p,q)=(1,1) and that M(p,q) is equivalent to M(p',q') if p/q=p'/q'. Following Williams' approach, we show that model M(p,q) admits a simple solution if p/q=1/2 or 2. We also present some numerical results for model M(p,q) when p/q is not in 1/2,1, 2, indicating that an intuitively appealing strategy is not optimal for the general model.

# 最佳化

**Organizer:Shue-Chin Huang**

**黃淑琴 教授**

**地點: 理D241**

**時間:2016年12月10日 (六)**

| | |
|---|---|
| 11:30∼ | *Highlight on recent progress for the trust region subproblem and its variants* |
| 12:20 | Ruey-Lin Sheu 許瑞麟 （主持人：林來居） |
| 13:40∼ | *Minimax problems and two-person (zero-sum) Dynamic game systems* |
| 14:05 | Hang-Chin Lai 賴漢卿（主持人：林來居） |
| 14:05∼ | *Solving Bipolar Max-product Equation Constrained* |
| 14:30 | Cheng-Feng Hu 胡承方（主持人：林來居） |
| 15:00∼ | *Multi-layer Structures for Set-valued Mappings* |
| 15:25 | Yen-Chernng Lin 林炎成（主持人：林來居） |
| 15:25∼ | *Second order duality for a minimax programming in complex spaces* |
| 15:50 | Tone-Yau Huang 黃同瑤（主持人：林來居） |

# Highlight on recent progress for the trust region subproblem and its variants

**Ruey-Lin Sheu(許瑞麟)**
**National Cheng Kung University**
**rsheu@mail.ncku.edu.tw**

**Abstract**

The talk aims to highlight important feature and results of the trust region subproblem and its variants. The trust region subproblem minimizes globally a possibly nonconvex quadratic function over the unit ball, whereas the generalization we discuss and review here is either to replace the unit ball with a general quadratic function; or to add additional linear inequality constraints to it, but not both. It is not until very recent that people completely understand the aforementioned variants of the trust region subproblem, so the results are relatively new and not known to many audiences in the society. As many results are scattered in some highly technical papers and many were indeed contributed by the same authors of this talk, we feel that it is necessary to address the core concepts and highlight the connections in between the technicality of different extensions. We shall focus on the polynomial solvability of the problems, by exploring the hidden convexity and strong duality through a tight SDP relaxation, or by an induction scheme reducing to the basic trust region subproblem.

# Minimax problems and two-person (zero-sum) Dynamic game systems

Hang-Chin Lai (賴漢卿)

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## Abstract

令任意兩個隨機空間 X 及 Y 為一兩人零和之動態賽局之甲乙兩個與賽者的分別策略空間。本演講主要說明 1929 年 Von Neumann 建立 Minimax 定理，在平衡經濟上，是否能建立實數函數$f$:X × Y → R使得在甲乙兩人賽局時，可得到下列等式:

$$\min_{x\in X}\max_{y\in Y} f(x,y) = \max_{y\in Y}\min_{x\in X} f(x,y) \qquad (*)$$

1953 年樊畿(Ky Fan)在 *Proc. Nat. Acad. Sci. U. S. A.* **39,** pp. 42–47

證明了三種情形的結果:

(I) 如果 X 和 Y 為緊緻 Hausdorff，函數 $f$:X × Y → R 為在 X 上 *l.s.c* 且為在 Y 上 *u.s.c.*。則(*)成立。

(II) 如果 X 為緊緻 Hausdorff 而 Y 為任意， $f(\cdot,y)$:X → $f$(x,y) 為在 X 上 *l.s.c.*且類凸，並且$f(x,\cdot)$:Y → $f$(x,y)為類凹。則(*)成立

(III) 如果 X 和 Y 為任意空間時，$f$:X × Y → R 為概週期函數:

對任意的 $\varepsilon > 0$, $\exists\ \{x_i\}_{i=1}^{n} \subset X$, $\{y_i\}_{j=1}^{m} \subset Y$及$(x_0,y_0) \in$ X × Y

使得 $f(x_0,y_j) - f(x_i,y_0) \le \varepsilon$

或等價於 $f(x_0,y_j) \le f(x_0,y_0) + \varepsilon \le f(x_i,y_0)$

則(*)成立之充要條件為$f: \mathrm{X} \times \mathrm{Y} \to \mathrm{R}$ 為概週期函數。

在今日的演講，我則先

(1) 先建立策略空間 X 與 Y，為兩人隨機選取$x \in \mathrm{X}$及$y \in \mathrm{Y}$並考慮兩人酬報之零和動態賽局(下列數學符號得以用數學分析來推演的賽局過程):

$$\mathrm{D}G_\theta \cdot (S_n, A_n, B_n, t_{n+1}, u_n, v_n, \theta), \quad \mathrm{n} \in \mathbb{N}$$

其中

1. $S_n$：state space (狀態空間)
2. $A_n \subset X, B_n \subset Y$: 兩個 players 的 action spaces
3. $t_{n+1}$: probability of state $S_n$ moves to $S_{n+1}$
4. $u_n$ and $v_n$為$I$及$II$兩人的回報函數
5. $\theta: parameter\ in\ the\ game$(為賽前雙方同意調節某些原因所作規定)

