

中華民國數學會

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一、學會獎

陳宜良 教授



學歷 Education :

美國紐約大學數學所博士, 1983

國立臺灣大學數學所碩士, 1978

國立臺灣大學數學系學士, 1975

經歷 Experience :

臺灣大學數學系名譽退休教授, 2018-

臺灣大學數學系教授, 1991-2014, 2016-2018

中央大學數學系講座教授, 2014-2015

交通大學數學建模與科學計算中心主任,
2012-2014

臺灣大學數學系系主任, 1999-2002

阿崗國家實驗室助理數學家, 1989-1991

紐約大學助理研究教授, 1987-1989

中央研究院數學研究所副研究員, 1983-1989

研究領域 Research interests :

偏微分方程，科學計算，影像處理

曾獲得之學術獎勵

1992 國科會傑出研究獎

2008-2011 臺灣大學特聘教授

2013-2014 交通大學特聘教授

2014-2015 中央大學講座教授

其他

2014- 工業與應用數學學會亞洲分部諮詢委員

2012-2018 臺灣工業與應用數學會理事長

2005-2014 工業與應用數學學會亞洲分部執行委員

2002-2004 中華民國數學會副理事長

編輯相關

- 2011- Communications in Information and Systems 主編
2006-2016 Journal of Computational Mathematics 副主編
2011-2016 East Asian Journal on Applied Mathematics 副主編
2016- East Asian Journal on Applied Mathematics 名譽編輯
2011-2013 International Journal of Numerical Analysis & Modeling, Series B
副主編

推薦理由

在研究方面，陳教授在hyperbolic conservation laws, computational fluid dynamics, image processing 以及Bose-Einstein condensation的數學基礎均有相當貢獻。他於1992年獲得國科會傑出研究獎，並受邀於ICCM作主講，以及許多國際會議作邀請演講。

教學方面，陳教授不但培育多位具有跨領域能力的博士生，還撰寫多門應用數學課程之教材。

服務方面，陳教授於擔任中華民國數學會副理事長期間(2002-2004)，積極推動中、小學的數學教育改革；於2006-2016年擔任普通高中數學課程綱要修訂召集人暨教科書審查主任委員，訂定並推動99課綱之施行；自1993年起，舉辦全國計算數學會議，建立數學界與工程界溝通的橋樑。除此之外，陳教授推動並籌辦台大應用數學科學研究所、台大數學科學研究中心；推動台大數學與中研院(天文所、數學所)的合作，並籌建天文數學大樓。最重要的是，陳教授在推動大學數學教育與應用數學教育改革上，功不可沒。

陳教授擔任SIAM東亞分會(EASIAM)執行理事及顧問多年，並在2012年舉辦EASIAM年會，是一場非常成功的年會。爾後陳教授於2012-2018擔任台灣工業與應用數學會(TWSIAM)理事長，建置學會制度、推動數學與工程界、工業界的連結，推動TWSIAM與ICIAM的連結，推動應用數學教育改革。

研究工作介紹

1. Bose-Einstein condensation and systems of nonlinear Schrodinger equations:
(1) developed pseudo-arclength continuation method to compute ground states of spinor BEC, dipolar BEC in uniform magnetic field and Ioffe-Pritchard magnetic field, provided a complete phase diagram of ground-state patterns [J2,J6,J9,J14,J20]; (2) provided existence theory for spinor BECs, characterization of

ground states, complete phase diagram of ground-state patterns in semi-classical regime and Thomas-Fermi regime [J4,J15,R1,R2]; (3) studied large-time behaviors of solutions of Schrodinger-Langevin equation with damping [J7].

2. Interface problems and applications: (1) proposed coupling interface method (CIM) to solve elliptic interface problems which is simple, truly second-order and can handle complex interfaces in 3D with applications in plasmonic crystals, ecological habitat patterns, fabric dynamics, macromolecule behaviors in solutions [J22,J19,J18,J17,J10,J3]; (2) studied dynamic phase transition for Cahn-Hilliard equation and simulated binary-fluid-surfactant dynamics by phase field model [J16,J12].

3. Image processing and numerical optimization: (1) proposed a registration method for set matching problems by using mass transportation theory with application to matching branch points in lung respiration [J11]; (2) proposed a method to mitigate B1+ inhomogeneity in 7T magnetic resonance imaging [J8]; (3) proposed an algebraic multigrid approach to speed up TV denoising algorithm [J23]; (4) proposed a theoretical framework for wavelets based on interpolation and finite difference, which is not limited to uniform grids nor one dimension [J26]; (5) proposed a new fast algorithm called string-average-expectation-maximization for maximum likelihood estimation for positron emission tomography [J5].

