The 12th Workshop on Markov Processes and Related Topics

July 13-17, 2016

Quanshan Campus

Jiangsu Normal University

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	07/13	07/14	07/15	07/16	07/17
08:15-09:00	Chairman **Yingchao XIE** Opening and take picture				
Chairman	**Mu-Fa CHEN**	**Renming SONG**	**Fuqing GAO**	**Chii-Ruey HWANG**	**Xia CHEN**
08:30-09:00		Jie Xiong 熊捷	Quansheng Liu 刘全升	Aihua Xia 夏爱华	Shinichi Kotani 小谷真一
09:00-09:30	Yun-Shyong Chow 周云雄	Ting-Li Chen 陳定立	Xian-Yuan Wu 吴宪远	Chenggui Yuan 袁成桂	Dayue Chen 陈大岳
09:30-10:00	Hanjun Zhang 张汉君	Yueyun Hu 胡跃云	Yuanyuan Liu 刘源远	Hui Jiang 蒋辉	Junping Li 李俊平
10:00-10:30	Tea break	Tea break	Tea break	Tea break	Tea break
Chairman	**Zenghu LI**	**Jie XIONG**	**Feng-Yu WANG**	**Aihua XIA**	**Tiefeng JIANG**
10:30-11:00	Kening Lu 吕克宁	Renming Song 宋仁明	Tiefeng Jiang 姜铁锋	Zhao Dong 董昭	Xia Chen 陈夏
11:00-11:30	Xicheng Zhang 张希承	Fubao Xi 席福宝	Shui Feng 冯水	Longjie Xie 解龙杰(11:00-11:20) Lujing Huang 黃璐静(11:20-11:40)	Litan Yan 闫理坦
11:30-12:00	Xiaowen Zhou 周晓文	Zechun Hu 胡泽春	Jianhai Bao 鲍健海	Wei Mao 毛伟(11:40-12:00)	Jiang-Lun Wu 吴奖伦
	Lunch	Lunch	Lunch	Lunch	Lunch
Chairman	**Kening LU**	**Yun-Shyong CHOW**	**Free Afternoon**	**Litan YAN**	
14:30-15:00	Xiangdong Li 李向东	Yaozhong Hu 胡耀忠		George Yin 殷刚	
15:00-15:30	Yanxia Ren 任艳霞	Shang-Yuan Shiu 須上苑		Xianping Guo 郭先平	
15:30-16:00	Mei Zhang 张梅	Guan-Yu Chen 陈冠宇		Jinghai Shao 邵井海	
16:00-16:30	Tea break	Tea break		Tea break	
Chairman	**Xiangdong LI**	**Yaozhong HU**		**George YIN**	
16:30-17:00	Dong Han 韩 东	Fuqing Gao 高付清		Lung-Chi Chen 陈隆奇	
17:00-17:30	Dejun Luo 罗德军	Chunhua Ma 马春华(17:00-17:20) Xin Chen 陈昕(17:20-17:40)		Bo Wu 吴波(17:00-17:20) Xiaobin Sun 孙晓斌(17:20-17:40)	
17:30-18:00	Chao Zhu 朱超	Yong Jiao 焦勇(17:40-18:00)		Xu Yang 杨旭(17:40-18:00)	
	Banquet	Dinner	Dinner	Dinner	Dinner

July 13

Chairman: Yingchao XIE

08:15-09:00 Opening and take pictures

Chairman: Mu-Fa CHEN

09:00-09:30 Yun-Shyong Chow (Academia Sinica, Taibei)

On Nash bargaining games

09:30-10:00 Hanjun Zhang (Xiangtan University, Xiangtan)

Quasi-stationary distributions and their applications

Chairman: Zenghu LI

10:30-11:00 Kening Lu (Brigham Young University, USA)

Lyapunov exponents and chaotic behavior for random dynamical systems in a Banach space

11:00-11:30 Xicheng Zhang (Wuhan University, Wuhan)

Stochastic Hamiltonian flows with singular coefficients

11:30-12:00 Xiaowen Zhou (Concordia University, Canada)

A continuous state branching process with population dependent branching rates

Chairman: Kening LU

14:30-15:00 Xiangdong Li (Chinese Academy of Sciences, Beijing)

On the stochastic approach to the Navier-Stokes equation

15:00-15:30 Yan-Xia Ren (Peking University, Beijing)

