

混杂跳扩散系统及其相关问题研讨会

2025.10.05- 2025.10.11



组织委员：闫理坦 东华大学
毛学荣 University of Strathclyde
张振中 东华大学

主办单位：天元数学国际交流中心

日程安排

(线上腾讯会议号: 884-5044-5152)

☆ 10月6日(线下地点: 华罗庚报告厅, 线上腾讯会议号: 884-5044-5152)

8:15-8:30	开幕式	
主持人：毛学荣		
8:30-9:30	向开南	The probabilistic approach to the Jacobian conjecture
9:30-10:15	邵井海	Invariant probability measures for path-dependent regime-switching processes
10:15-10:40	茶歇，照相	
主持人：闫理坦		
10:40-11:25	李石虎	Mean field stochastic partial differential equations with nonlinear kernels
11:25-12:10	吕昊俊	Drift estimation for Stochastic Partial Differential Equation Driven by Fractional Brownian Motion
12:10-14:30	午餐，休息	
主持人：向开南		
14:30-15:15	李应求	Mandelbrot's Cascade in Random Environments
15:15-16:00	陈娴	A variational formula for discrete-time Markov control processes under risk-sensitive average reward criterion
16:00-16:20	茶歇	
主持人：李应求		
16:20-17:05	张华	Varadhan Estimates for the Densities of Wiener-Poisson Functionals and Applications
17:05-17:50	阳芬芬	Distribution dependent stochastic differential equations with critical conditions

☆ 10月7日(线下地点: 华罗庚报告厅, 线上腾讯会议号: 884-5044-5152)

主持人：邵井海		
8:15-9:15	陈振庆	Quantitative homogenization for long range random walks in dynamic random environments
9:15-10:00	何辉	带随机漂移的反应扩散方程的前端行为
10:00-10:20	茶歇	
主持人： 陈振庆		
10:20-11:05	王炳昌	Mean Field LQG Games: Model Based/Free Approaches
11:05-11:50	张帅琪	Stochastic control problems for sub-diffusions
11:50-14:30	午餐，休息	

主持人：何辉		
14:30-15:15	孙晓斌	Averaging principles for time-inhomogeneous multi-scale SDEs with partially dissipative coefficients
15:15-16:00	郭精军	Statistical inference of the complex fractional Vasicek model with Hurst index $H \in (0, 1/2)$
16:00-16:20	茶歇	
主持人：郭精军		
16:20-17:05	田琳琳	Optimal investment problem in a renewal risk model with generalized Erlang distributed interarrival times
17:05-17:50	靳兴胡	Euler-Maruyama approximation for SDEs with Markovian switching

☆ 10月8日（线下地点：华罗庚报告厅，线上腾讯会议号：884-5044-5152）

主持人：席福宝		
8:15-9:15	吴付科	Systems of Singularly Perturbed Forward-Backward Stochastic Differential Equations and Control Problems
9:15-10:00	李晓月	Dynamical behaviors of nonlinear McKean-Vlasov stochastic differential equations with common noise
10:00-10:20	茶歇	
主持人：吴付科		
10:20-11:05	席福宝	Successful Couplings and Strong Ergodicity for Switching Diffusion Systems with Past-Dependent Switching
11:05-11:50	李培森	Uniform ergodicity of a stochastic Lotka--Volterra type population system
11:50-14:30	午餐，休息	
主持人：张振中		
14:30-15:15	罗德军	Edwards-Wilkinson limit for a stochastic advection-diffusion PDE
15:15-16:00	钱斌	Pricing model for data assets in investment-consumption framework with ambiguity
16:00-16:20	茶歇	
主持人：罗德军		
16:20-17:05	董海玲	Stabilization of highly nonlinear hybrid stochastic differential delay equations with Lévy noise by delay feedback control
17:05-17:50	刘晔	Numerical approximation to invariant measure of periodic stochastic differential equations with Markov switching

☆ 10月9日（线下地点：冯康报告厅，线上腾讯会议号：884-5044-5152）

主持人：周晓文

8:15-9:15	毛学荣	Stabilisation in Distribution of Hybrid Systems by Intermittent Noise
9:15-10:00	周华成	Event-triggered finite-dimensional observer-based control for a one-dimensional stochastic heat equation
10:00-10:20	茶歇	

