

同济大学
第二届国际青年学者论坛
数学分论坛

2016年12月27日

同济大学 致远楼

同济大学第二届国际青年学者论坛数学分论坛会议议程

时间：2016年12月27日

地点：同济大学数学科学学院致远楼

	论坛开幕式	08:15-08:30	致远楼 107
论坛主题报告 1	题目：Functional Data Analysis for Dynamic Biomedical Imaging 报告人：王远	08:30-09:00	致远楼 107
论坛主题报告 2	题目：Decision-making in Large Networks 报告人：章祯梁	09:00-09:30	致远楼 107
论坛主题报告 3	题目：Analysis of Longitudinal Survival Data with Multiple Features 报告人：鹿涛	09:30-10:00	致远楼 107
茶歇	茶歇	10:00-10:15	致远楼 107
论坛主题报告 4	题目：Spectral Collocation Methods for Fractional Boundary Value Problems 报告人：曾凡海	10:15-10:45	致远楼 107
论坛主题报告 5	题目：Analysis of Equivariant Dynamics for Systems of Nonlinear PDEs 报告人：姚景华	10:45-11:15	致远楼 107
论坛主题报告 6	题目：Multiensemble Markov Models of Molecular Thermodynamics and Kinetics 报告人：吴昊	11:15-11:45	致远楼 107
午餐	午餐	12:00-13:15	三好坞餐厅
论坛主题报告 7	题目：Atomistic/Continuum Coupling: Modeling, Analysis and Simulation. 报告人：张镭	13:15-13:45	致远楼 107
论坛主题报告 8	题目：A Potential Theory Based Cartesian Grid Method for Elliptic PDEs 报告人：应文俊	13:45-14:15	致远楼 107
论坛主题报告 9	题目：A Hybrid Numerical Method for Electro-kinetic Flow with Deformable Interfaces 报告人：马满满	14:15-14:45	致远楼 107
论坛主题报告 10	题目：Expicit Gross-Zagier Formulae and The Sylvester Problems 报告人：舒杰	14:45-15:15	致远楼 107
茶歇	茶歇	15:15-15:30	致远楼 102
座谈	青年学者座谈	15:30-17:00	致远楼 102
晚餐	晚餐	17:00-18:30	三好坞餐厅

同济大学第二届国际青年学者论坛数学分论坛报告介绍

论坛主题报告 1

报告题目：Functional Data Analysis for Dynamic Biomedical Imaging

报告人：王远，女，中国科学技术大学统计学学士，美国科罗拉多州立大学统计学博士，德克萨斯大学安德森癌症中心博士后，现任华盛顿州立大学数学与统计系助理教授。

摘要： Non-invasive biomedical imaging technologies have been widely used in various medical disciplines for interrogation of the pathophysiology and pathogenesis of diseases. Functional data are often generated when diseases features are accessed repeatedly over time and at multiple spatially interdependent units. The problem is motivated by a liver cancer study where patients underwent a dynamic computed tomography (CT) protocol to enable evaluation of multiple perfusion characteristics. The study was undertaken with the objective of determining the effectiveness of using perfusion characteristics to identify and discriminate between regions of liver that contain malignant tissues from normal liver tissue. To reduce model complexity and simplify the resulting inference, possible spatial correlation among neighboring units is often neglected. In this work, we consider a multivariate functional data model and propose a modified kernel smoothing estimation to leverage the spatial and temporal correlation. We also address the companion problem of developing a simultaneous classification method that utilizes the inter-unit correlation information to predict disease state. The proposed method outperforms conventional functional data classification approaches in the presence of strong correlation. The method offers maximal relative improvement in the presence of temporal sparsity wherein measurements are obtainable at only a few time points.