(2) History setting (自狀況$S_1 S_2, \dots, S_n$)

$$H_1 = S_1$$
$$H_2 = S_1 \times A_1 \times B_1 \times S_2$$
$$\vdots$$
$$H_n = S_1 A_1 B_1 S_2 A_2 B_2 S_3 \cdots S_{n-1} A_{n-1} B_{n-1} S_n$$
$$= H_{n-1} A_{n-1} B_{n-1} S_n, \ n = 2,3 \text{ interated}$$

(3) 當時間$\mathrm{n} \to \infty$時，I 及 II 的回報函數

$$u_n: H_n A_n B_n \to \mathbb{R} \ \text{及} \ v_n: H_n A_n B_n \to \mathbb{R}^+$$

則它們的極限函數(limit functions)

$$\lim_{n\to\infty} u_n = u\ (H_\infty \to \mathbb{R})\ \text{及}\ \lim_{n\to\infty} v_n = v\ (H_\infty \to \mathbb{R}^+)$$

就在 X 與 Y 為 Separability 時:

對任意的(x, y) ∈ X × Y，同時與其運動律$\{t_{n+1}\}_{n=1}^{\infty}$，必有唯一宇可測變異機率函數$P_{xy}(\cdot\,|\,\cdot)$從$S_1 \to A_1B_1S_2A_2B_2S_3$，則有$(u_n, v_n)$在 n ∈ ℕ時的條件總期望值分別為

$$\mathrm{E}(u_n, \mathrm{x}, \mathrm{y})(S_1) = \int_{H_\infty} u_n(h) P_{xy}(dh|S_1) = E_{xy}u_n(S_1)$$

$$\mathrm{E}(v_n, \mathrm{x}, \mathrm{y})(S_1) = \int_{H_\infty} v_n(h) P_{xy}(dh|S_1) = E_{xy}v_n(S_1)$$

(4) 從(3)我們可是義工有他的得(失)在n ∈ ℕ時為

(i) $F_\theta^n = u_n - \theta v_n$

而 player II 在時間n ∈ ℕ所得為

(ii) $-F_\theta^n$

不論何時(i)+(ii)的期望值都是零和

(5) 由(3)我們得知

$$\bar{F}_\theta(S_1) = \inf_{x\in X} \sup_{y\in Y} F_\theta(x, y)(S_1)$$

並得

$$\underline{F_\theta}(S_1) = \sup_{y\in Y} \inf_{x\in X} F_\theta(x, y)(S_1)$$

區間$\left[\underline{F_\theta}(S_1), \bar{F}_\theta(S_1)\right]$就稱該賽局(D$G_\theta$)的 duality gap。

結論:

- 若有$y^* \in$ Y為$F_\theta(x,y)(S_1)$ over y ∈ Y for each x ∈ X，則

$$\bar{F}_\theta(S_1) = \underline{F_\theta}(S_1) = F_\theta^*(S_1)。$$

則有 maximizer(*)成立

- 若有$x^* \in$ X為$F_\theta(x,y)(S_1)$ over x ∈ X for each y ∈ Y，則

$$\bar{F}_\theta(S_1) = \underline{F_\theta}(S_1) = F_\theta^*(x,y)(S_1)。$$

是一個$F_\theta(x,y)(S_1)$的 maximizer。

# Solving Bipolar Max-product Equation Constrained

**Cheng-Feng Hu(胡承方)**
**National Chiayi University**
**cfhu@mail.ncyu.edu.tw**

**Abstract**

This work considers a generalization of the linear optimization problem with fuzzy relational equations by allowing for bipolar max-product constraints, i.e., constraints in which not only the decision variables but also their logical negations occur. Some critical features associated with the feasible domain and optimal solutions of the bipolar max-product equation constrained linear optimization problem are studied. An integer optimization based technique is developed for solving the linear optimization problem constrained by a system of bipolar fuzzy relational equations with max-product composition.

# Multi-layer Structures for Set-valued Mappings

**Yen-Cherng Lin(林炎成)**
**China Medical University**
**yclin@mail.cmu.edu.tw**

**Abstract**

We study the minimax theorems of non-continuous set-valued mappings with multi-layer structures. Based on our new create scalar multi-layer minimax theorems, we construct many versions of multi-layer minimax theorems for non-continuous set-valued mappings. These theorems include many special cases. Some examples are also proposed in order to illustrate our new theories.

# Second order duality for a minimax programming in complex spaces

**Tone-Yau Huang(黃同瑤)**
**Feng Chia University**
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**Abstract**

In this talk, we consider a minimax complex programming problem (P). The goal of this talk, a second order dual problem for problem (P) is formulated. The weak, strong, and strict converse duality theorems are constructed under generalized $\Theta$-bonvexity assumptions. This means that there are no duality gaps between primary problem and its second order dual problem.