4. Computational Fluid Dynamics: (1) developed and analyzed front tracking method (conservative/non-conservative, stability analysis) to study Rayleigh-Taylor, Richtmyer-Meshkov problems, Mach reflection problems [J36,J39,J40]; (2) theoretical (well-posedness) and computational studies for geofluid dynamics on sphere [J32,J31]; (3) computational studies of fluid mixing problems via vortex dynamics [J35,30].

5. Hyperbolic Conservation Laws: (1) global existence of 1D hyperbolic conservation laws with large initial data (perturbations of strong discontinuities) [J36]; (2) global existence for non-genuinely nonlinear hyperbolic conservation laws [J27]; (3) asymptotic behaviors of conservation laws w/o strict hyperbolicity [J38,J33]; (3) showed long-range effect of relaxation is equivalent to viscous effect for hyperbolic conservation laws [J29].

代表著作

1. Liren Lin and I-Liang Chern*, "A kinetic energy reduction technique and characterizations of the ground states of spin-1 Bose-Einstein condensates," *Discrete and Continuous Dynamical Systems, Ser. B*, 19(4) (2014) 1119-1128.
2. I-Liang Chern* and Yu-Chen Shu, "Coupling interface method for elliptic interface problems," *Journal of Computational Physics*, Vol. 225, No. 2, pp.2138-2174 (2007).
3. I-Liang Chern*, "Long-time effect of relaxation for hyperbolic conservation laws," *Comm. Math. Phys.* 172 (1995) 39-55.

二、特殊貢獻獎

李文卿 教授



學歷 Education :

美國加州大學柏克萊校區數學博士, 1974
國立臺灣大學數學系學士, 1970

經歷 Experience :

賓州州立大學傑出講座教授, 2012-
清華大學侯金堆講座教授, 2012-2014
國家理論科學中心 主任, 2009-2014
賓州州立大學Graduate Mentoring主任, 2008-09
賓州州立大學教授, 1984-2011
賓州州立大學副教授, 1979-1984
普林斯頓高級研究所Member, 1979, 1984, 2000
伊利諾大學芝加哥校區助理教授, 1978-1979
哈佛大學助理教授, 1974-1977

研究領域 Research interests : Automorphic forms, number theory, representation theory, coding theory, spectral graph theory, zeta functions, and noncongruence modular forms.

曾獲得之學術獎勵

1981-1983 Alfred P. Sloan Fellow

1991-1992 NSF Visiting Professorship for Women Award

2010 Chern Prize

2012 美國數學學會首屆會士

其他

1992, 2006, 2009, 2018 Invited plenary address, TMS annual meeting

1983, 2008, Invited plenary address, AMS-MAA annual meeting

2010 Invited plenary address, ICCM

2015 AWM-AMS Noether Lecture, AWM-AMS-MAA joint meeting

2011 Oliver Atkin Memorial Lecture, Univ. of Illinois at Chicago

2011 Distinguished Women in Math Lecture, Univ. of Texas, Austin

編輯相關

Currently serving on the editorial board of The Ramanujan Journal (2015-), Tamkang Journal of Mathematics (2013-), Journal of Combinatorics and Number Theory (2008-), International Journal of Number Theory (2005-), Monographs in Number Theory book series, World Scientific (2008-)

2002-2010 Proceedings of AMS 編輯

1998-2014 台灣數學期刊 編輯

1992-1996 Transactions of AMS 編輯

推薦理由

被推薦人李文卿教授目前為賓州州立大學傑出講座教授。於2009-2014擔任國家理論科學研究中心主任期間，與多個國際研究機構簽屬合作交流備忘錄，大力提升了國內的學術研究。促成台灣成為泛亞數論組織之一員，提升台灣在數論研究的國際能見度。並開辦"NCTS Distinguished Lecture" series 與 "Meet with" series，成果卓著。同時，也開辦理論中心數學與理論物理兩組之間的對話與合作，特別對台灣應用數學及生物數學有很大助益。在國際學術會議上，曾主持過跨國（如台法、台韓等）學術研討會，促進台灣數學界與國際交流，對提升台灣數學界於世界上的能見度有重要的貢獻。並曾三度主辦由美國國家科學基金會及理論中心共同贊助的國際會議，提升理論中心之國際聲譽。在協助評鑑台灣數學學術與數學教育發展上，被推薦人曾擔任中華民國數學會青年數學家獎項之外審委員，並多次擔任科技部（原國科會）傑出獎、教育部國家講座、中央研究院年輕學者研究著作獎及建大文教基金會傑出年輕金玉學者審查委員會成員，曾擔任台灣數學雜誌（Taiwanese Journal of Mathematics）編輯十六年，對台灣數學學術與教育界服務提供重大的貢獻。

研究工作介紹

Li's research focuses on number theory. She studies the theory of automorphic forms and applications of number theory to coding theory and spectral graph theory. She also investigates the connections between number theory and combinatorics. In particular, she has applied her research results in automorphic forms and number theory to construct efficient communication networks called Ramanujan graphs and Ramanujan complexes. Her thesis work on the theory of modular forms was cited in Andrew Wiles' historical paper in which the

350-year-old unsolved problem -- "Fermat's Last Theorem" -- was proven. In recent years, Li has revitalized the research on a field of mathematics known as arithmetic of modular forms for noncongruence subgroups. In a different field, her team has made a breakthrough in studying zeta functions for higher dimensional complexes.

