2025年应用数学与风险管理研讨会

会议手册

南京审计大学

2025年11月29日

会议议程

11月28日：会议报到 【报到地点】：南京瑞斯丽酒店

时　间	内　　容
14:00 - 21:00	报到注册
19：00 晚　　餐 （瑞斯丽酒店）	

11月29日：上午大会报告，下午分组报告

第一阶段：开幕式 【地点】：中和楼502会议室

时　间	议　程	主持人
8:30 - 8:35	嘉宾介绍	杨洋
8:35 - 8:45	领导致辞（任志成校长）	
8:45 – 8:50	合　影	

第二阶段：大会报告【地点】：中和楼502会议室

时　间	议　程	主持人
8:50 - 9:30	大会报告　报告人：秦厚荣	尤国桥
9:30 - 10:10	大会报告　报告人：张　希	
10:10-10:30 会场休息		
10:30 - 11:10	大会报告　报告人：王雨顺	龚跃政
11:10 - 11:50	大会报告　报告人：杨俊锋	
12:00 - 13:00 午 餐 （金培餐厅）		

第三阶段：分组报告

会　场	中和楼502会议室		位育楼417会议室		位育楼217会议室	
时　间	报告人	主持人	报告人	主持人	报告人	主持人
13:30 - 14:00	曹春正	高庆武	许　超	刘桂东	周海燕	邓海云
14:00 - 14:30	梁志彬		龚跃政		王　婧	
14:30 - 15:00	李丹萍		廖洪林		蒋飞达	
15:00 - 15:30	蒋　辉		顾　洲		刘海蓉	
15:30-15:50 会场休息						
时　间	主题					
16：00 - 17：00	审计博物馆参观					
18：00 晚 餐 （瑞斯丽酒店）						
会议结束						

大会报告摘要

题 目：南京的数学故事

报告人：秦厚荣

摘 要：本次报告将带大家追溯历史上发生在南京的数学事件与数学家的故事，重点聚焦祖冲之、秦九韶等杰出数学家留下的光辉成就。

题 目：**The Hermitian-Yang-Mills equation on Higgs bundles**

报告人：张 希

摘 要：**Higgs bundle was introduced by Hitchin, it closely related to multiple fields such as non-abelian Hodge correspondence, algebraic geometry, K\"ahler geometry and group representations. In this talk, we recall the classical Donaldson-Uhlenbeck-Yau theorem, and consider asymptotic behavior of the perturbed Hermitian-Yang-Mills equation on Higgs bundles. Then, we introduce our recent works on the existence of canonical metrics on Higgs bundles and their applications. These works are joint with Chao Li, Chuanjing Zhang and Shiyu Zhang.**

题 目：能量算法构造的辅助变量法

报告人：王雨顺

摘 要：报告首先以**Camassa-Holm**方程为例，给出了一种可以构造任意高阶保系统原始能量的**Runge-Kutta**方法。随后，讨论了一般梯度流系统保结构算法构造的辅助变量法，研究了扩展系统的结构性质。报告从保结构算法的角度讨论了能量二次化方法的机理，分析了其只能保修正能量的原因，并尝试利用扩展系统的结构构造保原始能量的算法。

题　目：**New Adaptive Gradient Methods for Convex and Nonconvex Optimization**

报告人：杨俊锋

摘　要：**Consider the unconstrained optimization problem of a continuously differentiable function using the vanilla gradient method. When the objective function is convex and the gradient operator is locally Lipschitz continuous, we propose an adaptive strategy based on the short Barzilai-Borwein step size formula for choosing the step size. The resulting algorithm is line-search-free and parameter-free. We establish the convergence of the iterates and the ergodic convergence of the objective function value. Compared with existing works in this line of research, our algorithm provides the best lower bounds on the step size and the average of the step sizes. Furthermore, we present extensions to the locally strongly convex case and the case of composite convex optimization. Our numerical results also demonstrate the promising potential of the proposed algorithms on some representative examples. We also present an adaptive strategy for choosing the step sizes when the objective function is globally L-smooth but possibly nonconvex. (Joint work with Shiqian Ma, Zilong Ye and Danqing Zhou)**