主持人：周华成

10:20-11:05	巫静	On Viscosity and Distribution Solutions of PDEs with Neumann Boundary Conditions: Probabilistic Approach
11:05-11:50	赵国焕	Probabilistic Perspectives on the 2D Navier-Stokes Equations: Well-Posedness, Large Deviation Principles and Long-Time Behaviors
11:50-14:30	午餐，休息	

主持人：巫静

14:30-15:15	张德飞	A stochastic epidemic model with G-Brownian motion
14:15-16:00	张雪康	Asymptotic behavior of the improved trajectory fitting estimation for linear self-interacting diffusions
16:00-16:20	茶歇	

主持人：张德飞

16:20-17:05	周晓文	Refracted oscillating Brownian motion
17:05-17:50	王荔丹	Heat kernel estimates for a class of (killed) anisotropic Markov processes

☆ 10月10日（线下地点：冯康报告厅，线上腾讯会议号：884-5044-5152）

主持人：闫理坦

8:15-9:15	李娟	A global stochastic maximum principle for Mean-field forward-backward stochastic control systems with quadratic generators
9:15-10:00	王龙敏	The Growth of Green Functions for Random Walks on Relatively Hyperbolic Groups
10:00-10:20	茶歇	

主持人：李娟

10:20-11:05	刘凯	Local Hölder Continuity of Stochastic Convolution of Delay Systems
11:05-11:50	张振中	The Dirichlet problem for weakly coupled non-local operators with Neumann boundary conditions
11:50-14:30	午餐，休息	

主持人：毛学荣、李娟、王龙敏

14: 30-16:30	讨论	
--------------	----	--

报告摘要

A variational formula for discrete-time Markov control processes under risk-sensitive average reward criterion

陈娴
(厦门大学)

We study the risk-sensitive average reward criterion for discrete-time Markov control processes. The state space is a Borel space and the reward function can be unbounded. We prove the existence of a solution to the risk-sensitive average reward optimality equation and the existence of an optimal stationary policy via a new technique of constructing an approximating sequence of coercive reward functions and introducing the split chain. Moreover, we develop a new approach to obtain a variational formula for the risk-sensitive average reward criterion without the compactness condition on the state space in the existing literature.

Quantitative homogenization for long range random walks in dynamic random environments

陈振庆
(University of Washington)

In this talk, I will present quantitative homogenization results for stable-like long range random walks in time-dependent random conductance models, where the conductance is bounded above but can be degenerate. Based on joint work with X. Chen, T. Kumagai and J. Wang.

Stabilization of highly nonlinear hybrid stochastic differential delay equations with Lévy noise by delay feedback control

董海玲
(深圳大学)

We focus on a class of highly nonlinear stochastic differential delay equations (SDDEs) driven by Lévy noise and Markovian chain, where the drift and diffusion coefficients satisfy more general polynomial growth condition. Under the local Lipschitz condition, the existence-and-unique theorem of the solution to the highly nonlinear SDDE is established. The key aim is to investigate the stabilization problem by delay feedback controls. The key features include that the time delay in the given system is of time-varying and may not be differentiable while the time lag in the feedback control can also be of time-varying as long as it has a sufficiently small upper bound.

Limits of Brownian trees with exponential weight on its height

郭精军
(兰州财经大学)

This paper investigates a statistical inference issue concerning two drift parameter estimators in the complex-valued Vasicek model influenced by fractional Brownian motion. We develop the moment estimator specifically for mean-reversion parameter and also construct the least squares estimators for two drift parameters. Furthermore, these estimators are demonstrated to be of strongly consistent and asymptotically normal. This extends the findings in Shen et al. \cite{Shen}

to the case of Hurst index $H \in (\frac{1}{4}, \frac{1}{2})$, as well as the results of Alazemi et al. \cite{Alazemi} from Ornstein-Uhlenbeck process to Vasicek model. The key way of our computations is a novel inner product formula on a reproducing kernel Hilbert space about fractional Brownian motion for bounded variation functions, which is presented in Alazemi et al. \cite{Alazemi} and $H \in (0, \frac{1}{2})$. The main results involve the utilization of complex fourth moment theorems and the Garsia-Rodemich-Rumsey inequality.