# 最佳化

**Organizer:Shue-Chin Huang**

**黃淑琴 教授**

**地點: 理D241**

**時間:2016年12月11日 (日)**

| | |
|---|---|
| 11:10∼ | *From symmetric cone optimization to nonsymmetric cone optimization: spectral decomposition, nonsmooth analysis, and projections* |
| 12:00 | Jein-Shan Chen 陳界山（主持人：許瑞麟） |
| 13:30∼ | *Optimization problem over the solution set for the sum of two functions with applications* |
| 13:55 | Lai-Jiu Lin 林來居（主持人：許瑞麟） |
| 14:00∼ | *Construction of convex functions and cone on Euclidean Spaces* |
| 14:25 | Yu-Lin Chang 張毓麟（主持人：許瑞麟） |
| 14:25∼ | *Some Results of Alternative Contractions* |
| 14:50 | Yi-Chou Chen 陳怡州（主持人：許瑞麟） |
| 15:20∼ | *The choices on particle swarm optimization parameters and their applications* |
| 15:45 | Chi-I Yang 楊期壹（主持人：許瑞麟） |
| 15:45∼ | *Some properties for numerical hierarchical minimax theorem* 數值之層次極大極小定理的一些性質 |
| 16:10 | Wei-Yu Yen 顏瑋郁（主持人：許瑞麟） |

# From symmetric cone optimization to nonsymmetric cone optimization: spectral decomposition, nonsmooth analysis, and projections

**Jein-Shan Chen(陳界山)**
**National Taiwan Normal University**
**jschen@math.ntnu.edu.tw**

**Abstract**

It is well known that symmetric cone optimization can be unified under Jordan algebra and Euclidean Jordan algebra. To the constrast, there is no unified framework for nonsymmetric cone optimization. Nonetheless, we figure out that there seem some common concepts between them. In this talk, we focus on what the bridge is between symmetric cone optimization and nonsymmetric cone optimization.

# Optimization problem over the solution set for the sum of two functions with applications

**Lai-Jiu Lin(林來居)**
**National Changhua University of Education**
**maljlin@cc.ncue.edu.tw**

**Abstract**

# Construction of convex functions and cone on Euclidean Spaces

**Yu-Lin Chang(張毓麟)**
**National Taiwan Normal University**
**ylchang@math.ntnu.edu.tw**

**Abstract**

In this talk we will relate convex functions and cones. They seem have some close relationship.

# Some Results of Alternative Contractions

**Yi-Chou Chen(陳怡州)**
**National Army Academy**
**cycu.chou@gmail.com**

**Abstract**

Let $(X,d)$ be a metric space, $Ai, i = 1,2,\ldots,m$ nonempty subsets of $(X,d)$ and $T : \bigcup_{1\le i\le m} Ai \to \bigcup_{1\le i\le m} Ai$ a nonlinear operator. We call that $T$ is an alternative map if $T(Aj) \subseteq \bigcup Ai$ for any $j = 1,2,\ldots,m$ and an alternative contraction if there exists a constant $\alpha \in [0,1)$ such that $d(x,y) \le \alpha d(x,y) + (1-\alpha)d(Aj,Ak)$ for some $x \in Aj$ and $y \in Ak$ for some $1 \le j,k \le m$. In this paper, we prove that if an alternative map $T$ satisfies the alternative contraction with the UC condition, then the best proximity point for $T$ exists.

Key words and phrases : Alternative map, best proximity point, convergence theorem.
2000 Mathematics Subject Classification: 47H10

# The choices on particle swarm optimization parameters and their applications

**Chi-I Yang(楊期壹)**
**Feng Chia University**
**yesheslhamo@gmail.com**

**Abstract**

There are numerous factors, such as government decision making, international situations, company fundamentals, and corporate operations which could all lead to dramatic fluctuation of stock prices. The use of wavelet as the function of prediction model is based on its advantage of noise filtering in order to effectively reduce the complexity in waveform and prediction caused by external factors. This research examines the forecasting performance of wavelet neural network (WNN) model with particle swarm optimization (PSO) by using published stock data obtained from Taiwan Stock Exchange (TWSE) 50 index. Moreover, we provide a new method to demonstrate PSO parameters for WNN. The findings come with advantages. By means of PSO, WNN initial parameters can be "automatically" selected. We not only achieve a success rate over 73%, but it is not necessary to create new math model to certain stocks.

# Some properties for numerical hierarchical minimax theorem 數值之層次極大極小定理的一些性質

**Wei-Yu Yen(顏瑋郁)**
**China Medical University**
**u104072803@cmu.edu.tw**

**Abstract**

In this research, a whole intersection property with hierarchical structures is obtained. We also establish a new type minimax theorems with hierarchical structures. Furthermore, as an application, the existent results of maximal element are also discussed.

# 數學科普

**Organizer:Shin-Shin Kao**

**高欣欣 教授**

**時間:2016年12月10日 (六)**

| | |
|---|---|
| 11:00∼ 12:30 | **提升民眾對於數學的知覺** (地點: 理二講堂)<br>Ko-Wei Lih **李國偉（主持人：高欣欣）** |
| 13:30∼ 15:30 | **科普** DIY **活動: 數學魔術** (地點: 理 A316)<br>Wei-Tung Chuang **莊惟棟（主持人：嚴志弘）** |

# 提升民眾對於數學的知覺

**Ko-Wei Lih(李國偉)**
**Academia Sinica**
**makwlih@sinica.edu.tw**

**Abstract**

什麼是數學知覺? 今年五月初《華盛頓郵報》報導的一則烏龍事件或可說明。美國一位經濟學教授孟齊奧 (Guido Menzio) 在等待飛機起飛時, 在座位上計算微積分, 但鄰座乘客因看不懂其中使用的數學符號, 以爲他在用異國文字擬定恐怖攻擊行動, 並向空服員反應孟齊奧很可能是恐怖份子。後來孟齊奧被請下機調查, 他得知緣由後哭笑不得, 只能無奈地解釋自己只是在算數學, 並將剛寫的算式給調查人員檢查。最後他獲准重新登機, 不過該班機已經延誤了2個多小時, 終於結束了這場因數學知覺不足所引起的烏龍事件。