论坛主题报告 2

报告题目： Decision-making in Large Networks

报告人： 章桢梁，男，中国科学技术大学物理学学士，美国科罗拉多州立大学物理学硕士，电子与计算机工程博士，曾任高通公司研发高级工程师，现任英特尔实验室主管科学家。

摘要： Have you ever shopped online? Do you read other people's reviews before buying something? Over the past few decades, people get connected within social network more than ever in history. We see, we hear, and we learn from other people around us. There is no doubt that learning and influence from others help us to make smarter decisions. However, have you ever thought about how learning might actually harm? When what you learn is bad or even malicious information, will you still be available to dust off rumor and make the right decision? Same concerns occur in engineering networks (e.g., wireless sensor networks and smart grids), which are informationally decentralized, comprise many nodes carrying disparate information, and are subject to constraints on computation, power, and communication. A central question here is whether we can aggregate the disparate information to jointly make a smart decision. In today's talk, I will discuss the fundamental limits of decision making in several network structures.

论坛主题报告 3

报告题目： Analysis of Longitudinal Survival Data with Multiple Features

报告人： 鹿涛，男，中国科学技术大学数学专业学士，美国康奈尔大学数学硕士，罗彻斯特大学统计博士，现任纽约州立大学助理教授。

摘要： Longitudinal survival data are often collected from clinical studies. Mixed-effects joint models are commonly used for the analysis of such data. Nevertheless, the following issues may arise in longitudinal survival data analysis: (i) most joint models assume a simple parametric mixed-effects model for longitudinal outcome, which may obscure the important relationship between response and covariates; (ii) clinical data often exhibits asymmetry so that symmetric assumption for model errors may lead to biased estimation of parameters; (iii) response may be missing and missingness may be informative. There is little work concerning all of these issues simultaneously. Motivated by an AIDS clinical data, we develop a Bayesian varying coefficient mixed-effects joint model with skewness and missingness to study the simultaneous influence of these features.

论坛主题报告 4

报告题目： Spectral Collocation Methods for Fractional Boundary Value Problems.

报告人：曾凡海，男，西北工业大学信息与计算科学专业学士，上海大学计算数学专业硕士、博士，美国布朗大学应用数学系博士后，现任昆士兰科技大学博士后。

摘要： We develop spectral collocation methods for fractional differential equations with variable-order with two end-point singularities. Specifically, we derive three-term recurrence relations for both integrals and derivatives of the weighted Jacobi polynomials of the form $(1+x)^{\mu_1}(1-x)^{\mu_2}P_j^{a,b}(x)$ ($\{a,b,\mu_1,\mu_2>-1\}$), which leads to the desired differentiation matrices. We apply the new differentiation matrices to construct collocation methods to solve fractional boundary value problems and fractional partial differential equations with two end-point singularities. We demonstrate that the singular basis enhances greatly the accuracy of the numerical solutions by properly tuning the parameters μ_1 and μ_2 , even for cases that we do not know explicitly the form of singularities in the solution at the boundaries. Comparison with other existing methods shows the superior accuracy of the proposed spectral collocation method.

论坛主题报告 5

报告题目： Analysis of Equivariant Dynamics for Systems of Nonlinear PDEs

报告人：姚景华，男，兰州大学数学学士、硕士，美国印第安纳大学博士，曾任爱荷华大学数学系访问助理教授、印第安纳大学访问学者，现任肯特州立大学博士后研究学者。

摘要： We study the equivariant dynamics of systems of nonlinear PDEs with Euclidean symmetries. We will analyze a class of our recently discovered systems of PDE examples for $O(2)$ Hopf bifurcation with multiple bifurcation parameters, and establish the connections between the current equivariant dynamics and fundamental concepts in the theory of hyperbolic conservation laws. The interplay between theory of PDE, theory of linear operators, invariant manifold theory, normal form theory and symmetries plays an essential for our program.