Williams decomposotion for superprocesses

15:30-16:00 Mei Zhang (Beijing Normal University, Beijing)

The Seneta-Heyde scaling for stable branching random walk

Chairman: Xiangdong LI

16:30-17:00 Dong Han (Shanghai Jiao Tong University, Shanghai)

On the Nash equilibrium of an evolving random network

17:00-17:30 Dejun Luo (Chinese Academy of Sciences, Beijing)

The Itô SDEs and Fokker–Planck equations with Osgood and Sobolev coefficients

17:30-18:00 Chao Zhu (University of Wisconsin-Milwaukee, USA)

On Feller and strong Feller properties of regime-switching jump-diffusion processes with countable regimes

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July 14

Chairman: Renming SONG

08:30-09:00 Jie Xiong (University of Macau, Macau)

Optimal control under partial information: a brief introduction

09:00-09:30 Ting-Li Chen (Academia Sinica, Taibei)

On the optimal transition rate matrix of Markov process

09:30-10:00 Yueyun Hu (Université Paris 13, France)

On the minimum of a branching random walk

Chairman: Jie XIONG

10:30-11:00 Renming Song (University of Illinois, USA)

Heat kernels of non-symmetric jump processes: beyond the stable case

11:00-11:30 Fubo Xi (Beijing Institute of Technology, Beijing)

On the martingale problem and Feller and Strong Feller properties for weakly coupled Lévy type operators

11:30-12:00 Ze-Chun Hu (Sichuan University, Chengdu)

Hunt's hypothesis (H) and Getoor's conjuecture

Chairman: Yun-Shyong CHOW

14:30-15:00 Yaozhong Hu (University of Kansas, USA)

Regularity and strict positivity of densities for stochastic fractional heat equation

15:00-15:30 Shang-Yuan Shiu (National Central University, Taoyuan)

Dissipation in parabolic SPDEs

15:30-16:00 Guan-Yu Chen (National Chiao Tung University, Hsinchu)

The L^2-cutoff for reversible Markov chains

Chairman: Yaozhong HU

16:30-17:00 Fuqing Gao (Wuhan University, Wuhan)

Moderate deviations of additive functionals for lattice gas models

17:00-17:20 Chunhua Ma (Nankai University, Tianjin)

Some limit theorems for CBI processes

17:20-17:40 Xin Chen (Shanghai Jiao Tong University, Shanghai)

Ultracontractivity of symmetric jump processes on unbounded open sets

17:40-18:00 Yong Jiao (Central South University, Changsha)

Classical and noncommutative martingale inequalities

July 15

Chairman: Fuqing GAO

08:30-09:00 Quansheng Liu (Université de Bretagne -Sud, France)

Cramé's large deviation expansion for a supercritical branching process in a random environment

09:00-09:30 Xian-Yuan Wu (Capital Normal University, Beijing)

On the waiting time for a non-Markovian M/M/1 queueing system

09:30-10:00 Yuanyuan Liu (Central South University, Changsha)

Singular perturbation analysis for countable Markov chains

Chairman: Feng-Yu WANG

10:30-11:00 Tiefeng Jiang (University of Minnesota, USA)

Determinants of correlation matrices with applications

11:00-11:30 Shui Feng (McMaster University, Canada)

Large deviations for the Pitman-Yor process

11:30-12:00 Jianhai Bao (Central South University, Changsha)

Convergence of Euler-Maruyama scheme for SDEs with irregular coefficients

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July 16

Chairman: Chii-Ruey HWANG

08:30-09:00 Aihua Xia (The University of Melbourne, Australia)

A dichotomy for CLT in total variation

09:00-09:30 Chenggui Yuan (Swansea University, UK)

Some properties of neutral stochastic functional differential equations

09:30-10:00 Hui Jiang (Nanjing University of Aeronautics and Astronautics, Nanjing)

Moderate deviations for the Grenander estimator near the boundaries of the support

Chairman: Aihua XIA

10:30-11:00 Zhao Dong (Chinese Academy of Sciences, Beijing)

Stationary measures for stochastic Lotka-Volterra systems with spplication to turbulent convection

11:00-11:20 Longjie Xie (Jiangsu Normal University, Xuzhou)

Singular stochastic differential equations driven by Markov processes

11:20-11:40 Lu-Jing Huang (Beijing Normal University, Beijing)

On some mixing times for non-reversible finite Markov chains

11:40-12:00 Wei Mao (Jiangsu Second Normal University, Nanjing)