有鑑於民眾對於數學的知覺嚴重不足, 國際數學界自上世紀末, 除了致力傳統上的學校教育改善, 逐漸意識到讓數學走入社會的重要性。在聯合國教、科、文組織以及第三世界科學院的支持下, 國際數學聯合會的主席里昂 (Jacques-Louis Lions) 於1992年5月6日宣布, 將2000年定爲「世界數學年」(World Mathematical Year,WMY 2000)。這個宣示的主要目標是要凸顯數學的形象, 讓一般大眾可以看見數學在各種不同領域中扮演的重要角色。不少國家還發行 WMY 2000的紀念郵票。爲了吸引更多民眾關注, 英國的艾薩克·牛頓數學科學研究所 (Isaac Newton Institute for Mathematical Sciences) 還製作了12款海報, 在倫敦地鐵車廂裡按月張貼。「世界數學年」的活動在歐美獲得很大的迴響, 若干國家的數學團體以此經驗爲基礎, 持續發展向民眾推廣數學的活動, 一直到今日。

# 科普 DIY 活動: 數學魔術

**Wei-Tung Chuang(莊惟棟)**
**National Taiwan Science Education Center**
**wtmathmagic@gmail.com**

**Abstract**

英文中有一組合字 Mathemagician「魔數師」, 據說人稱「葛老爹」的數學遊戲大師馬丁葛登能 (Martin Gardner) 是這個名號最早的得主, 在他爲 Scientific American 執筆二十五年的數學遊戲專欄以及生涯中七十餘本著作裡, 數學就像神奇的魔術一樣, 令人目眩神迷, 心生嚮往。葛老爹的文章除了揭露質樸純粹的數學本質, 同時又能夠激發重要問題。從語言學家喬姆斯基 (Noam Chomsky) 給他的評語「無論是廣度、深度乃至於重要困難問題的理解, 都是獨一無二的。」我們可以感受到葛老爹的影響有多廣泛且深刻。「本世紀美國最偉大的知識份子之一」則是普立茲獎得主、美國認知科學家霍夫斯塔特 (Douglas Hofstadter) 爲葛老爹致上的最高敬意。

在葛老爹之後, 這個字開始用來稱呼一位數學家同時也兼具魔術師身分的人, Arthur Benjamin, Persi Diaconis, Colm Mulcahy, Ronald Graham 等都是目前世界上「使用數學變魔術」及「使用魔術秀數學」知名的人物。值得一提的是 Persi Diaconis 爲當時世界牌神的徒弟, 在魔術手法上非常出色。

# 統計

**Organizer:Chen-Hai Tsao**
**曹振海 教授**
**地點: 理A316**
**時間:2016年12月11日 (日)**

| | |
|---|---|
| 11:10∼ | *Bayesian Sparse Support Union Recovery* |
| 12:00 | Ray-Bing Chen 陳瑞彬 (主持人: 曹振海) |
| 13:30∼ | *Goodness-of-fit Statistics of Proportional Odds Models Based on the Pooled Observations* |
| 13:55 | Wei-Hsiung Chao 趙維雄 (主持人: 曹振海) |
| 14:00∼ | *Systemic Risk and Stochastic Games with Delay* |
| 14:25 | Li-Hsien Sun 孫立憲 (主持人: 曹振海) |
| 14:25∼ | *On High-Dimensional Cross-Validation* |
| 14:50 | Wei-Cheng Hsiao 蕭維政 (主持人: 曹振海) |
| 15:20∼ | *On Developing Markov-based Regression Models for General Trend Analysis of Bivariate Continuous Panel Data* |
| 15:45 | Wei-Hsiung Chao 趙維雄 (主持人: 吳韋瑩) |
| 15:45∼ | *Asymptotic Theory for Linear Mixed-Effects Model Selection* |
| 16:10 | Chih-Hao Chang 張志浩 (主持人: 吳韋瑩) |

# Bayesian Sparse Support Union Recovery

**Ray-Bing Chen(陳瑞彬)**
**National Cheng Kung University**
**rbchen@mail.ncku.edu.tw**

**Abstract**

This paper studies the variable selection problem in high dimensional regression, where there are multiple response variables (or vectors), and there are a potentially large pool of predictor variables (or vectors). It is assumed that each response variable can be explained by a subset of predictor variables. This subset is called the support of the corresponding response variable. It is further assumed that these multiple response variables share the same or similar supports. The goal is to recover the union of the supports of all the response variables. We propose to solve this problem using a Bayesian method where we introduce two nested sets of binary indicators. In the first set, each indicator is associated with a predictor variable, indicating whether this predictor variable belongs to the support union. In the second set, each indicator is associated with both a predictor variable and a response variable, indicating whether the predictor variable belongs to the support of the corresponding response variable. The support union can then be recovered based on the posterior distribution of these indicator variables. We develop MCMC algorithms to sample from the posterior distribution for support union recovery. Our simulation studies show that the proposed Bayesian method outperforms the Lasso-type methods. We also illustrate our method on a real example of image representation.