论坛主题报告 6

报告题目： Multiensemble Markov Models of Molecular Thermodynamics and Kinetics

报告人： 吴昊，男，清华大学计算机科学与技术学士、博士，现任柏林自由大学数学与计算机科学系博士后。

摘要： Molecular dynamics simulations can provide mechanistic understanding of biomolecular processes. However, direct simulation of slow transitions such as protein conformational transitions or protein – ligand dissociation are unfeasible with commonly available computational resources. Two typical strategies are (i) conducting large ensembles of short simulations and estimating the long-term kinetics with a Markov state model, and (ii) speeding up rare events by bias potentials or higher temperatures and estimating the unbiased thermodynamics with reweighting estimators. In this work, we introduce the transition-based reweighting analysis method (TRAM), a statistically optimal approach that combines the best of both worlds and estimates a multiensemble Markov model (MEMM) with full thermodynamic and kinetic information at all simulated ensembles.

论坛主题报告 7

报告题目： Atomistic/Continuum Coupling: Modeling, Analysis and Simulation.

报告人：张镞，男，北京大学学士，中国科学院计算数学研究所硕士，加州理工学院博士，Max-Planck 研究所和牛津大学博士后，现任上海交通大学特别研究员、入选中组部“青年千人计划”。

摘要： We discuss the construction of atomistic/continuum (A/C) coupling methods for crystalline solids with defects using a generic numerical analytical framework. Sharp a priori and a posteriori error estimates for the coupling methods can be derived, which lead to their optimal implementation. Possible extensions to more general problems will be mentioned.

论坛主题报告 8

报告题目: A Potential Theory Based Cartesian Grid Method for Elliptic PDEs

报告人: 应文俊,男, 清华大学应用数学学士, 计算数学硕士, 美国杜克大学计算数学博士, 生物医学工程系博士后, 曾任美国密歇根理工大学助理教授, 现为上海交通大学自然科学研究院及数学科学学院特聘教授,是中组部首批"青年千人计划"入选者之一。

摘要: In this talk, I will give a talk on a potential theory based Cartesian grid method for elliptic PDEs. The method solves a boundary value or interface problem of elliptic PDE in the framework of second-kind Fredholm boundary integral equations. It avoids some limitations of the traditional boundary integral method for elliptic PDEs. It does not need to know or compute the fundamental solution or Green's function of the PDE and allows the solution of variable coefficients and nonlinear PDEs. The method evaluates boundary and volume integrals indirectly by solving equivalent but much simpler interface problems on Cartesian grids, based on properties of single, double layer boundary integrals and volume integrals in potential theory. In addition to its taking advantage of the well-conditioning property of the second-kind Fredholm boundary integral equations in an iterative solution of the resulting discrete system, the method makes full use of fast elliptic solvers on Cartesian grids. The Cartesian grid method can also accurately compute nearly singular and hypersingular boundary integrals in a natural and convenient way. In this talk, I will present several different applications of the method, including computational cardiac dynamics and fluid dynamics of incompressible flow, as well as some moving interface and free boundary problems.

论坛主题报告 9

报告题目： A Hybrid Numerical Method for Electro-kinetic Flow with Deformable Interfaces

报告人： 马满满，男，南京大学数学学士，美国新泽西理工学院应用数学博士，现任上海交通大学自然科学研究院博士后。

摘要： A hybrid or multiscale numerical method is introduced to describe the deformation of an immiscible fluid drop in the two-phase flow of ionic fluid electrolytes in the presence of an applied DC electric field. The starting point is the Poisson-Nernst-Planck equations in the Stokes regime, followed by their asymptotic reduction in the limit when the thickness of the Debye layers that form adjacent to the interface is much less than the initial undeformed size of the drop. This leads to the formulation of boundary integral equations for the electrostatic potential and the fluid and interface velocities that contain the coupling between the electrostatic and fluid fields within the thin Debye layers. Dimensionless groups that appear in the model include the contrast in material properties between the interior and exterior electrolyte phases for the electrical permittivity, available molar ion concentration, the ion diffusivity, and fluid viscosity. The small deformation theory will be developed and the numerical implementation and results of the numerical simulations will be presented.