代表著作

1. (with Ming-Hsuan Kang) Zeta functions of complexes arising from $PGL(3)$, *Adv. Math.* 256 (2014), 46-103.
2. (with Tong Liu and Ling Long) Potentially $GL(2)$ -type Galois representations associated to noncongruence modular forms, *Transactions of AMS*, to appear. DOI: <https://doi.org/10.1090/tran/7364>.
3. Zeta and L-functions in Number Theory and Combinatorics, *CBMS Regional Conference Series in Mathematics*, American Mathematical Society, to appear in 2019 (monograph, 126 pages).

三、青年數學家獎

沈俊嚴 副教授



學歷 Education :

美國印第安納大學數學所博士, 2010
國立清華大學數學所碩士, 2002
國立中興大學數學系學士, 2000

經歷 Experience :

臺灣大學副教授, 2017-
中央大學副教授, 2016-2017
中央大學助理教授, 2013-2016
密西根州立大學助理教授, 2012-2013
麥馬士達大學博士後研究員, 2010-2012

研究領域 Research interests :

調和分析, 組合數論

曾獲得之學術獎勵

2016 中央大學研究傑出獎

2015 國家理論科學研究中心年輕理論學者獎

2013-2016 中央大學新聘傑出獎勵

2009 Indiana University College of Arts and Sciences Dissertation Year Research Fellowship

2008 William B. Wilcox mathematics award (outstanding graduate student)

推薦理由

Chun-Yen Shen works on Harmonic analysis and additive combinatorics. In both fields, Dr. Shen with coauthors solved some longstanding open problems.

國內兩位專家學者對沈俊嚴副教授研究成果給予如下之綜合評語：

1. The weighted norm inequality was established in 1970's and became a fundamental tool in harmonic analysis. Such inequalities have found many important applications. The most famous result solved in terms of weighted norm inequality was Dirichlet problem on a Lipschitz domain obtained by

Dahlberg in 1977. Another famous result was the characterization of one weight norm inequality for the Hilbert transform. This problem was solved by Hunt, Muckenhoupt and Wheeden in 1973. However, the problem characterizing two weights norm inequality for the Hilbert transform was a longstanding open problem. This problem is related to many questions such as PDE, embedding model spaces, perturbation problems for rank 1 operators. In a series of work, see Two weight inequality for the Hilbert transform, *Duke Math J*, A note on failure of energy reversal for classical fractional singular integrals, *International Math. Research Notice*, A two weight theorem for fractional singular integrals with an energy condition, *Rev. Mat. Iber.*, Dr. Shen and his coauthors solved this problem. They introduced many new tools which will be used in many other applications.

2. In the area of harmonic analysis, Chun-Yen Shen investigates the following well-known open problem: to find necessary and sufficient conditions for the boundedness of two-weight Calderon-Zygmund operators. The solution has important applications to several subjects. One of the major challenging open problems was the so-called NTV conjecture for the Hilbert transform, a 40 years open problem. This problem was finally settled in Shen's work [*Duke Math. J.*, 2014]. In addition, his recent work on the two weight boundedness of Cauchy transform has also settled another longstanding open problem, the embedding problem for Model spaces in the Hardy spaces. Also, his recent work on the boundedness of two weight inequality for the Hilbert transform in terms of Tb testing is a very successful work extending his previous solution of NTV conjecture in a very flexible and profound way.

Chun-Yen Shen has a series interesting results related to sum-product estimates, which are of importance in additive combinatorics, number theory, and the theory of expanders. Several years ago best current result for fields of prime order was obtained by J. Bourgain (who received the Fields Medal in 1994) and M. Z. Garaev. However, it was not completely satisfactory since they considered difference rather than sums. The problem to get similar bound of sums and products remained open. It was finally solved by Shen. Moreover, he obtained a substantial generalization of the result of Bourgain and Garaev replacing products by general polynomials. Next, he proved an estimate for sums and products with a quite good exponent in other finite fields. He

developed an original algebraic approach to prove analogs of sum-product estimates for polynomials as well. This result using algebraic methods actually solved a problem proposed by Van. Vu [Israel J. Math., 2012]. I believe that algebraic methods will be increasingly the tool of choice in this area in the future. In addition, his recent work in [J. London Math. Soc., 2018] was very impressive as he proved a very nice lower bound for the size of the set $AA+A$, and also provided an upper bound for the same set which disproves a longstanding conjecture of A. Balog (a remarkable mathematician in this area).