On the asymptotic stability and numerical analysis of solutions to s-tochastic differential equations with jumps

Chairman: Litan YAN

14:30-15:00 Geroge Yin (Wayne State University, USA)

Stochastic SIR models

15:00-15:30 Xianping Guo (Sun Yat-Sen University, Guangzhou))

The average value-at-risk criterion for finite horizon semi-Markov decision processes

15:30-16:00 Jinghai Shao (Beijing Normal University, Beijing)

Stabilization of regime-switching processes by feedback control based on discrete time observations

Chairman: Geroge YIN

16:30-17:00 Lung-Chi Chen (National Chengchi University, Taibei)

Asymptotic behavior for a generalized Domany-Kinzel model

17:00-17:20 Bo Wu (Fudan University, Shanghai)

Pointwise characterizations of curvature and second fundamental form on Riemannian manifolds

17:20-17:40 Xiaobin Sun (Jiangsu Normal University, Xuzhou)

Gaussian estimates of the density of systems of non-linear stochastic heat equations

17:40-18:00 Xu Yang (Beifang University of Nationalities, Yinchuan)

Maximum likelihood estimator for discretely observed CIR model with small α-stable noises

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July 17

Chairman: Xia CHEN

08:30-09:00 Shinichi Kotani (KwanseiGakuin University and Osaka University, Japan)

Level statistics of eigenvalues for 1D random Schrödinger operators

09:00-09:30 Dayue Chen (Peking University, Beijing))

The contact process on the regular tree with random vertex weights

09:30-10:00 Junping Li(Central South University, Changsha)

Decay property of stopped Markovian bulk-arriving queues with c-servers

Chairman: Tiefeng JIANG

10:30-11:00 Xia Chen (University of Tennessee, USA)

Spatial asymptotics for the parabolic Anderson models with generalized time-space Gaussian noise

11:00-11:30 Litan Yan (Donghua University, Shanghai)

Quadratic covariations for the solution to a stochastic heat equation

11:30-12:00 Jiang-Lun Wu (Swansea University, UK)

On stochastic scalar conservation laws with boundary conditions

Convergence of Euler-Maruyama Scheme for SDEs with Irregular Coefficients

Jianhai BAO *School of Mathematics and Statistics, Central South University, China*, E-mail: jianhaibao13@gmail.com
Xing Huang *School of Mathematical Sciences, Beijing Normal University, China*
Chenggui Yuan *Department of Mathematics, Swansea University, UK*

Key words: Convergence rate, Euler-Maruyama scheme, irregular coefficient, Zvonkin transformation

Mathematical Subject Classification: 60H35, 41A25, 60C30

Abstract: In this talk, we consider the Euler-Maruyama approximation for SDEs with irregular coefficients. This talk contains three parts. More precisely, the first part is concerned with convergence of Euler-Maruyama scheme for SDEs with bounded Dini-Continuous drift, the second part is devoted to convergence of Euler-Maruyama scheme for SDEs with unbounded Dini-Continuous drift, and the last part focuses on the issue for SDEs in Hilbert space with multiplicative noises and Dini continuous drifts.

References

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The Contact Process on the Regular Tree with Random Vertex Weights

Dayue CHEN *Peking University, China*, E-mail: dayue@pku.edu.cn

Abstract: In this paper, we are concerned with contact process with random vertex weights on regular trees, and study the asymptotic behavior of the critical infection rate as the degree of the trees increasing to infinity. In this model, the infection propagates through the edge connecting vertices x and y at rate $\lambda\rho(x)\rho(y)$ for some $\lambda > 0$, where $\{\rho(x), x \in T^d\}$ are *i.i.d.* vertex weights. We show that when d is large enough there is a phase transition at $\lambda_c(d) \in (0, \infty)$ such that for $\lambda < \lambda_c(d)$ the contact process dies out, and for $\lambda > \lambda_c(d)$ the contact process survives with a positive probability. Moreover, we also show that there is another phase transition at $\lambda_e(d)$ such that for $\lambda < \lambda_e(d)$ the contact process dies out at an exponential rate. Finally, we show that these two critical values have the same asymptotic behavior as d increases. This is a joint work with Yu Pan and Xiaofeng Xue.