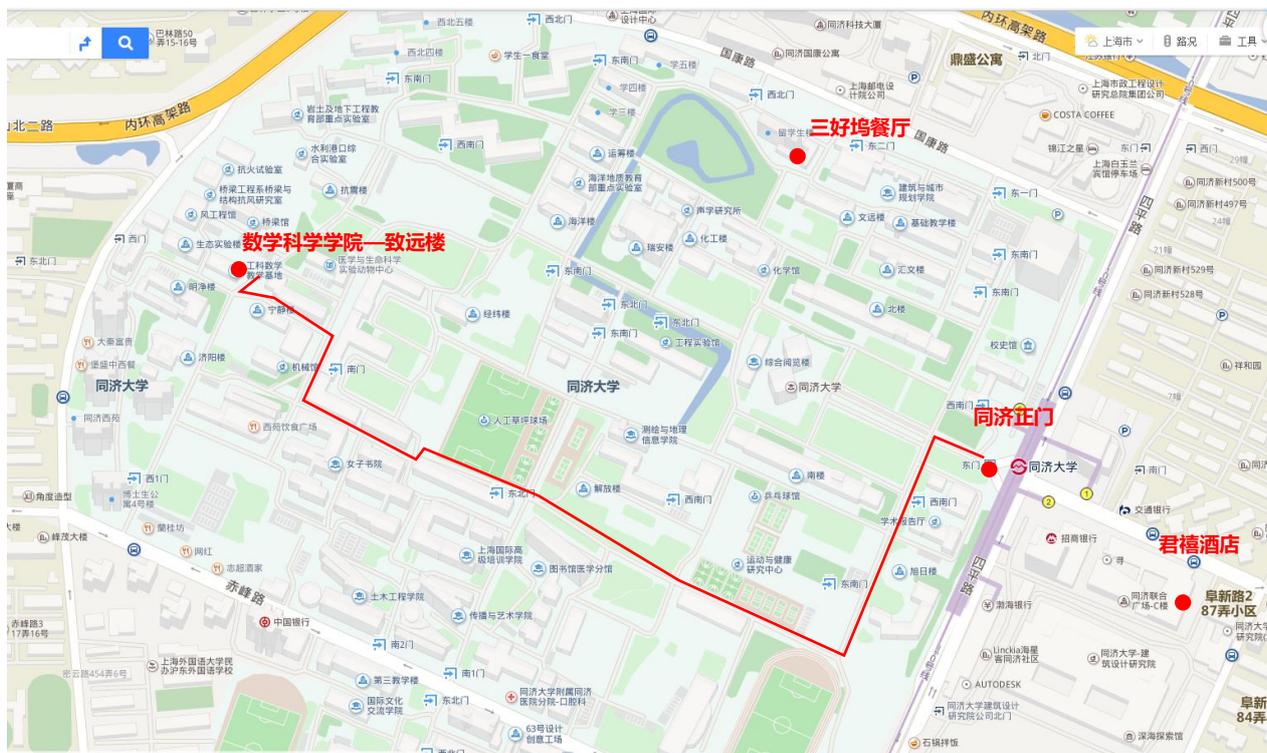
论坛主题报告 10

报告题目：Explicit Gross-Zagier Formulae And The Sylvester Problems

报告人：舒杰，男，四川大学数学系学士，中国科学院数学与系统科学研究院硕士、博士，现任复旦大学上海数学中心博士后。

摘要：The Birch and Swinnerton-Dyer conjecture, which still remains largely unproven, relates the analytic aspect and the arithmetic aspect of elliptic curves. The Gross-Zagier formula is an important analytic tool for studying this conjecture. The most general case of Gross-Zagier formula has been established by the recent work of Yuan-Zhang-Zhang. Nevertheless, when it comes to actual applications to the arithmetic of elliptic curves or abelian varieties, one very often needs an explicit form of the Gross-Zagier formula. I will talk about our work on the general explicit Gross-Zagier formula and its applications in the Sylvester problems. These are joint with L. Cai and Y. Tian.

同济大学附近地图



会场地点：同济大学数学科学学院致远楼

住 宿：上海同济君禧酒店（步行至致远楼约 15 分钟）

餐 饮：三好坞餐厅