带随机漂移的反应扩散方程的前端行为

何辉
(北京师范大学)

我们考虑一类反应扩散方程，这类方程的对空间的一阶导数项带有一个随机漂移，方程的解可以看做是一个随机漂移的分枝布朗运动，我们在一定条件下研究这类方程解的前端行为。

A global stochastic maximum principle for Mean-field forward-backward stochastic control systems with quadratic Generators

李娟
(山东大学)

Our talk is devoted to the study of Peng's stochastic maximum principle (SMP) for a stochastic control problem composed of a controlled forward stochastic differential equation (SDE) as dynamics and a controlled backward SDE which defines the cost functional. Our studies combine the difficulties which come, on one hand, from the fact that the coefficients of both the SDE and the backward SDE are of mean-field type (i.e., they do not only depend on the control process and the solution processes but also on their law), and on the other hand, from the fact that the coefficient of the BSDE is of quadratic growth in Z . Our SMP is novel, it extends in a by far non trivial way existing results on SMP.

The talk is based on a joint work with Rainer Buckdahn (UBO, France), Yanwei Li (SDU, China), Yi Wang (SDU, China)

Uniform ergodicity of a stochastic Lotka--Volterra type population system

李培森
(北京理工大学)

We study a stochastic Lotka–Volterra model, which is constructed as the unique strong solution of a two-dimensional stochastic differential equation with jumps. By developing a novel localization-based Markov coupling approach, we establish sharp sufficient conditions for uniform ergodicity in total variation. This talk is based on the joint work with Shukai Chen and Jian Wang.

Mean field stochastic partial differential equations with nonlinear kernels

李石虎
(江苏师范大学)

In this talk, we consider mean field stochastic partial differential equations with nonlinear kernels. We first prove the existence and uniqueness of strong and weak solutions for mean field stochastic partial differential equations in the variational framework, then establish the convergence (in certain Wasserstein metric) of the empirical laws of interacting systems to the law of solutions of mean field equations, as the number of particles tends to infinity. The main challenge lies in addressing the inherent interplay between the high nonlinearity of operators and the non-local effect of coefficients that depend on the measure.

Dynamical behaviors of nonlinear McKean-Vlasov stochastic differential equations with common noise

李晓月
(天津工业大学)

This talk reports some results on the dynamical behaviors of McKean-Vlasov stochastic differential equations (SDEs) with common noise whose coefficients depend on both the state and the measure. We give the existence and uniqueness of the invariant measure for McKean-Vlasov SDEs with common noise whose drift and diffusion coefficients grow polynomially. Second, we investigate the uniform-in-time propagation of chaos and then the convergence between the measure of one particle of the mean-field particle systems and the invariant measure of the McKean-Vlasov SDE with common noise.

Mandelbrot's Cascade in Random Environments

李应求
(长沙理工大学)

报告了随机环境中 Mandelbrot 瀑布的最新研究进展。首先, 讨论了极限变量 W 和 Y 的非退化条件, 其中 W 是规范化 Mandelbrot 鞅 (W_n) 的极限, $W_n = Y_n / \Pi_n$; Y 是过程 (Y_n) 的极限。建立了 $(W - W_n)$ 的几乎必然收敛速率。研究了 $\log Y_n$ 的极限定理, 包括中心极限定理、大偏差原理和中等偏差结果, 并进一步给出了中心极限定理收敛速率的 Berry-Esseen 界。给出了 Y 的矩、加权矩以及 W 的调和矩的存在条件, 分析了这些结果对级联过程行为的理论意义。

Local Hölder Continuity of Stochastic Convolution of Delay Systems

刘凯
(University of Liverpool)

In this talk, we are concerned about the regularity, i.e., local Hölder continuity, of stochastic convolutions of a class of linear stochastic delay differential equations in Hilbert spaces. To this end, we first define the fundamental solution and introduce the variation of constants formula of the systems under investigation. Then we show two important estimates on fundamental solutions from which the desired Hölder continuity of stochastic convolutions is worked out.