The L^2-Cutoff for Reversible Markov Chains

Guan-Yu CHEN *National Chiao Tung University, Taiwan*,
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Jui-Ming Hsu *National Chiao Tung University, Taiwan*
Yuan-Chung Sheu *National Chiao Tung University, Taiwan*

Key words: Reversible Markov chains, cutoff phenomenon

Mathematical Subject Classification: 60J10, 60J27

Abstract: In this talk, we consider reversible Markov chains of which L^2-distance can be expressed as a Laplace transform. The cutoff of Laplace transformations was first discussed by Chen and Saloff-Coste in [2], while we introduce a different viewpoint here that reveals more intrinsic structures of cutoffs. For an illustration of our method, we consider the product chains and derive equivalent conditions of their cutoffs.

References

[1] G.-Y. Chen and L. Saloff-Coste (2008). The cutoff phenomenon for ergodic markov processes, *Electron. J. Probab.*, **13**, 26–78.

[2] G.-Y. Chen and L. Saloff-Coste (2010). The L^2-cutoff for reversible Markov processes, *J. Funct. Anal.*, **258**(7), 2246–2315.

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Asymptotic Behavior for a Generalized Domany-Kinzel Model

Lung-Chi CHEN *Department of Mathematical Sciences, National Chengchi University, Taiwan*, E-mail: lcchen@nccu.edu.tw

Abstract: We consider a generalized Domany-Kinzel model such that vertical edges are directed upward with probability p_1 and p_2 in alternate rows, and horizontal edges are directed rightward with probabilities one. Let $\tau(M, N)$ be the probability that there is at least one connected-directed path of occupied edges from $(0, 0)$ to (M, N). In this talk I present that for each $p_1 \in [0, 1]$, $p_2 \in [0, 1]$, but $p_1 \vee p_2 > 0$, $p_1 \wedge p_2 < 1$ and aspect ratio $\alpha = M/N$ fixed for the square lattice, there is an $\alpha_c = (2 - p_1 - p_2)/(p_1 + p_2)$ such that as $N \to \infty$, $\tau(M, N)$ is 1, 0 and 1/2 for $\alpha > \alpha_c$, $\alpha < \alpha_c$ and $\alpha = \alpha_c$, respectively. Moreover, I also present the rate of convergence of $\tau(M, N)$ and the asymptotic behavior of $\tau(M_N^-, N)$ and $\tau(M_N^+, N)$ where $M_N^-/N \uparrow \alpha_c$ and $M_N^+/N \downarrow \alpha_c$ as $N \uparrow \infty$. This is a joint work with Shu-Chiuan Chang and Chien-Hao Huang.

On the Optimal Transition Rate Matrix of Markov Process

Ting-Li CHEN *Institute of Statistical Science, Academia Sinica, Taiwan*,
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Key words: Markov process, transition rate matrix, asymptotic variances

Mathematical Subject Classification: 60J27

Abstract: Asymptotic variance has been a commonly used criterion to evaluate the performance of Markov chain Monte Carlo (MCMC). Many researches are devoted to comparison and improvement of MCMC algorithms with respect to asymptotic variance. The asymptotic variance depends on the statistics to estimate. For the average-case analysis, Chen et al. (2012) obtained the asymptotic variance and the structure of the optimal transition matrix for discrete-time Markov chains. In this paper, we will present the result for continuous-time Markov chains. The structure of the optimal transition rate matrix for the continuous case is not the same as the optimal transition matrix for the discrete case. The asymptotic variance of the continuous Markov chain is lower.

References

[1] T.-L. Chen, W.-K. Chen, C.-R. Hwang, and H.-M. Pai (2012). On the optimal transition matrix for markov chain monte carlo sampling, *SIAM Journal on Control and Optimization*, **50**, 2743–2762.

Spatial Asymptotics for the Parabolic Anderson Models with Generalized Time-Space Gaussian Noise

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Key words: Generalized Gaussian field, white noise, fractional noise, Brownian motion, parabolic Anderson model, Feynman-Kac representation

Mathematical Subject Classification: 60J65, 60K37,60K40, 60G55, 60F10

Abstract: Partially motivated by the work by Conus el, this work is concerned with the precise spatial asymptotic behavior for the parabolic Anderson equation

$$\begin{cases} \dfrac{\partial u}{\partial t}(t,x) = \dfrac{1}{2}\Delta u(t,x) + V(t,x)u(t,x) \\ \\ u(0,x) = u_0(x) \end{cases}$$

where the homogeneous generalized Gaussian noise $V(t,x)$ is, among other forms, white or fractional white in time and space. Associated with the Cole-Hopf solution to the KPZ equation, in particular, the precise asymptotic form

$$\lim_{R\to\infty} (\log R)^{-2/3} \log \max_{|x|\le R} u(t,x) = \frac{3}{4}\sqrt[3]{\frac{2t}{3}} \quad a.s.$$

is obtained for the parabolic Anderson model $\partial_t u = \frac{1}{2}\partial^2_{xx} u + \dot{W} u$ with the $(1+1)$-white noise $\dot{W}(t,x)$.