綜觀兩位專家學者對沈俊巖副教授研究所給高度肯定之評語，本會特頒青年數學家獎，以茲表揚。

研究工作介紹

In 1990s, the research area of nonhomogeneous Harmonic analysis became very active due to three famous mathematicians Nazarov, Treil and Volberg published an important result in Acta Math journal, where they successfully characterized the non-classical one weight norm inequality for singular integrals and later an application of their result settled a longstanding conjecture of Vitushkin, that asked the question of analytic continuation of bounded analytic functions. Shortly after their result was published, all the focus went to the problem of characterizing two weight norm inequality for singular integrals, in part the solution will have many applications to other problems, such as PDE, embedding model spaces, perturbation problem for rank 1 operators e.t.c. Even the case for the Hilbert transform remained open until the results of Shen with his coauthors that completely settled the problem. One of main difficulties in two weight theory is that the given two weights are arbitrary Borel measures, and therefore all the classical Calderon-Zygmund theory can not be applied, and it required completely new ideas. In their proof, they introduced a new corona decomposition with the help of the nonhomegeneous stopping time methods, and used the two weight energy condition. Their result can be considered a profound extension of the famous T1 theorem by David-Journe in 1970 Annals. In addition, their recent result on the two weight norm inequality for the Cauchy transform in the complex plane has also completely settled a difficult problem, the so-called Carleson embedding problem for model spaces.

Another research area that Shen is active on is the area of additive

combinatorics, which studies the structures of sets. For example, Shen has been working on the sum-product types problems in various settings. The sum-product problem became well-known as soon as the breakthrough work of Bourgain, Katz and Tao appeared in 2004. It also has been found to have many applications in discrete geometry and number theory. Shen started working on these problems through the rapid-developed Fourier analytic methods. Some of his early work gave a new proof of the sum-product estimate, and obtained an explicit bound for the exponents. Later, Shen also worked on the extension problem in the setting of vector spaces over finite fields, in which he obtained a complete solution in the finite plane, and made an interesting application to the Erdos distinct distances problem.

代表著作

1. On the size of the set $AA+A$, (with O. Newton, I. Ruzsa and I. Shkredov), to appear in *Journal of the London Mathematical Society*, 2018.
2. A two weight fractional singular integral theorem with side conditions, energy and k -energy dispersed, (with E. Sawyer and I. Uriarte-Tuero), *Springer Volume on Harmonic Analysis, Partial Differential Equations, Banach Spaces, and Operator Theory (Volume 2)*, 2017 (71 pages).
3. A two weight theorem for fractional singular integrals with an energy condition, (with E. Sawyer and I. Uriarte-Tuero), *Revista Matematica Iberoamericana*, Issue 1, 2016 (102 pages).

四、青年數學家獎

黃皓瑋 助理教授



學歷 Education :

美國印第安納大學數學所博士, 2013
國立清華大學數學所碩士, 2003
國立臺灣大學數學系學士, 2001

經歷 Experience :

中山大學助理教授, 2015-
皇后大學合聘助理教授, 2013-2015

研究領域 Research interests :

算子理論、自由機率、隨機矩陣。

曾獲得之學術獎勵

2017-2021 科技部優秀年輕學者專題研究計畫

2017 國家理論科學研究中心年輕理論學者獎

推薦理由：

黃皓瑋助理教授主要的研究領域是非交換機率理論，這個領域起初是1985年由D.V. Voiculescu教授提出的，是一個嶄新且具有挑戰性的研究領域。此領域有別於典型的機率領域因其具有非換性，且其與數學其他領域如代數幾何、算子理論、隨機矩陣都有密切的關聯。近三十年來獲得一些令人驚奇的結果，同時也有許多還未清楚還須釐清之處，所以此領域目前正在蓬勃發展中。

國內兩位專家學者對黃助理教授研究成果給予如下之綜合評語：

1. 黃助理教授與國外的合作團隊致力研究於自由機率在一些條件下是否可獲得對應的經典的機率定理，為此目標他們使用調和分析的技巧，獲得free convolution的機率分佈之拓樸性質和free Lévy processes地一些性質。這些結果不僅使他們能夠夠具有特定規律性的free Lévy過程，同時也為自由機率理論提供了新的拓樸視角。這幾年黃助理教授與其合作團隊考慮在complex Hilbert空間的自由乘積，為此向左向右自由乘積隨機變數之間的選擇提供新的概念。然後他們開發了一種新的分析工具，即所謂的bi-free harmonic analysis，並

