

2nd Singapore Mathematics Symposium

Singapore Mathematical Society

May 3, 2011

(Venue: LT5, School of Physical and Mathematical Sciences, NTU)

Program

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| 1:00pm | Welcome and opening remarks
Zhu Chengbo, President of SMS |
| 1:05 – 1:50pm | Invited Talk 1
Speaker: YU Shih-Hsien, Department of Mathematics, NUS
Title: The development of Green's function approach to Boltzmann equation
Chair: LOKE Hung Yean |
| 1:50pm-2:00pm | Break |
| 2:00pm – 2:45pm | Special Guest Lecture
Speaker: Frank Morgan, Williams College, USA
(SMS Distinguished Visitor 2011)
Title: Isoperimetric Problems
Chair: ZHU Chengbo |
| 2:45 – 3:15 | Tea Break & Viewing of Posters |
| 3:15 – 4:00pm | Invited Talk 2
Speaker: CHEN Ning, Division of Mathematical Sciences, NTU
Title: From stable matching to competitive equilibrium: incentives and computation
Chair: Bernhard SCHMIDT |
| 4:00 – 4:15pm | Break |
| 4:15 – 5:00pm | Invited Talk 3
Speaker: TOH Kim Chuan, Department of Mathematics, NUS
Title: Semidefinite programming: algorithms and applications
Chair: ZHANG De-Qi |
| 5:00 – 5:15pm | Closing & Poster Prize Presentation |

Abstract of talks

1. The development of Green's function approach to Boltzmann equation

(Yu Shih-Hsien, Department of Mathematics, NUS)

Abstract: In this talk we will give a survey on the physics background of the Boltzmann equation and its related mathematical theory in hydrodynamics. In particular, we will review a powerful tool, the Green's function for the Boltzmann equation. The Green's function is a general and powerful tool for studying partial differential equation. The study on the precise structure of the Green's function was initiated by Tai-Ping Liu and Yu in 2003. In this talk, we review the current development of the Green's function for a Boltzmann equation around a shock profile, a boundary layer, and initial layer will be discussed as well as its applications to nonlinear time asymptotic stability problems.

Brief biography of the speaker:

YU Shih-Hsien is a professor of mathematics at the National University of Singapore. He was educated as an undergraduate in National Taiwan University and received his PhD from Stanford University in 1994. Before joining NUS, Professor Yu has been with the University of Minnesota, UCLA, Osaka University, and City University of Hong Kong. Professor Yu's research interests are in Boltzmann Equation, Conservation Laws, Nonlinear Partial Differential Equations and Numerical Analysis.

2. Isoperimetric Problems

(Frank Morgan, Williams College, USA)

Abstract: In Euclidean space a round sphere solves the isoperimetric problem by providing the least-area way to enclose given volume, as was proclaimed by the Ancient Greeks. Two thousand years later, we've been able to solve this problem in relatively few other spaces or Riemannian manifolds. The talk will include open questions and progress by undergraduates. Students welcome.

Brief biography of the speaker:

Frank Morgan is currently the Webster Atwell '21 Professor of Mathematics at the Williams College and Vice President of the American Mathematical Society. His research is on geometric measure theory and minimal surfaces.

Professor Morgan is most famous for proving the double bubble conjecture on the minimum-surface-area enclosure of double bubbles. He is also well-known as the founder of SMALL, one of the largest and best known summer undergraduate mathematics research programs in the US. Professor Morgan has authored six books, including The Math Chat Book 2000, based on his live, call-in Math Chat TV show and Math Chat column.

3. From stable matching to competitive equilibrium: incentives and computation (Chen Ning, Division of Mathematical Sciences, NTU)

Abstract: Stable matching and competitive equilibrium are two well-studied solution concepts in Economics and have extensive applications in matching marketplaces. In the talk, we will review their mathematical structures, economic properties, and algorithmic computations, showing similarities between the two concepts. We will further discuss extensions of these concepts with their incentive and computational aspects, motivated from the emerging marketplaces, like sponsored search, online dating, and social lending, enabled by the Internet.

Brief biography of the speaker:

CHEN Ning is currently a Nanyang Assistant Professor at the Division of Mathematical Sciences in Nanyang Technological University. He obtained his Ph.D. from Computer Science of the University of Washington in 2008, and B.S. from Mathematics of Fudan University. He works on algorithm design, algorithmic game theory, and Internet economics.

4. Semidefinite programming: algorithms and applications (Toh Kim Chuan, Department of Mathematics, NUS)

Abstract: The last two decades have seen dramatic advances in the theory and practice of semidefinite programming (SDP), stimulated in part by the realization that SDP is an extremely powerful modeling tool. Applications of SDP include signal processing, relaxations of combinatorial and polynomial optimization problems, covariance matrix estimation, and sensor network localization. The first part of the talk will describe several applications, such as sensor network localization and matrix completion that have attracted recent interest in large scale SDP. The second part will focus on algorithms for SDP. First, we present interior-point methods (IPMs) for medium scale SDP and discuss their inherent limitations. Then we present recent algorithmic advances for large scale SDP and demonstrate that semismooth Newton-CG augmented Lagrangian methods can be very efficient.

Brief biography of the speaker:

TOH Kim Chuan is a Professor at the National University of Singapore (NUS). He obtained his Bachelor degree from NUS in 1990 and the PhD degree from Cornell University in 1996. He is currently an Area Editor for Mathematical Programming Computation, and an Associate Editor for the SIAM Journal on Optimization. His research focuses on designing efficient algorithms and software for convex programming, particularly linear and convex quadratic semidefinite programming (SDP). Together with M.J. Todd and R.H. Tutuncu, he developed the general purpose software, SDPT3, for solving medium scale SDP. SDPT3 is currently used as the computational engine in high-level modeling languages such as CVX and YALMIP.