Numerical approximation to invariant measure of periodic stochastic differential equations with Markov switching

刘晔
(上海师范大学)

In this talk, I will review studies on numerical methods for invariant measures of stochastic differential equations (SDEs) in past years firstly. Then, our recent study on this topic for a class of SDEs with periodic coefficient is reported. Compared with existing fruitful results of this topic, our work is devoted to the case of non-autonomous SDEs, which bring technical challenges including time-inhomogeneity and periodicity. This is a joint work with Dr Yongmei Cai and Prof Xuerong Mao.

Edwards-Wilkinson limit for a stochastic advection-diffusion PDE

罗德军
(中国科学院数学与系统科学研究院)

We consider a diffusion in a Gaussian random environment that is white in time and study the large-scale behavior of the quenched density with respect to the Lebesgue measure. We show that under diffusive rescaling, the fluctuations of the density converge to a Gaussian limit, described by an additive stochastic heat equation.

Drift estimation for Stochastic Partial Differential Equation driven by Fractional Brownian Motion

吕昊俊
(东华大学)

In this paper, we study the least squares estimator (LSE) of the drift coefficient for the fractional stochastic heat equation driven by fractional Brownian motion. In the first part of the paper, we consider continuous-time observations of the Fourier coefficients of the solutions and show that the LSE is strongly consistent and asymptotically normal. In the second part, we investigate the natural time discretization of the LSE and establish its weak consistency and asymptotic normality under certain assumptions.

Euler-Maruyama approximation for SDEs with Markovian switching

靳兴胡
(合肥工业大学)

We investigate the Euler-Maruyama (EM) approximation for $\mathbb{R}^d$ -valued ergodic stochastic differential equations with Markovian switching, driven by L^2 processes (including Brownian motion and rotationally invariant α -stable processes with $\alpha \in (1,2)$). Under mild assumptions on the coefficients, we establish quantitative error bounds between the original process and its EM discretization under a specially designed metric d_G , using the Lindeberg principle (or Stein's method).

Stabilisation in Distribution of Hybrid Systems by Intermittent Noise

毛学荣

(University of Strathclyde)

For many stochastic hybrid systems in the real world, it is inappropriate to study if their solutions will converge to an equilibrium state (say, 0 by default) but more appropriate to discuss if the probability distributions of the solutions will converge to a stationary distribution. The former is known as the asymptotic stability of the equilibrium state while the latter the stability in distribution. This talk aims to determine whether or not a stochastic state feedback control can make a given nonlinear hybrid differential equation, which is not stable in distribution, to become stable in distribution. We will refer to this problem as stabilization in distribution by noise or stochastic stabilization in distribution. Although the stabilization by noise in the sense of almost surely exponential stability of the equilibrium state has been well studied, there is little known on the stabilization in distribution by noise. This talk initiates the study in this direction. This talk is based on the joint work with Wei Mao and Junhao Hu.

Pricing model for data assets in investment-consumption framework with ambiguity

钱斌

(苏州工学院)

Consider the SDE in $\mathbb{R}^n$, $dX_t = A(t)X_t + b(t)dt + \sigma(t)dB_t$ where B is a d -dimensional Brownian motion with $d \leq n$ and $\sigma(t), A(t), b(t)$ are $L^\infty_{loc}(\mathbb{R})$ functions with values respectively in the matrix spaces of dimension $n \times d, n \times n, n \times 1$. Under the assumption that the covariance of X_t is positive definite, we obtain the (right and reverse) Bakry-Emery inequality by coupling. Moreover, we can obtain Bismut formula by Malliavin calculus and coupling. Consequently, we can give Poincaré inequality, Log-Sobolev inequality and Wang-Harnack inequality for the associated semigroup P_t .

Invariant probability measures for path-dependent regime-switching processes

邵并海

(天津大学)

We consider stochastic functional differential equations with Markovian regime-switching on an (infinitely) countable state space. Via establishing the Feller property and contraction in L_1 -Wasserstein distance of the semigroup associated with the segment process, we show the existence and uniqueness of invariant probability measure. In order to cope with switching processes on an infinite state space, we develop a truncation method based on a new construction of order preserving coupling for Markov chains to generalize the estimation of exponential functionals for Markov chains with infinite states. The existing sharp estimation is only valid for Markov chains on a finite state space, as it fundamentally relies on the Perron-Frobenius theorem.