使用bi-free harmonic analysis研究bi-free probability中的極限定理和平面且bi-circle上infinite divisibility的機率分佈。這些工作無論是在純數或應數都是重要的結果。非交換機率理論是嶄新且具淺力無窮的領域，黃助理教授與其合作團隊在當今世界非交換機率理論之領域屬於領先地位，並發表數篇文章於國際一流期刊。

2. Free probability和bi-free probability 屬算子代數的範疇；他們雖在隨機矩陣的譜分布上有好的應用，但和機率論還有相當的距離。平行於機率論，用freeness和 bi-freeness來取代獨立的觀念， free convolution和 bi-free convolution取代convolution；然後找到適當的transform 來扮演Fourier transform在獨立和弱收斂上的角色來探討弱極限定理和極限的表示式。

黃助理教授發表四篇有關bi-free probability的論文，有系統的討論二維的bi-freely infinitely divisible distributions的Levy-Khinchine formula及其相關的弱收斂極限定理。其中一篇是在2-torus上用partial S-transform 得到Levy-Khinchine formula及討論triangular array 弱收斂極限定理。其他三篇則是利用partial R-transform。

從機率論來看，找對了transform後，在bi-free probability上對應古典定理的formulation是清楚的，但定理的證明並不容易。年輕人能有耐心，一步一步的做完全，值得鼓勵。

綜觀兩位專家學者對黃皓璋助理教授研究所給高度肯定之評語，本會特頒青年數學家獎，以茲表揚。

研究工作介紹

Dr. Huang's interest mainly lies in the area of non-commutative probability theory, which is a branch of pure mathematics and often recognized to be the non-commutative parallelism of classical probability theory. This rather young research field was initiated by D. V. Voiculescu around 1985, with the intention of examining in a probabilistic framework a yet open problem (free group factor isomorphism problem) in the theory of operator algebra. Since then, non-commutative probability theory has gradually been attested to be closely related to several research fields in physics and engineering other than operator algebra, such as random matrix theory, quantum information theory, and wireless communications.

From Dr. Huang's doctoral research period to the present, he has worked on several topics in free probability theory by making use of the auxiliary of free harmonic analysis, including topological properties of the free convolution of probability distributions and regularities of free Lévy processes. His findings not only allow ones to without difficulty construct free Lévy processes having specified regularities, strengthening regularity results established by Belnschi, Benaych-Georges, Bercovici, and Guionnet in the literature, but also offer a new topological perspective for free probability theory.

In recent years, a series of papers originating with the article by Voiculescu [Comm. Math. Phys. 332(2014), no.3, 955-980] investigated the bi-free extension of free probability, a brand new theory studying non-commutative bivariate random vectors (also known as two-faced faces). On a free product of complex Hilbert spaces, one simultaneously considers the left and right actions of linear operators on the original spaces. Choices between these two actions when modeling free random variables on the free product of Hilbert spaces afterward generate a new notion of independence among two-faced faces, the bi-freeness. Dr. Huang and his collaborators subsequently developed an analytical implement, referred to as bi-free harmonic analysis, and employed the bi-free combinatorics machinery to study the limit theorems and related questions in bi-free probability, for instance, the bi-free infinite divisibility and stability of planar probability distributions. The corresponding themes in classical probability can trace back to the works of Khintchine, Kolmogorov, Gnedenko, and Lévy.

Concretely, explicit two-faced pairs in the bi-partite system were constructed by Dr. Huang and his research members to characterize the collection of bi-freely infinitely divisible distributions with compact support. Later, using the self-developed analytical tool enabled them to eliminate the previously mentioned boundedness limitation of models in C^* -algebras and theorize the infinite divisibility notion in the von Neumann algebra framework. The derivation of the bi-free analogous Lévy-Khintchine formula offers a homeomorphism between the sets of infinitely divisible laws in bi-free and classical probability theories. Identical consequences in the bi-circle context were attained as well. Putting it differently, they have confirmed one important feature of bi-free probability, as appearing in the free case, that this bi-free extension parallels perfectly well with classical

probability. The rigid links between bi-free and classical probability discovered by Dr. Huang's research team will play a notable role in the following development.