分组报告摘要

（中和楼502会议室）

题 目：**Kernel Supervised Functional Principal Components Analysis**

报告人：曹春正

摘 要：**Functional principal components analysis (FPCA) is a key method for dimensionality reduction in functional data analysis. By capturing the maximum variability in the data, FPCA identifies a linear subspace spanned by a few leading functional principal components. However, for tasks such as scalar-on-function regression or functional classification, a supervised version of FPCA (sFPCA) is often preferred, as it extracts low-rank features from the functional covariates by leveraging their relationship with the response variable. Despite its utility, the sFPCA may be ineffective when the functional predictors exhibit nonlinear characteristics or have nonlinear association with the response. To address this, we propose a kernelized version of supervised FPCA (kernel sFPCA), which accommodates unknown nonlinear relationships between the functional predictors and the response. The kernel sFPCA maps the functional predictors into a higher-dimensional space, where it identifies a linear subspace composed of functional principal components through supervised learning. The kernel sFPCA offers a closed-form solution and is capable of handling multi-dimensional and multivariate functional data. Some theoretical properties are discussed. Furthermore, we investigate the supervised learning problem for spatio-temporal data and propose a supervised principal component method that fuses nonlinear temporal and spatial features, which is then applied to the classification of hyperspectral data.The effectiveness of the proposed approach is demonstrated through both simulated studies and real data experiments.**

题　目：**Optimal timing of strategic bank closure under deposit insurance and capital requirements**

报告人：梁志彬

摘　要：**In this work, we conduct a detailed study of the deposit insurance with the presence of liquidation cost and capital requirements. More specifically, the deposit insurance contract is modeled as a put option, and the insured bank has the right of choosing an optimal time to strategically close itself during the valid period. Meanwhile, the bank will be closed by the regulator if the surplus of the bank is lower than the threshold. Based on the optimal stopping theory, we give the corresponding variational inequalities and free boundaries. Two different kinds of boundaries are derived respectively, and the connection between them are also explored. Further numerical analysis are given to make the theoretical results intuitive and show the effects of some important parameters. This model captures some interesting findings, such as, banks always choose to wait when the wealth is close to compensation threshold; If regulations raise the capital requirement, banks will delay the closure time.**

题　目：**Green stimulus, dynamic cash management and corporate investment**

报告人：李丹萍

摘　要：**We study a continuous-time green fiscal stimulus problem for a firm at different levels of green investment. The firm can access government loans up to a maximum limit and balance the trade-off between shareholders'benefits and its environmental responsibility to optimize cash management and investment policies. This framework involves a challenging singular control problem of a two-dimensional degenerate diffusion system but enables a unified analysis of the marginal value of government spending and the impact of loan availability on both brown and green firms. We provide theoretical insights into the lower dividend payments and higher take-up of loans for greener firms relative to brown firms. The model predictions together with the numerical results have implications for how policymakers can prioritize green spending and plan green stimulus programmes.**

题　目：**Precise deviations of drift estimation in stochastic heat equation**

报告人：蒋 辉

摘　要：**For the stochastic fractional heat equation driven by additive noise, we study asymptotic properties for the maximum likelihood estimator (MLE) of drift coefficient. Via the parameter-dependent change of measure methods and asymptotic analysis techniques, we obtain the the (non-)uniform Berry-Esseen bounds, (self-normalized) Cram\'er-type moderate deviations, moderate deviations and precise large deviations. The paper contains three asymptotic regimes: large time asymptotics, increasing number of Fourier modes, large time asymptotics and increasing number of Fourier modes. Our main results show the relationship between the time horizon, number of Fourier modes, space dimension and fractional order.**

分组报告摘要

（位育楼417会议室）

题 目：待定

报告人：许 超

摘 要：待定

题　目：Linearized SVM approach for the incompressible Navier-Stokes equations

报告人：龚跃政

摘　要：This talk introduces a linearized SVM approach for the incompressible Navier-Stokes equations, establishing a foundational framework for designing efficient, structure-preserving algorithms that strictly conserve the original energy dissipation law. The proposed fully discrete schemes both maintain the original energy dissipation law and admit unique solutions. And they are linear and require only the solutions of three linear Stokes systems and one ξ2\times 2ξ system of linear equations. Extensive numerical experiments are carried out to verify the accuracy, efficacy, and advantageous performance of our newly developed methods.

