The 1st CAS SIAM Student Chapter Annual Meeting

May 25, 2013

Beijing, China

The 1st CAS SIAM Student Chapter Annual Meeting will take place on Saturday, 25th May 2013 at Institute of Computational Mathematics and Scientific/Engineering Computing, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, Beijing, China.

The goal of the meeting is to bring together graduate students, young researchers and faculty to share their works, exchange ideas and promote potential cooperations.

The conference includes two plenary talks and six student talks. We are very honored to invite Prof. Wuming Liu (Institute of Physics, CAS) and Dr. Xin Liu (AMSS, CAS) to give the plenary talks. All students who are interested in applied and computational mathematics are encouraged to attend. The conference, including coffee and lunch, is free for those who have registered.

The 1st CAS SIAM Student Chapter Annual Meeting is sponsored by Institute of Computational Mathematics and Scientific/Engineering Computing and Society of Industrial and Applied Mathematics (SIAM).
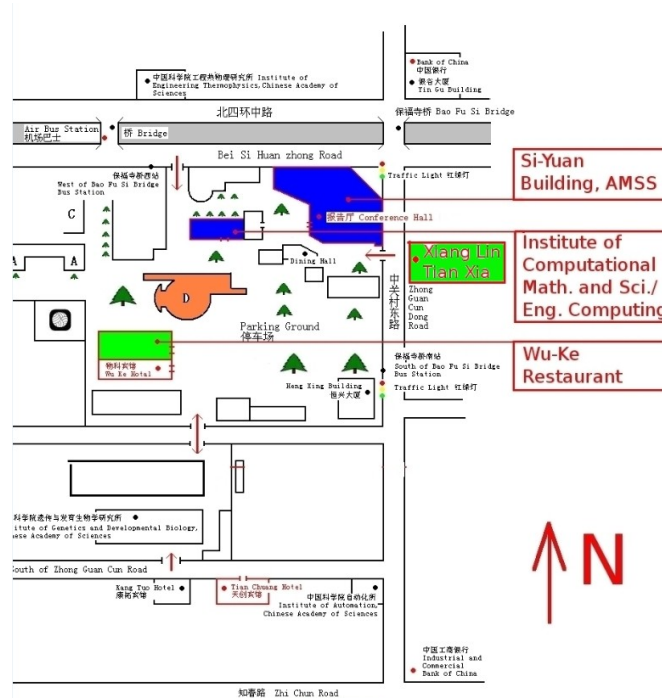
Conference Schedule

08:20-08:50 Registration

08:50-09:00 Opening Ceremony
Distinguished Guest: Prof. Qun Lin, Prof. Yuhong Dai

09:00-09:50 Plenary Talk: Prof. Wuming Liu
The Science and Technology of Laser Cooling Atoms and Molecules

09:50-10:10 Coffee Break & Conference Photography

10:10-10:40 Yuwei Fan
From Discrete Velocity Method to Moment Method

10:40-11:10 Geovani Nunes Grapiglia
A Trust-Region Algorithm for Composite Nonsmooth Optimization without Derivatives

11:10-11:40 Guanghui Huang
Introduction to Inverse Scattering Imaging

12:00-13:30 Lunch: Fundamental Science Restaurant

13:30-14:20 Plenary Talk: Dr. Xin Liu
Unconstrained Optimization Approaches for Large-Scale Eigenspace Computation

14:20-14:50 Coffee Break

14:50-15:20 Fusheng Luo
The Adaptive Time-stepping Method to the Cahn-Hilliard Equation

15:20-15:50 Quan Yuan
Large-scale Machine Learning in Advertising

15:50-16:20 Jinwei Zhu
Graphical of Tensor and Its Application to Spin-wave Systems

16:20-16:30 Closing Ceremony

Plenary Talk

The Science and Technology of Laser Cooling Atoms and Molecules

Prof. Wuming Liu

Institute of Physics, Chinese Academy of Sciences

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I will review our works on the science and technology of laser cooling atoms and molecules. Laser cooling atoms to realize Bose-Einstein condensation (BEC) is a great breakthrough of physical science at the end of the 20th century. Since 1997, four Nobel Prizes (1997's, 2001's, 2005's and 2012's) have been awarded to physicists from the field of laser cooling atom physics and precise measurement. The unique properties displayed in the ultra-cold atomic system, such as the wave-like quantum property, macroscopic quantum coherence and excellent artificial controllability, make it a system with the best coherence, the longest lifetime, the best stability and controllability and thus an unprecedented new quantum system for physicists. How to manipulate the inter-particle interactions, componental proportionality, structure, and dimensionality etc. in order to discover novel quantum states, to simulate the controllable many-body quantum system, especially the strong correlated system and to lay foundations for high and new technologies such as atomic laser, atom chip and atomic clocks are important researching areas in the study of ultra-cold atomic physics .