代表著作

1. H.-W. Huang and J.-C. Wang, Harmonic analysis for the bi-free partial S-transform, *J. Funct. Anal.*, 274(5):1306-1344, 2018
2. H.-W. Huang and J.-C. Wang, Analytic aspects of the bi-free partial R-transform, *J. Funct. Anal.*, 271(4):922-957, 2016
3. H.-W. Huang, Supports of measures in a free additive convolution semigroup, *Int. Math. Res. Not.*, no. 12, 4269-4292, 2015

五、傑出博士論文獎

金牌獎

陳星谷 博士

論文：三維代數多樣體

Geometry of Algebraic Threefolds

論文指導教授：陳榮凱教授。



學歷：

國立臺灣大學數學系博士, 2013-2018

國立臺灣大學數學系碩士, 2010-2012

國立臺灣大學數學系學士, 2006-2010

研究興趣：

I am interesting about algebraic geometry, particularly birational geometry. I am familiar with theories of terminal threefolds and the minimal model program

論文工作介紹

This thesis consists of two parts. In the first part we prove that the difference of the Betti numbers of a smooth threefold and its minimal model can be bounded by a constant depending only on the Picard number of the smooth threefold. In the second part we prove that the 96-th pluricanonical system of a smooth threefold of Kodaira dimension one defines the Iitaka fibration.

著作目錄

1. Betti numbers in three-dimensional minimal model program, arxiv: 1605.04372.
2. Threefolds of Kodaira dimension one, arxiv: 1710.11224

推薦函節錄

兩位學者對陳星谷博士博士論文的綜合評語：

1. The thesis is around the birational geometry in dimension three. In less than a year, Hsin-Ku Chen worked out a project on Betti numbers. His result is extracted and written as a journal article "*Betti numbers in three dimensional minimal program*", submitted to *Jour of London Math. Soc.* and got very positive referee report.

The second half of his thesis is to study effective litaka fibration in dimension three. He managed to obtain a bound (86), which is almost optimal. This part of work was rewritten and submitted to prestigious journal *Math. Annalen*. He also got very positive reply.

2. Hsin-Ku's area of expertise is Algebraic Geometry and especially the binational geometry of complex 3-folds. This is a very active area of research with a long history and many contributions by some of the top researchers in this area of mathematics.

The thesis contains two very impressive contributions solving two interesting and natural problems about the birational geometry of complex algebraic threefolds. The first problem that Hsin-Ku solves in his thesis is about understanding the topology of the varieties obtained by steps of the minimal model program. The second interesting problem solved by Hsin-Ku is a precise understanding of pluri-canonical maps of smooth complex projective 3-folds of Kodaira dimension 1.

綜觀兩位學者對陳星谷博士博士論文所給高度肯定之評語，本會特頒傑出博士論文獎金牌獎，以茲表揚。

六、傑出碩士論文獎

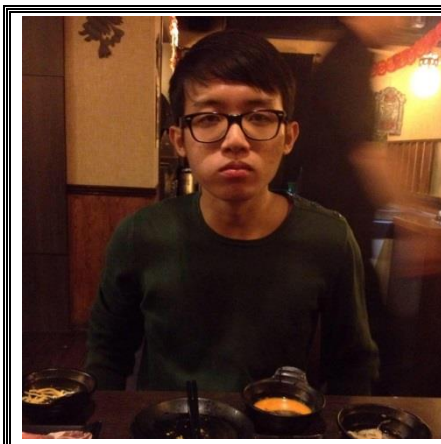
金牌獎

吳其豪 碩士

論文：基於期望往返時間之馬可夫鏈蒙地卡羅法收斂速率分析

On the Convergence Rate of Markov Chain Monte Carlo through Mean Commute Time

論文指導教授：陳定立教授。



學歷：

國立臺灣大學應用數學科學研究所碩士, 2016-2018

國立臺灣大學經濟系學士, 2011-2016

研究興趣：

分析、機率

論文工作介紹

此論文是關於馬可夫鏈蒙地卡羅法理論性質的研究，藉由演算法漸進變異數衍生的一些準則，做了不同轉移矩陣生成的馬可夫過程間的優劣比較；特別地，在此論文裡計算出一些演算法漸進變異數與期望往返時間的關係，並且利用這些關係證明其主要結果。

論文主要分成了三個部分。第一部分是關於演算法平均情況漸進變異數分析，作者給出一個新的方法去推導出 Chen et al. (2012)裡得到的最佳轉移矩陣；第二部分是關於演算法均勻情況漸進變異數分析，論文中證明了 Chen and Hwang (2013)提出的關於可逆樹狀馬可夫鏈無法被均勻優化的猜想；第三部分是關於演算法平均情況漸進變異數分析，作者延伸 Chen et al. (2012)在離散時間馬可夫鏈的結果至連續時間馬可夫過程，推導出在平均情況漸進變異數分析底下最佳的連續時間馬可夫過程。

著作目錄

1. Wu, C.-H and Chen, T.-L., On the asymptotic variance of reversible Markov chain without cycles, *Statistics & Probability Letters*, 137:224-228, 2018

推薦函節錄

兩位學者對吳其豪碩士論文的綜合評語：

1. 陳定立教授跟黃啟瑞教授在 2013 年的一篇文章中提出一個未被證明的猜想，吳同學在去年暑假很短的時間就將它證明出來。這結果已寫成論文，被 *Statistics and Probability Letter* 接受。而這項研究成果，他也在去年底的三所聯合會議中以壁報論文形式發表。