References

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Intrinsic Ultracontractivity of Symmetric Jump Processes on Unbounded Open Sets

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Panki Kim *Department of Mathematics, Seoul National University, South Korea*,
E-mail: pkim@snu.ac.kr
Jian Wang *School of Mathematics and Computer Science, Fujian Normal University, China*,
E-mail: jianwang@fjnu.edu.cn

Key words: Symmetric jump process, Dirichlet form, intrinsic ultracontractivity, intrinsic super Poincaré inequality

Mathematical Subject Classification: 60G51, 60G52, 60J25, 60J75

Abstract: We will study some criterions of the intrinsic ultracontractivity for a large class of symmetric jump process killed on exiting an unbounded open set, including the stable process and truncated stable process killed on exiting a horn-shaped region. We will provide some examples to show that our criterions are sharp in some sense, and for the horn-shape region, a two-side estimate for the associated ground state will also be given. The talk is based on a joint work with Panki Kim and Jian Wang.

On Nash Bargaining Games

Yunshyong CHOW *Institute of Mathematics, Academia Sinica, Taiwan*,
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Key words: Bargaining games, 2-person cooperative games

Mathematical Subject Classification: 91A12

Abstract: Besides his well-known result on non-cooperative games in Annals of Math. 54 (1951), Nash had done some works on cooperative games as well. The main purpose of this talk is to introduce his bargaining models for 2 person cooperative games published in Econometrica 18 (1950).

References

[1] E.N. Barron (2013). Game Theory, 2nd ed., Wiley.

[2] A.J. Jones (2000). Game Theory: Mathematical Models of Conflict, Woodhead Publishing Limited, Cambridge.

Stationary Measures for Stochastic Lotka-Volterra Systems with Application to Turbulent Convection

Zhao DONG *Institute of Applied Mathematics, Academy of Mathematics and Systems Sciences, Chinese Academy of Sciences, China*, E-mail: dzhao@amt.ac.cn

Abstract: In this talk I will give some ergodicity and nonergodicity for a class of stochastic Lotka-Volterra systems as the noise intensity vanishes. The nonergodicity case can be illustrated the turbulent characteristics. It is a phenomenon that the turbulence in a fluid layer heated from below and rotating about a vertical axis is robust under stochastic disturbances. This is a joint work with Lifeng Chen, Jifa Jiang, Lei Niu and Jianliang Zhai.

Large Deviations for the Pitman-Yor Process

Shui FENG *McMaster University, Canada*, E-mail: shuifeng@mcmaster.ca

Abstract: The Pitman-Yor process is a random measure depending on a gamma parameter and a stable parameter. In the context of random energy models, the stable parameter is the ratio between the subcritical temperature and the critical temperature. In this talk we will present the large deviation principle for the Pitman-Yor process when the temperature approaches the critical value from below. The rate function obtained describes the instantaneous cooling effect. This is a joint work with Fuqing Gao and Youzhou Zhou.

References

[1] S. Feng, F.Q. Gao & Y.Z. Zhou (2016). Limit theorems associated with the Pitman-Yor process. *preprint.*

Moderate Deviations of Additive Functionals for Lattice Gas Models

Fuqing GAO *School of Mathematics and Statistics, Wuhan University, China*, E-mail: fqgao@whu.edu.cn

Key words: Additive functional, exclusion process, lattice gas model, moderate deviation

Mathematical Subject Classification: 60K35, 60F10

Abstract: We present moderate deviation principles of some additive functionals for lattice gas models. Our method is based on local average technique which is developed in hydrodynamic limits. As an intermediate result, we obtain a moderate deviation principle for the empirical density. Then using the moderate deviation principle and an approximation method, we establish moderate deviation principles for local functions.