Biography:
Prof. Wu-Ming Liu obtained Ph. D. degree of Institute of Metal Research, Chinese Academy of Science (CAS) in 1994 and got the1st class prize of the President Prize of Chinese Academy of Sciences in 1994. He was postdoctor and research scientist of Institute of Physics, Institute of Theoretical Physics, CAS and The University of Texas at Austin, The University of Delaware, USA from 1994 to 2002. He became professor of Institute of Physics, CAS since 2002. His research interest is quantum many-body theory and its applications in atomic and molecule physics, optics and condensed matter physics. He has published 110 papers in Physical Review and 12 papers in Physical Review Letters, and his papers have been cited 3500 times in Web of Science. He got the Distinguished Young Scholar, National Natural Science Foundation of China (NSFC) in 2005 and The 1st Class Prize for Science and Technology, Chinese People's Liberation Army in 2000.

Plenary Talk

Unconstrained Optimization Approaches for Large-Scale Eigenspace Computation

Dr. Xin Liu

AMSS, Chinese Academy of Sciences

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Eigenvalue and eigenvector calculation is a fundamental computational problem with extraordinarily wide ranging applications, such as electronic structure calculations. However, with the number of desired eigenpairs increase, The Rayleigh-Ritz (RR) procedure, including orthogonalization, constitutes a major bottleneck in computing relatively high-dimensional eigenspaces of large sparse matrices. Although operations involved in RR steps can be parallelized to a certain level, their parallel scalability, which is limited by some inherent sequential steps, is lower than dense matrix-matrix multiplications. In this talk, we propose an unconstrained optimization models, which reduce the use of the RR procedure in exchange for matrix-matrix multiplications, and establish its equivalence to the eigenvalue problem. This model enables us to deploy gradient, Gauss-Newton, Levenberg-Marquardt algorithms. Although the proposed algorithm does not necessarily reduce the total number of arithmetic operations, it leverages highly optimized operations on modern high performance computers to achieve parallel scalability. Numerical results based on a preliminary implementation, parallelized using OpenMP, show that our approach is promising.

Biography:
Dr. Xin Liu is an assistant professor of Academy of Mathematics and Systems Science, Chinese Academy of Sciences. His research interests include computational methods for nonlinear least squares problems, matrix optimization problems, sparse optimization problems and data assimilation problems.

He got his bachelor degree at Peking University in 2004, and Ph.D. degree at Graduate University of Chinese Academy of Sciences (now, University of Chinese Academy of Sciences) in 2009. His supervisor is Prof. Ya-xiang Yuan. He was a post-doctor fellow at Zuse Institute Berlin and visiting scholar at Rice University, National University of Singapore and Hong Kong Paptist University. He was awarded Euler Award of Applied Mathematics which is presented by Swiss State Secretariat for Education and Research in 2007. He was selected to participate the Young Science Professionals Voluntary Visitor Program organized by the United States Department of State in 2012.

From Discrete Velocity Method to Moment Method

Yuwei Fan

School of Mathematical Sciences, Peking University

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In kinetic theory, the discrete velocity method(DVM) and the moment method (MM) are two important numerical methods. By using the adaptive technique on the discrete velocity points in DVM for one-dimensional case, we discover that it yields the Grad-type moment method. As a unified understanding, MM can be treated as DVM with adaptive discrete velocity points, and DVM is a kind of MM with a special group of "moments". Hence, we can study the DVM and MM in a unified frame. To build the unified frame, the regularization theory, developed by us recently, is an esstial work.

Biography:
Education

Sept. 2011 – present, M. Sc. in Information and Computational Sciences, School of Mathematical Sciences, Peking University, China

Sept. 2007 – June 2011, B. S. in Information and Computational Sciences, Yuanpei College(majored in math), Peking University, China

Research Interests

Thoery and numerical methods for solving fluids. In particular, rarefied gas dynamics and microflows

A Trust-Region Algorithm for Composite Nonsmooth Optimization without Derivatives

Geovani Nunes Grapiglia

Federal University of Paraná, Brazil

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A derivative-free trust-region algorithm is presented for minimizing the nonsmooth composite function $F(x) = h(f(x))$, where f is smooth and h is convex. Under certain conditions, global convergence results are given. Preliminary numerical tests indicate that the algorithm is promising for finite minimax problems, least-square problems and nonlinear programming problems.