Averaging principles for time-inhomogeneous multi-scale

SDEs with partially dissipative coefficients

孙晓斌
(江苏师范大学)

In this talk, we consider a class of time-inhomogeneous stochastic differential equations (SDEs) with slow and fast time-scales, where the drift term in the fast component is time-dependent and only partially dissipative. Under asymptotic assumptions on the coefficients, we prove that the slow component converges strongly to the unique solution of an averaged equation, when the diffusion coefficient in the slow component is independent of the fast component; on the other hand, we establish the weak convergence of slow component in the continuous function space and identify the limiting process by the martingale problem approach, when the diffusion coefficient of the slow component depends on the fast component. The proofs of strong and weak averaging principles are partly based on the study of the existence and uniqueness of an evolution system of measures for time-inhomogeneous SDEs with partially dissipative drift. This is a joint work with Professors Jian Wang and Yingchao Xie.

Optimal investment problem in a renewal risk model with generalized Erlang distributed interarrival times

田琳琳
(东华大学)

This paper explores the optimal investment problem of a renewal risk model with generalized Erlang distributed interarrival times. The phases of the Erlang interarrival time is assumed to be observable. The price of the risky asset is driven by the constant elasticity of variance model (CEV) and the insurer aims to maximize the exponential utility of the terminal wealth by asset allocation. By solving the corresponding Hamilton-Jacobi-Bellman (HJB) equation, we establish the concavity of the value function and derive an explicit expression for the optimal investment policy when the interest rate is zero. When the interest rate is nonzero, we obtain an explicit form of the optimal investment strategy, along with a semi-explicit expression of the value function, whose concavity is also rigorously proven.

Mean Field LQG Games: Model Based/Free Approaches

王炳昌
(山东大学)

平均场博弈是近年来的热门专题。报告人突破不动点方程难解所导致的研究障碍,提出了“解耦正倒向方程”方法,得到了最基本假设下分散渐近最优策略和平均场控制系统一致镇定的充要条件,并运用相关结果到经济学和电力系统的研究中。报告人简要回顾平均场博弈研究概况,重点汇报近三年在平均场博弈专题取得最新研究进展。

Systems of Singularly Perturbed Forward-Backward Stochastic Differential Equations and Control Problems

吴付科
(华中科技大学)

This paper focuses on systems of singularly perturbed forward-backward stochastic differential equations (FBSDEs) and control problems. Assuming Lipschitz continuity on the coefficients and

allowing degeneracy in the diffusion terms, it establishes that the solution of a two-time-scale FBSDE converges to the solution of an averaged FBSDE as a small parameter ε tends to zero. Furthermore, it is shown that the value function of the singularly perturbed systems converge to the solution of a nonlinear partial differential equation (PDE). Furthermore, under additional conditions, it is demonstrated that the solution of the limit PDE is in fact the limit value function. These results provide insights into the convergence rate and extend existing results on the averaging principles for such stochastic control problems.

Heat kernel estimates for a class of (killed) anisotropic Markov processes

王嘉丹
(南开大学)

Abstract: In this talk, we consider a large class of anisotropic Markov processes, which, in contrast with isotropic Markov processes, only jump along the coordinate directions. We establish two-sided heat kernel bounds on $\mathbb{R}^d$, as well as on C^1 open sets. Based on joint works with K.-Y. Kim.

The Growth of Green Functions for Random Walks on Relatively Hyperbolic Groups

王龙敏
(南开大学)

Given a probability measure μ on a finitely generated group Γ , the Green function $G(x, y | r)$ encodes many properties of the random walk associated with μ . Endowing Γ with a word distance, we denote by $H_r(n)$ the sum of the Green function $G(e, x | r)$ along the sphere of radius n . This quantity appears naturally when studying asymptotic properties of branching random walks driven by μ on Γ . In this talk we will exhibit a relatively hyperbolic group with convergent Poincaré series generated by $H_r(n)$. Based on joint works with Matthieu Dussaule and Wenyan Yang.