References

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The Average Value-at-Risk Criterion for Finite Horizon Semi-Markov Decision Processes

Xianping GUO *Sun Yat-Sen University, China*, E-mail: mcsgxp@mail.sysu.edu.cn
Yonghui Huang *Sun Yat-Sen University, China*

Key words: Semi-Markov decision processes, finite horizon cost, average value-at-risk, algorithm, optimal policy

Mathematical Subject Classification: 90C40, 93E20

Abstract: In this talk, we introduce the average value-at-risk (AVaR) criterion for finite horizon semi-Markov decision processes (SMDPs). Via an alternative representation of AVaR, we reduce the problem of minimizing the AVaR of the finite horizon cost to two sub-problems: one is to minimize the expected-positive-deviation of the finite horizon costs from some level over policies, which itself is a new and interesting problem in the finite horizon SMDP setting; the second is an ordinary problem of minimizing a function of a single variable. For the first sub-problem, we will show that the value function is a minimum solution to the optimality equation (OE), and an optimal policy exists under suitable conditions. Furthermore, we will show that the value function is the unique solution to the OE under additional conditions. Based on the solution of the first sub-problem, the existence and computation of an AVaR optimal policy are established by solving the second sub-problem. To facilitate practical implementation of our results, we derive a value iteration algorithm and a policy improvement algorithm for computing an AVaR optimal policy. We perform complexity analysis of the value iteration algorithm, and discuss Monte Carlo simulation as a method of minimizing AVaR for a finite horizon SMDP. To

demonstrate our results, two examples about a maintenance system and a cash-flow system are provided.

References

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Regularity and Strict Positivity of Densities for Stochastic Fractional Heat Equation

Le Chen *University of Kansas, USA*
Yaozhong HU *University of Kansas, USA*, E-mail: yhu@ku.edu
David Nualart *University of Kansas, USA*

Abstract: In this paper, by using Malliavin calculus, we prove that the solution to a semilinear stochastic (fractional) heat equation with measure-valued initial data has a smooth joint density at multiple points. This is achieved by proving that the solutions to a related stochastic partial different equation have negative moments of all orders. We also prove that the density is strictly positive in the interior of the support of the law, where we allow both measure-valued initial data and unbounded diffusion coefficient. One aim of this study is to cover the *parabolic Anderson model.*

References

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On the Minimum of a Branching Random Walk

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Key words: Branching random walk, minimum, boundary case, law of the iterated logarithm

Mathematical Subject Classification: 60J80, 60F15

Abstract: Consider a branching random walk on the real line and denote by $\mathcal{M}_n$ its minimal position in the n-th generation. It is known that in the boundary case, $\mathcal{M}_n - \frac{3}{2}\log n$ is tight (see Addario-Berry and Reed (2009), Bramson and Zeitouni (2009), Aïdékon (2013)). We study here the almost sure limits of $\mathcal{M}_n$ and present here two laws of the iterated logarithm to describe the upper and lower limits, in particular this gives a positive answer to a question in Aïdékon and Shi (2014). We also study the problem of moderate deviations of $\mathcal{M}_n$ which is closely related to the small deviations of a class of Mandelbrot's cascades.

Hunt's Hypothesis (H) and Getoor's Conjuecture

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Key words: Hunt's hypothesis (H), Getoor's conjecture, Lévy process, subordinator

Mathematical Subject Classification: 60J45, 60G51

Abstract: This talk discusses Hunts hypothesis (H) for Lévy processes and contains five parts. Firstly, I will talk about the background on Hunt's hypothesis (H). Secondly, I will recall the meaning of Hunts hypothesis (H) and its importance. Thirdly, I will introduce Getoors conjecture and the existing results. Fourthly, I will present our results. Finally, I will mention some problems. The talk is based on joints works with Wei Sun and Jing Zhang.

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On the Nash Equilibrium of an Evolving Random Network

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Abstract: It is known that somebody's behavior (decision) in a social network may be influenced by that of his (or her) friends. In this talk, we will discuss on two game models on evolving random network, which can be defined respectively by two different utility functions. Some sufficient conditions for the existence of Nash equilibrium (NE) in the two network game models are obtained by analyzing the different effort relation between a player and his (or her) neighbors.

On Some Mixing Times for Non-reversible Finite Markov Chains

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Yong-Hua Mao *School of Mathematical Sciences, Beijing Normal University, China*

Abstract: By adding a vorticity matrix to the reversible transition probability matrix, we show that the commute time and average hitting time are smaller than that of the original reversible one. In particular, we give an affirmative answer to a conjecture of Aldous and Fill. Further quantitive properties are also studied for the non-reversible finite Markov chains.