Biography:

Geovani N. Grapiglia is a second-year doctoral candidate in the Graduate Program in Mathematics and Applied Mathematics at the Federal University of Paraná, Brazil, under the supervision of Professor Jinyun Yuan. Currently, he is visiting the Institute of Computational Mathematics and Scientific/Engineering Computing of the Chinese Academy of Sciences under the supervision of Professor Ya-xiang Yuan.

Introduction to Inverse Scattering Imaging

Guanghui Huang

AMSS, Chinese Academy of Sciences

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In this talk, I will give an introduction to the inverse scattering problem with the emphasis on time reversal imaging theory in the passive and active inverse scattering problems. For the passive inverse source problems, the source localization technique has been of significant interest in recent years and finds numerous applications, particularly in biomedical imaging and medical diagnosis with photoacoustic technique; For the active source scattering problems, the Reverse Time Migration(RTM) method, based on wave equation theory with wide application in geophysical exploration community, has attracted a lot of people for its strong imaging power in the complex medium. Recently, we present a theoretical resolution analysis of RTM without high frequency assumption and small asymptotic expansion. For the extension to the elastic wave and electromagnetic wave imaging problem and planar acoustic waveguide problem, we develop novel RTM imaging method based on our previous mathematical analysis. Numerical results will be reported.

Biography:
RESEARCH INTERESTS
    Seismic Wave Propagation Theory
    Seismic Imaging and Full Waveform Inversion
    Automatic Migration Velocity Analysis and Estimate
    Acoustic/Electromagnetic/Elastic Wave Inverse Scattering Imaging and Inverse Problem
EDUCATION
    2005-2009, B.S.,Information and Computational Science, Central South University (CSU)
    2009-present, PhD Candidate, Computational Mathematics, Institute of Computational Mathematics and Scientific/Engineering Computing (ICMSEC), Chinese Academic of Science.
EXPERIENCE
    2010.10-2011.6, Visit and Study in Tongji University, Shanghai(Collaboration with Prof. Huazhong Wang)
AWARDS AND HONORS
    2013, Pivot of Merit Student of Academy of Mathematics and Systems Science, Chinese Academic of Science(1%)

The Adaptive Time-stepping Method to the Cahn-Hilliard Equation

Fusheng Luo

AMSS, Chinese Academy of Sciences

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Cahn-Hillard equation is first used in modeling the spinodal decomposition phenomena, and then in other applications. The model contains small parameter, high order derivatives, and nonlinear term, which leads to long time computation for the problem to reach steady state. Here, based on specific difference schemes, we proposed a new adaptive time-stepping method, which varies time step according to the intensity of phase change. And it avoids the artificial parameter selection problem in the existing method. Some numerical results are used to show the efficiency of this new method.

Biography:
Fusheng Luo is currently a Phd Candidate majored in computational mathematics in Academy of Mathematics and Systems Science, CAS, under the supervision of academician Qun Lin. He received his Bachelor degree in computational mathematics in 2008 at Peking University. His research interests include: finite element method to eigenvalue problem; numerical simulation to phase field problems; the a posterior error estimate to PDEs.

Large-scale Machine Learning in Advertising

Quan Yuan

Advertising BU, Alibaba

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Online recommendation and advertising services are widely available today, from e-commerce to social media, from music sharing sites to modern internet TVs, these technologies greatly promote users experience and benefits platform providers as well as millions of advertisers. Behind these applications, machine learning, data mining and recommendation technologies on large user data plays a dominant role. In this talk, we will uncover some typical scenarios and its associated mathematical models, and illustrate the difference between industrial practice and academia works.

Biography:

Education

M.S. Computer Science and Engineering, Xian Jiaotong University, 2003-2006.

Dual B.S. Computer Science and Engineering, Material Science and Engineering; Xian Jiaotong University, 1999-2003.

Fields of Interest

Recommender System, User Modeling, Large-Scale Machine Learning

Employment

Advertising BU, Alibaba, May 2012–Nows

IBM Research - China, July 2006–2012

Graphical of Tensor and Its Application to Spin-wave Systems

Jinwei Zhu

AMSS, Chinese Academy of Sciences

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In this talk, I will introduction the basic properties of tensor and establish the mapping between the graphical schemes of the tensor operations and the mathematical schemes of the tensor operations. Then I will introduce the HOSVD of tensor and its graphical scheme. At last I will apply this HOSVD to the Ising model with the idea of coarse graining.

Biography:

2005.9 - 2009.6 : The School of Mathematics and Statistics of Centeral China Normal University

2009.9 - now: Academy of Mathematics and Systems Science, CAS