# Goodness-of-fit Statistics of Proportional Odds Models Based on the Pooled Observations

**Wei-Hsiung Chao(趙維雄)**
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**Abstract**

Cross-sectional data involving categorical responses are often fitted by polytomous regression models using the method of maximum likelihood estimation to study the dependence of the response on the covariate. The assessment of goodness of model fit is an important issue for model checking. Without using any grouping strategies as in other ad-hoc statistics of Pearson type, we propose a Pearson-like W statistic based on pooled observations which was shown to have asymptotic chi-square null distribution under certain rank condition. Through numerical studies, we show that the rank condition is satisfied for ordinal response with cumulative logit link. To study the finite sample properties of the W test statistic, we focus on the proportional odds regression model and conducted simulations. For all sample sizes and simulation scenarios being considered, the W statistic was found to have a good size performance. In addition, the power performance of the proposed test was compared with two existing ad-hoc methods using simulated data. The W test was found to be significantly superior to these ad-hoc tests in detecting the omission of a quadratic term and a false link function, and comparable to these ad-hoc tests in detecting the omission of an interaction term.
This is a joint work with Yi-Ran Lin.

# Systemic Risk and Stochastic Games with Delay

**Li-Hsien Sun(孫立憲)**
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**Abstract**

We propose a simple model of inter-bank lending or borrowing with the corresponding delayed obligations. The evolution of log-monetary reserve of N banks is described by coupled diffusions driven by regular controls and controls with delay in the drifts satisfying the optimization for coupled objective functions. The amount of each bank desiring lending to or borrowing from a central bank is evaluated through the comparison of its log-monetary reserve and the ensemble average. Systemic risk is characterized by a large number of defaults, the log-monetary reserve reaching the given default barrier in the fixed time horizon. The equilibrium is obtained using fully coupled forward and anticipated backward stochastic differential equation. We observe that the lending or borrowing leading to the mean-reverting at ensemble average creates stability but systemic risk. In addition, we obtain that the delayed obligations not only give diversity leading to the avoidance of systemic risk but affect the liquidity rate of borrowing and lending.

# On High-Dimensional Cross-Validation

**Wei-Cheng Hsiao(蕭維政)**
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**Abstract**

Cross-validation (CV) is one of the most popular methods for model selection. By splitting $n$ data points into a training sample of size $n_c$ and a validation sample of size $n_v$ with $n_v/n \to 1$ and $n_c \to \infty$, Shao (1993) showed that subset selection based on CV is consistent in a regression model of $p$ candidate variables with $p << n$. However, in the case of $p >> n$, not only does CV's consistency remain undeveloped, but subset selection is also practically infeasible. In this paper, we fill this gap by using CV as a backward elimination tool for eliminating variables that are included by high-dimensional variable screening methods possessing sure screening property. By choosing an $n_v$ such that $n_v/n$ converges to 1 at a rate faster than the one in Shao's (1993) paper, we establish the consistency of our selection procedure. We also illustrate the finite-sample performance of the proposed procedure using Monte Carlo simulation.

# On Developing Markov-based Regression Models for General Trend Analysis of Bivariate Continuous Panel Data

**Wei-Hsiung Chao(趙維雄)**
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**Abstract**

In many longitudinal studies, the underlying continuous response processes of interest may undergo natural fluctuation over time, as is the case with blood pressure. In these situations, transitions between specific states are often not as interesting as the general direction and rate of movement, since uncountably many transitions between states are involved and they do not provide a summary information about the evolution of the process. To provide such general trend information for panel data of a single continuous response, Chao and Chen (2009) developed a Markov-based regression model that can be viewed as a continuous time first order autoregressive regression model with time varying lag effects of the covariate. In this talk, we further extend their model to settings of panel data of two continuous response variables. This is done by using the technique of reparameterization to search for meaning parameters. In addition to assessing the general trend of each underlying response process, the proposed model can help determine if there is feedback effect of one response process on the other process. For robust inference on parameters in the conditional mean structure, the generalized estimating equation approach is adopted, along with the method of moment for estimating the nuisance parameter matrix.
This is a joint work with Yi-Ran Lin.