题　目：**A class of refined implicit-explicit Runge-Kutta methods with robust time adaptability for the Cahn-Hilliard model**

报告人：廖洪林

摘　要：**One of main obstacles in verifying the energy dissipation laws of implicit-explicit Runge-Kutta (IERK) methods for phase field equations is to establish the uniform boundedness of stage solutions without the global Lipschitz continuity assumption of nonlinear bulk. With the help of discrete orthogonal convolution kernels, an updated time-space splitting technique is developed to establish the uniform boundedness of stage solutions for a refined class of IERK methods in which the associated differentiation matrices and the average dissipation rates are always independent of the time-space discretization meshes. This makes the refined IERK methods highly advantageous in self-adaptive time-stepping procedures as some larger adaptive step-sizes in actual simulations become possible. From the perspective of optimizing the average dissipation rate, we construct some parameterized refined IERK methods up to third-order accuracy, in which the involved diagonally implicit Runge-Kutta methods for the implicit part have an explicit first stage and allow a stage-order of two such that they are not necessarily algebraically stable. Then we are able to establish, for the first time, the original energy dissipation law and the unconditional ξL^2ξ norm convergence. Extensive numerical tests are presented to support our theory.**

题　目：事件触发控制研究进展及其应用

报告人：顾　洲

摘　要：事件触发控制（ETC）作为降低网络控制系统通信负担的关键技术，近年来在非线性、多智能体与网络化系统中取得了重要进展，已成为国际控制领域的前沿和热点问题。报告将回顾ETC由“周期采样”走向“状态依赖触发”的演进。阐述动态事件、自触发、记忆型事件触发、学习触发等机制在降低通信频次、抵御恶意攻击、适配模型不确定性方面的进展；指出最小触发间隔保障；最后阐述研究结果在智能交通、智能电网以及金融系统中的应用。

分组报告摘要

（位育217会议室）

题　目：**Analysis of Roth-Lempel codes**

报告人：周海燕

摘　要：**Near maximum distance separable (NMDS) codes have been widely used in various fields such as communication systems, data storage, and quantum codes due to their algebraic properties and excellent error-correcting capabilities.This report focuses on Roth-Lempel codes and establishes necessary and sufficient conditions for them to be NMDS and further completely determine its weight distributions . Besides, we illustrate the linearly inequivalence of Roth-Lempel codes and NMDS codes of elliptic curve type when their corresponding code lenthts exceed ξ\frac{4(q+2\sqrt{q｝+1)｝{5｝-1ξ. Finally we show that some special linear codes of elliptic-curve type are not equivalent to Roth-Lempel code C by Schur product.**

题　目：**Absolute continuity of the integrated density of states in the localized regime**

报告人：王　婧

摘　要：**In this talk, we will discuss the absolute continuity of the integrated density of states (IDS) IDS for quasi-periodic operators.We establish the absolute continuity of the IDS for quasi-periodic Schr\"odinger operators with large trigonometric potentials and Diophantine frequencies. This partially solves Eliasson's open problem in 2002. Furthermore, this result can be extended to a class of quasi-periodic long-range operators on $\ell^2(\Z^d)$. Our proof is based on stratified quantitative almost reducibility results of dual cocycles. Specifically, we prove that a generic analytic one-parameter family of cocycles, sufficiently close to constant coefficients, is reducible except for a zero Hausdorff dimension set of parameters. This result affirms Eliasson's conjecture in 2017.**

题　目：**Entire solutions and asymptotic behavior to a class of Parabolic Hessian Equations**

报告人：蒋飞达

摘　要：**In this talk, we make a systematic investigation of the existence, uniqueness and nonexistence of entire separable variable radial solutions to the following class of parabolic ξkξ-Hessian equations with the parameter ξ\alphaξ:ξξ-u_t[S_k(D^2u)]^\alpha = 1.ξξ We also study the asymptotic behavior and its refined version of the solution at infinity. The main tools employed in this work comprise Euler's broken line method, local boundedness estimate, Keller-Osserman type criteria, the generalized L'Hospital's rule, and asymptotic stability analysis.**

题　目：**Quantitative unique continuation property for solutions to a bi-Laplacian equation with a potential**

报告人：刘海蓉

摘　要：**In this talk, we will show the quantitative unique continuation property of solutions to a bi-Laplacian equation with a potential. Our key argument is to lift the original equation to that with a positive potential, then decompose the resulted fourth-order equation into a special system of two second-order equations. Based on the special system, we define a variant frequency function with weights and derive its almost monotonicity to establishing some doubling inequalities with explicit dependence on the Sobolev norm of the potential function.**