三所聯合會議後，獲得繼續在日本統計數理研究所一個月研習的難得機會。他在 Satoshi Ito 教授的指導下，研究關於球隊奪冠的魔術數字問題，並應用在中華職棒上，也快速地有著成果，正在撰寫論文以投稿。

接著，吳同學又將陳定立教授跟黃啟瑞教授等人在 2012 年一篇關於最佳馬可夫鏈傳遞矩陣的結果推廣到連續時間的馬可夫過程。結果也已經寫成論文，正在投稿中。

2. Markov chain Monte Carlo is an important topic in probability and statistics. This idea has been widely adopted in applications but some related theoretical problems are yet to be investigated in depth. 吳其豪's work is in this direction.

The novelty of his approach is to use the mean commute time instead of the usual mean hitting time to study the asymptotic variance of the underlying approximating Monte Carlo Markov chain. This attribute describes the fluctuation of the Monte Carlo approximation corresponding to a central limit theorem.

He investigated equalities and inequalities related to the mean commute time. With this new perspective he obtained three very good results. 1) He presented a simpler and more intuitive way of deriving the optimal transition matrix studied in the paper. 2) He surprised me by solving a conjecture proposed by me a few years ago. 3) He studied the continuous time version of the problem. This is the first result along this line of research.

綜觀兩位學者對吳其豪碩士論文所給高度肯定之評語，本會特頒傑出碩士論文獎金牌獎，以茲表揚。

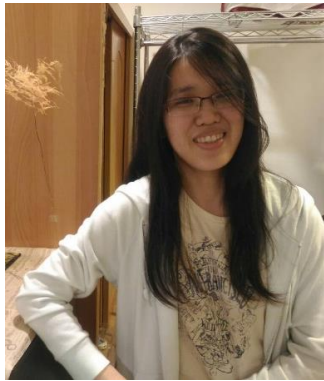
七、傑出碩士論文獎

銀牌獎

許乃珩 碩士

論文：表現理論初探 **A Glimpse of Representation Theory**

論文指導教授：余家富研究員。



學歷：

國立臺灣大學數學系碩士, 2015-2018

國立清華大學資訊工程系雙主修數學學士, 2010-15

研究興趣：

Modular and integral representation theory for finite groups

論文工作介紹

The authors study modular and integral representation theory of finite groups. They focus on indecomposable kG -modules and ZG -modules, with $\text{char}k|G|$. Since not every group rings kG , ZG is of finite representation type, they give the criteria based on Webb (for modular cases) and Reiner & Heller (for integral cases). They also construct infinitely many non-isomorphic classes of indecomposable ZG -modules, if ZG is not of finite representation type. They also study algebraic tori and a result of splitting fields of algebraic torus since the character group of an algebraic torus is an integral representation of a finite group.

著作目錄

Nai-Heng Sheu. 2018. A Glimpse of Representation Theory, master thesis, National Taiwan University

推薦函節錄

兩位學者對許乃珩碩士論文的綜合評語：

1. The main purpose of Miss Sheu's master thesis was to organize several fundamental results of modular representations and integral representations of finite groups. The Chapter on integral representations where she reorganizes the main results of Myrna Lee "Integral Representations of

Dihedral Groups of order $2p$ ". This paper is technically written and involved complicated calculations. I would say that her exposition actually simplifies and make the content more transparent. In fact, from the point she stands she could even generalize Lee's result to dihedral groups of order $2n$ where n is a product of distinct old primes which would be useful and new results.

She also worked on two papers of Heller and Reiner for the proof of the main result stating that a finite group G of finite representation type for integral representations if and only if any Sylow p -subgroup of G of order $1, p$ or p^2 . She brought my attention to a question of Heller and Reiner concerning integral representations of the product $G=C_p \times C_p$ of two cyclic subgroups of prime order. The existence of infinitely many indecomposable integral representations of G plays a key role in the main result. Heller and Reiner proved this for odd, but they could only construct an example for the case $p=2$. They asked for a construction of arbitrary primes p . She tried to give a construction and finally she answered this question of Heller and Reiner (Proposition 72 of her thesis).

The last part of her thesis studies about splitting of algebraic tori. We worked out various proofs that every algebraic torus splits over a finite separable extension. This result links tori with integral representations of Galois groups and connects with current interesting results on the inverse Galois problem and Noether's problem. In this part we generalize Chow's Theorem to semi-abelian varieties and give the sharp bound for the degree of splitting fields.