# Asymptotic Theory for Linear Mixed-Effects Model Selection

**Chih-Hao Chang(張志浩)**
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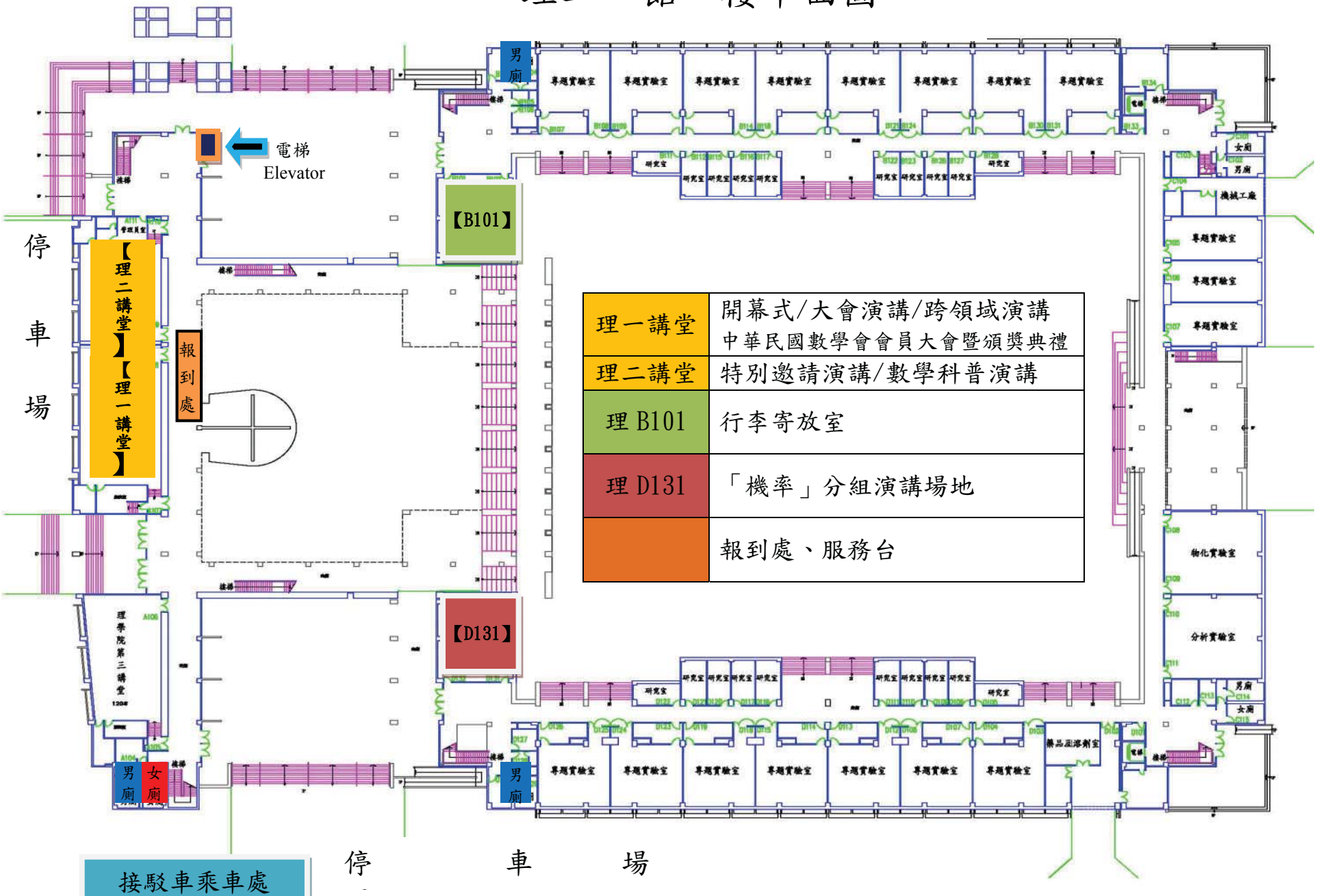
**Abstract**

In our research, we propose a conditional generalized information criterion (CGIC) for linear mixed-effects model selection. The CGIC includes the conditional Akaike's information criterion (CAIC) proposed by Vaida and Blanchard as a special case. In practice, CAIC is considered to be an adequate criterion for prediction purpose of mixed-effects where the criterion is an unbiased estimator of the expectation of the squared error loss function of the best linear unbiased predictor established under the linear mixed-effects model. In this talk, we propose CGIC to select fixed-effects and random-effects models simultaneously which is convinced helpful for the prediction purpose if the random-effects model could be properly selected. In general we aim for two asymptotic properties: consistency and asymptotic loss/risk efficiency, which are kernel asymptotic properties for prediction purpose of linear mixed-effects data analysis. In this talk, we establish the asymptotic theory of CGIC for the linear mixed-effects model selection under some regularity conditions.
Keywords: Variable selection, linear mixed-effects model, Conditional GIC.