On Viscosity and distribution solutions of PDEs with Neumann boundary conditions: Probabilistic approach

巫静
(中山大学)

In this talk we are going to discuss via the probabilistic approach the relations between the viscosity solution and the distribution solution to PDEs with Neumann boundary conditions.

Successful Couplings and Strong Ergodicity for Switching Diffusion Systems with Past-Dependent Switching

席福宝
(北京理工大学)

In this work we consider a class of switching diffusion systems consisting of continuous and discrete components, in which the switching rates of discrete component depend on the value of the continuous component involving past history. Motivated by the aim to study the strong ergodicity or uniform ergodicity in the sense of convergence in total variation norm, we construct a type of couplings for this class of switching diffusion systems, and give some sufficient conditions to

guarantee this type of couplings to be successful. In addition, we also provide some illustrative examples.

The probabilistic approach to the Jacobian conjecture

向开南
(湘潭大学)

In this talk, we will describe the following probabilistic approach to the Jacobian conjecture, introduced by E. Bisi, P. Dyszewski, N. Gantert, S. G. G. Johnston, J. Prochno and D. Schmid [(2023). Random planar trees and the Jacobian conjecture. arXiv:2301.08221v3 [math.CO], Preprint.]: If there is an integer $d \geq 3$ such that for all natural numbers p , there exists a p -shuffle Markov chain on large d -Catalan trees with the uniform distribution being its stationary distribution, then the Jacobian conjecture is true. And we will also discuss our own related probability questions. The Jacobian conjecture, proposed by Ott-Heinrich Keller in 1939, says that any polynomial mapping on n -dimensional complex space with a nonzero constant Jacobian determinant has an inverse polynomial mapping. As one of the outstanding open problems in all of mathematics (particularly in algebraic geometry), the conjecture was listed as one of 18 mathematical problems for the 21st century by Steve Smale in 1998.

Distribution dependent stochastic differential equations with critical conditions

阳芬芬
(上海大学)

In this paper, we establish the existence and uniqueness of the solution for distribution dependent SDEs with critical drift coefficients by utilizing fixed point theorem and Krylov's estimate. Furthermore, Wang's Harnack inequality under critical conditions are investigated with singular drift using coupling by change of measures, gradient estimation and Girsanov's transformation. These results generalize those results for distribution dependent SDEs with singular coefficients to critical conditions and are also new for classic singular SDEs with distribution independent coefficients.

A stochastic epidemic model with G-Brownian motion

张德飞
(红河学院)

In this talk, we propose a new stochastic epidemic model driven by G-Brownian motion. The model embodies both the mean and variance uncertainty. It can be seen as an extension of the existing model. It shows a unique positive solution in the sense of quasi surely and will asymptotically tend to zero quasi surely and is p th-moment stable.

Varadhan Estimates for the Densities of Wiener-Poisson Functionals and Applications

张华
(江西财经大学)

In this paper, a criterion for the Varadhan estimates for the densities of Wiener-Poisson functions is established using the lent particle method created by Bouleau and Denis. As an application, we

give the Varadhan estimates for the densities of stochastic differential equations driven by multiplicative Lévy noise under the Hörmander's condition.

Event-triggered finite-dimensional observer-based control for a one-dimensional stochastic heat equation

周华成
(中南大学)

In this talk, we study the event-triggered finite-dimensional output feedback stabilization for a one-dimensional stochastic heat equation. Both static and dynamic event-triggering mechanisms are proposed with introducing a fixed positive dwell time for the inter-execution time, which inherently avoids the occurrence of Zeno behavior. By decomposing the system into two subsystems: the one being unstable finite-dimensional system, the other being infinite-dimensional stable system, we design a finite-dimensional observer and subsequently construct a finite-dimensional controller. By estimating the sampling error, designing the appropriate Lyapunov functional and adopting some stochastic analysis, we achieve the mean square exponential stability of the closed-loop system with some verifiably feasible linear matrix inequalities (LMIs) conditions. Based on the mean square exponential stability result, we further obtain that the closed-loop system achieves almost surely exponential stability. Moreover, we also show that the inter-execution time of dynamic event-triggered is not less than that of static event-triggering mechanism. Finally, some simulations are included to verify the analysis results.