2. Nai-Heng's thesis is about modular representation of finite groups. She studied thoroughly P. Webb's book "A course on finite group representation theory", and the main novelty in her thesis is to fill in details that are not presented therein. In particular, she provided all details on the construction of infinitely many module representations of a product of cyclic groups of the same prime order. My impression is that the results may not be new although I am not an expert in this field, but the exposition of this thesis is high quality and above the average among Taiwan master theses in algebra.

綜觀兩位學者對許乃珩碩士論文所給高度肯定之評語，本會特頒傑出碩士論文獎銀牌獎，以茲表揚。

八、傑出碩士論文獎

銀牌獎

廖信傑 碩士

論文：Signed Countings on Type B and D permutations and t, q -Euler numbers

論文指導教授：游森棚教授。



學歷：

國立臺灣師範大學數學所碩士, 2016-2018

國立交通大學應用數學系學士, 2009-2013

研究興趣：

Enumerative and algebraic combinatorics

論文工作介紹

A classical result states that the parity balance of number of excedances of all permutations (derangements, respectively) of length n is the Euler number. In 2010, Josuat-Vergès gives a q -analogue with q representing the number of crossings. We extend this result to the permutations (derangements, respectively) of type B and D. It turns out that the signed countings are related to the derivative polynomials of \tan and \sec .

Springer numbers defined by Springer can be regarded as an analogue of Euler numbers defined on every Coxeter group. In 1992 Arnol'd showed that the Springer numbers of classical types A, B, D count various combinatorial objects, called snakes. In 1999 Hoffman found that derivative polynomials of $\sec x$ and $\tan x$ and their subtraction evaluated at certain values count exactly the number of snakes of certain types. Then Josuat-Vergès studied the (t, q) -analogs of derivative polynomials $Q_n(t, q)$, $R_n(t, q)$ and showed that as setting $q=1$ the polynomials are enumerators of snakes with respect to the number of sign changing. Our second result is to find a combinatorial interpretations of $Q_n(t, q)$ and $R_n(t, q)$ as enumerator of the snakes, although the outcome is somewhat messy.

著作目錄

1. [1] (with T.-S. Fu, H.-C. Hsu) Folding Phenomenon of Major-balance Identities on Restricted Involutions, Taiwanese Journal of Mathematics (accepted), 2018.
2. [2] (with S.-P. Eu, T.-S. Fu, H.-C. Hsu) Signed countings of types B and D permutations and t, q -Euler numbers, Adv. Appl. Math. 97(2018) 1-26.

推薦函節錄

兩位學者對廖信傑碩士論文的綜合評語：

1. 這篇論文的貢獻是實質上推廣了Euler與Roselle的成果到其他types，而且不只是數量上的推廣，更是做到 q, t -analogue的推廣，換言之也一併推廣了Josuat-Vergès等人的結果，並解答了 q, t -analogue中 t 變數的組合意義。

論文中間有不少巧思，比如找到正確的統計量 $[^{\text{exc}}_2]$ ，與設計對消的對應，都是相當不平凡的。論文用到的方法主要為透過生成函數看組合模型，設計精巧的對應與代數運算。

2. 廖信傑的研究是關於有號排列多元統計量的計數定理。排列的統計量是古典組合數學重要的研究主題，如交錯排列個數是著名的尤拉數(Euler numbers)，其指數型生成函數可表示成 $\tan x + \sec x$ 。尤拉證明了一個技術定理：奇數長的排列按excedence統計量奇偶對消後剩餘的排列個數恰好為尤拉數，偶數長時則為0。學者Han, Randrianarivony, Zeng提出廣義的尤拉數，他們利用連分數定義單變數 q -尤拉數，Josuat-Vergès則推廣尤拉的結果，得到細分計數定理：按crossing統計量分類之後，奇數長的排列按exdedence統計量奇偶對消後剩餘的排列個數恰好為 q -尤拉數。此外，Josuat-Vergès利用代數方法定義雙變數 t, q -尤拉數，信傑的碩士論文主要成果之一是利用組合方法將Josuat-Vergès的結果進一步推廣至B型與D型的有號排列上，得到以 t, q -尤拉數為結果的雙統計量細分計數定理，並且為雙變數 t, q -尤拉數提出一個有號排列的組合解釋，這是一個創新的進展。

信傑研究的題目是相當難的問題，相關文獻都相當有深度，進入這個題材的門檻很高，而有號排列是排列的各個元素都有正負之分，其個數是排列個數的2的 n 次方倍，數量龐大，呈幾何級數成長，電腦能處理的長度相當有限，信傑有良好的程式能力，能從有限的線索中找出規律相當不容易，主要定理的證明方法是以賦權格路為骨幹的組合證明，相當有巧思。

綜觀兩位學者對廖信傑碩士論文所給高度肯定之評語，本會特頒傑出碩士論文獎銀牌獎，以茲表揚。



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The Mathematical Society of the Republic of China