國立東華大學校園導覽平面圖
NDHU CAMPUS MAP
往志學村(志學火車站、公車站)
往台九線
大學路一段
大學路二段
往花蓮市南濱
學生宿舍區
Dormitory Areas
大會會場
理工一館
行政區 Administrative zone
服務區 Amenity
教學區 Academic zone
宿舍區 Dormitory
校園警衛室 Campus security office
停車場 Parking
廁所 Toilet
餐廳 Restaurant
主要方向指標 Sign post
校園位置平面圖 Campus map
索 引 Index
1 行政大樓 Administration Building
2 藝術學院 Arts Building
3 人社三館 Humanities and Social Sciences Building III
4 人社一館 Humanities and Social Sciences Building I
5 人社二館 Humanities and Social Sciences Building II
6 花師教育學院 Hua-Shih Education Building
7 資訊與網路中心 Information and Network Center
8 管理學院 Management Building
9 學生活動中心 Student Activities Center
10 圖書館 Library
11 湖畔餐廳 Lakeside Restaurant
12 理工一館 Science and Engineering Building I
13 理工二館 Science and Engineering Building II
14 育成中心 Incubation Center
15 理工三館 Science and Engineering Building III
16 藝術工坊 Arts Workshop
17 原住民民族學院 Indigenous Studies Building
18 環境學院 Environmental Studies Building
19 東華會館 Guest House
20 環境解說中心 Environmental Exposition Center
21 大門及警衛室 Main Entrance (with Security Office) / South Exit
22 學人宿舍一 Faculty Quarters I
23 幼稚園 Kindergarten
24 學人宿舍二 Faculty Quarters II
25 社區中心 Community Center
26 社區球場一 Community Courts I
27 學生宿舍(攝雲莊) Dormitory I
28 多容館 West Community House
29 學生宿舍(仰山莊) Dormitory II
30 學生宿舍(追星莊) Dormitory III
31 學生宿舍(向晴莊) Dormitory IV
32 游泳池 Swimming Pools
33 綜合球場一 Sports Courts I
34 棒、足球場 Baseball / Soccer Field
35 志學門 Entrance / North Exit
36 運動場 Athletic Field
37 體育館 Indoor Sports Center
38 綜合球場二 Sports Courts II
39 探索體驗教育場地 Rope Course Field
40 學生宿舍(行雲莊) Dormitory V
41 社區球場二 Community Courts II
42 集賢館 East Community House
43 學生宿舍(沁月莊) Dormitory VI
44 學生宿舍(迎曦莊) Dormitory VII
45 倉庫 Warehouse
46 污水處理廠 Sewage Treatment Plant
47 東湖 Dong Lake
48 華湖 Hwa Lake
49 小華湖 Hwa Lake II
50 景觀橋 Scenic Bridge

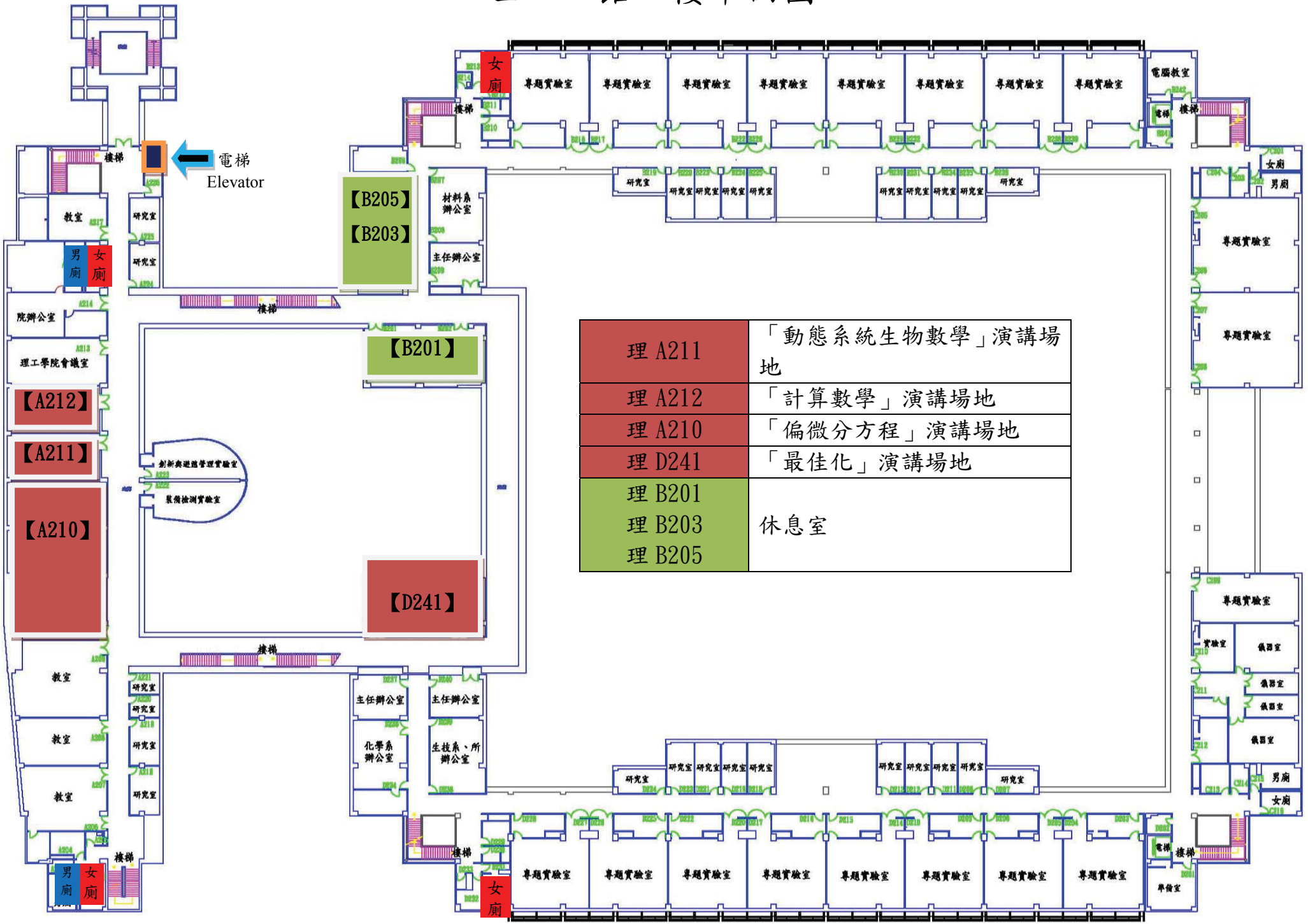
# 理工一館一樓平面圖

湖畔餐廳(晚宴)




| | |
|---|---|
| 理一講堂 | 開幕式/大會演講/跨領域演講<br>中華民國數學會會員大會暨頒獎典禮 |
| 理二講堂 | 特別邀請演講/數學科普演講 |
| 理 B101 | 行李寄放室 |
| 理 D131 | 「機率」分組演講場地 |
| | 報到處、服務台 |