Stochastic control problems for sub-diffusions

张帅琪
(中国矿业大学)

This talk presents our recent work on stochastic control problems for systems driven by sub-diffusions, covering stochastic differential equations, forward-backward stochastic differential equations(FBSDEs), and the switching between Brownian motion and sub-diffusions. We establish the existence and uniqueness of fully coupled FBSDEs driven by sub-diffusions under suitable monotonicity conditions on the coefficients. Additionally, we explore the stochastic maximum principle and dynamic programming principle. Due to the intrinsic structure of sub-diffusions, these control problems exhibit a unique blend of deterministic and stochastic control characteristics. To illustrate our main results, we apply our results to a linear quadratic example.

The Dirichlet problem for weakly coupled non-local operators with Neumann boundary conditions

张振中
(东华大学)

In this talk, we consider the Dirichlet problem for weakly coupled non-local operators with Neumann boundary conditions. Under some conditions, we prove that the existence and uniqueness for an class exterior Dirichlet problem with Neumann boundary conditions. Besides, Some sufficient conditions for the maximum principle、Harnack inequalities for such systems have been provided.

Probabilistic Perspectives on the 2D Navier–Stokes Equations: Well-Posedness, Large Deviation Principles and Long-Time Behaviors

赵国焕

(中国科学院 数学与系统科学研究院)

In this talk, I will discuss recent results on the well-posedness of McKean–Vlasov equations with critical interaction kernels, motivated by the two-dimensional vorticity formulation of the Navier–Stokes equations. We then study the associated interacting particle systems and establish a large deviation principle for their empirical measures. Finally, we analyze the asymptotic behavior of the corresponding rate function and rigorously derive the microcanonical variational principle from a nonequilibrium model formulated from first principles.

Refracted oscillating Brownian motion

周晓文

(Concordia University)

Motivated by problems in stochastic control, we consider the unique solution X to the following SDE.

$$dX_t = (\mu_1 1_{\{X_t \leq 0\}} + \mu_2 1_{\{X_t > 0\}})dt + (\sigma_1 1_{\{X_t \leq 0\}} + \sigma_2 1_{\{X_t > 0\}})dB_t$$

for $\mu_1, \mu_2 \in \mathbb{R}$ and $\sigma_1, \sigma_2 > 0$.

For $\mu_1 = \mu_2$ an explicit expression for transition density of X was obtained by Keilson and Wellner (1978). For $\sigma_1 = \sigma_2$ the transition density was obtained by Karatzas and Shreve (1984). But the transition density for general X was not known. We first solve the exit problem to process X , and then adopt a perturbation approach to find an expression of potential measure for X . The transition density is found by inverting the Laplace transform.

This talk is based on joint work with Zengjing Chen, Panyu Wu and Weihai Zhang.

东华大学数学与统计学院简介

学院数学学科最初由吴让泉（国内随机微分方程领域的开拓者之一）、李绍宽（新中国第一批博士）等教授在 1980 年代创建，经过四十多年的发展，形成了基础数学、概率论与数理统计、应用数学、运筹学与控制论 4 个特色学科方向，紧密对接国家和上海市战略发展需求，培养了毛学荣（爱丁堡皇家学会会士、1980 级）、陈增敬（国家杰青、1985 级）、王子栋（欧洲科学院院士、1986 级）等在国内外有较大影响的专家学者以及一大批能运用数学方法解决实际问题的创新型人才。

学院下设“数学与应用数学（金融工程）”和“统计学（金融统计与风险管理）”两个本科专业，其中“数学与应用数学”于 2020 年入选国家级一流本科专业建设点、“统计学”于 2021 年入选国家级一流本科专业建设点。目前，学院拥有数学一级学科博士点、数学一级学科硕士点以及应用统计专业学位硕士点（同时招收全日制专业硕士与非全日制专业硕士）。学院还组建了非线性科学研究所，由李大潜院士担任名誉所长。特聘中科院李大潜院士、郭柏灵院士、英国爱丁堡皇家学会毛学荣会士担任兼职教授。

截止 2025 年 9 月，学院现有全日制本科生约千人，专任教师 60 余位，其中教授 14 名，博士生导师 10 余名，硕士生导师 40 余名。