# 理工一館二樓平面圖

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|---|---|
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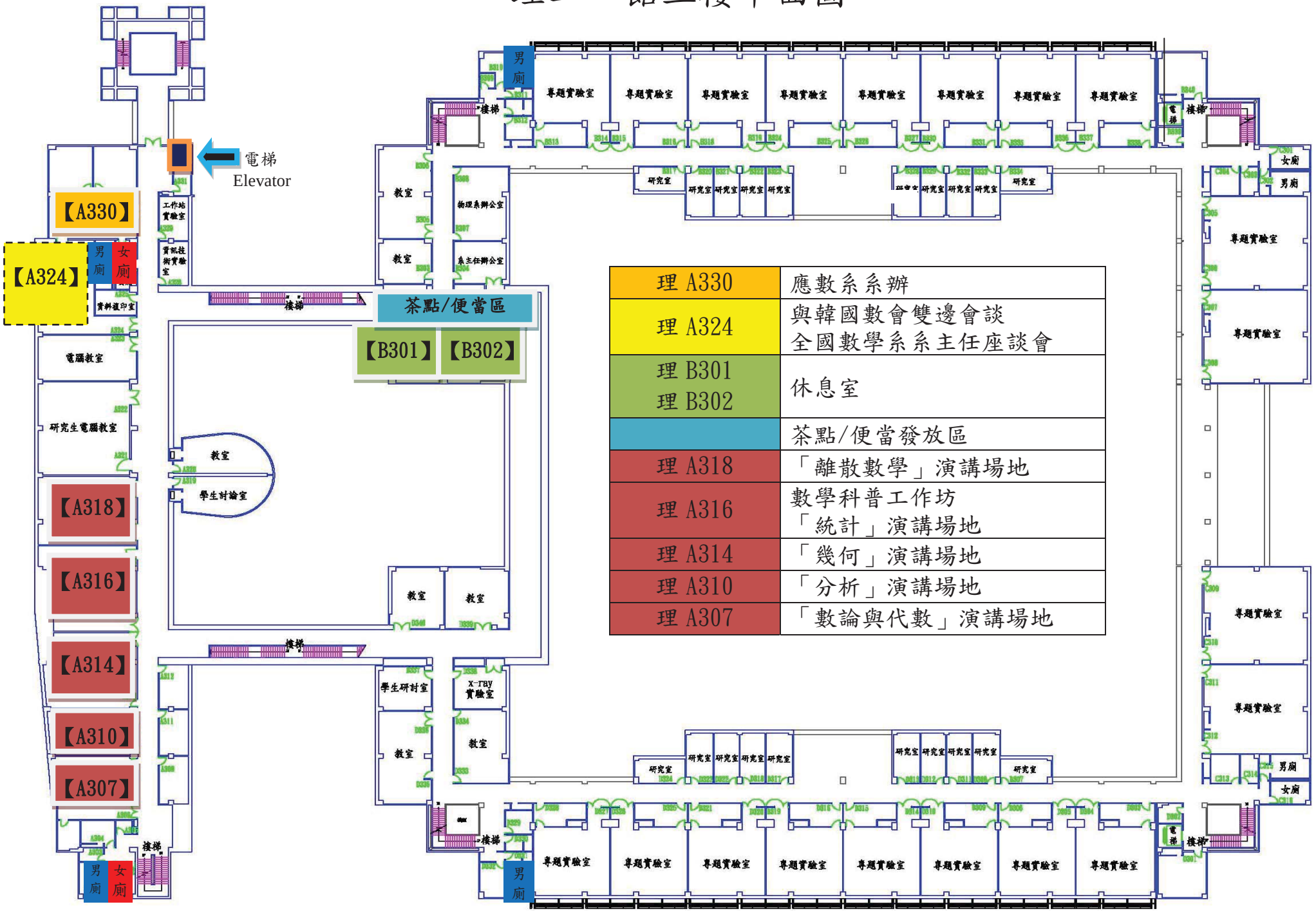
| 理 A212 | 「計算數學」演講場地 |
| 理 A210 | 「偏微分方程」演講場地 |
| 理 D241 | 「最佳化」演講場地 |
| 理 B201<br>理 B203<br>理 B205 | 休息室 |

# 理工一館三樓平面圖




| | |
|---|---|
| 理 A330 | 應數系系辦 |
| 理 A324 | 與韓國數會雙邊會談<br>全國數學系系主任座談會 |
| 理 B301<br>理 B302 | 休息室 |
| | 茶點/便當發放區 |
| 理 A318 | 「離散數學」演講場地 |
| 理 A316 | 數學科普工作坊<br>「統計」演講場地 |
| 理 A314 | 「幾何」演講場地 |
| 理 A310 | 「分析」演講場地 |
| 理 A307 | 「數論與代數」演講場地 |

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