Moderate Deviations for the Grenander Estimator near the Boundaries of the Support

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KEY WORDS: Empirical process, Grenander estimator, large deviations, moderate deviations, strong approximation

MATHEMATICAL SUBJECT CLASSIFICATION: 60H10, 62G20, 62F12

Abstract: We investigate the asymptotic behavior of the nonparametric maximum likelihood estimator $\hat{f}_n$ for a decreasing density f near the boundaries of the support of f. Using strong approximate and small ball estimates, a moderate deviation with explicit rate function for $\hat{f}_n$ is established.

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Determinants of Correlation Matrices with Applications

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Abstract: Let M_n be the sample correlation matrix associated with a random sample from a p-dimensional normal distribution with correlation matrix R_n. Assume the sample size is n. The sample correlation matrix is a popular object in statistics and has many connections with mathematical and physical problems. We show that the logarithm of M_n satisfies the central limit theorem if the smallest eigenvalue of R_n is larger than $1/2$ and that n and p are comparable. The result is applied to a problem in high-dimensional statistics. In addition, some new tools will be introduced.

Classical and Noncommutative Martingale Inequalities

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KEY WORDS: Martingales, Burkholder-Gundy-Davis inequalities, Carleson measures, noncommutative martingales

Abstract: In this talk, we discuss some classical martingale inequalities and the corresponding noncommutative martingale inequalities. In particular, we present some new advances on the Burkholder-Gundy inequalities in noncommutative symmetric operator spaces.

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Level Statistics of Eigenvalues for 1D Random Schrödinger Operators

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Key words: Schrödinger operator, eigenvalue, level statistics

Mathematical Subject Classification: 82B44, 60B20

Abstract: We consider the limit distributions of level statistics for eigenvalues of 1D Schrödinger operators with random decaying potentials restricted on finite intervals when the intervals expand to the whole space. The results change according as the decaying order of the potentials change.

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Decay Property of Stopped Markovian Bulk-Arriving Queues with c-Servers

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Lina Zhang *Xiangtan University, China*

Key words: Markovian bulk-arriving queues, decay parameter, invariant measure

Mathematical Subject Classification: Primary 60J27; Secondary 60J35

Abstract: This talk concentrates on investigating decay properties of Markovian bulk-arriving queues with c-servers which stop immediately after hitting the state zero. The exact value of the decay parameter λ_C for the case $B_c'(1) > 0$ is firstly given. Then by using the generating functions of the corresponding q-matrix, a test function $F_\lambda(s)$ is constructed. The exact value of the decay parameter λ_C for the case $B_c'(1) \leq 0$ is then obtained according to the sign of $F_{\bar{\lambda}}(\bar{s})$.

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On the Stochastic Approach to the Navier-Stokes Equation

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Abstract: In 1966, V. I. Arnold proved that the incompressible Euler equation is the geodesic equation on the group of volume preserving diffeomorphisms. In this talk I will first review some known results on the stochastic characterization of the incompressible Navier-Stokes equation. Then I will present a new stochastic approach to derive the incompressible Navier-Stokes

equation via the stochastic dynamic program principle over the group of volume preserving diffeomorphisms. Joint work with Songzi Li and Guoping Liu.

Cramé's Large Deviation Expansion for a Supercritical Branching Process in a Random Environment

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Key words: Branching processes, random environment, harmonic moments, Stein's method, Berry-Esseen bound, Cramér's change of probability

Mathematical Subject Classification: Primary 60F17, 60J05, 60J10; Secondary 37C30

Abstract: Let (Z_n) be a supercritical branching process in an independent and identically distributed random environment. We show Cramér's large deviation expansion for $(\log Z_n)$. In the proof we establish a Berry-Esseen theorem on the rate of convergence in the central limit theorem for $(\log Z_n)$, improve an earlier result about the harmonic moments of the limit variable of the naturally normalized population size, and use in an adapted way Cramér's change of probability for the associated random walk. (The talk is based on the reference below.)

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Singular Perturbation Analysis for Countable Markov Chains

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Key words: Markov chains, queues, perturbation analysis, stationary distribution

Mathematical Subject Classification: 60J10, 60J27, 60J22

Abstract: In this talk, I will present our recent results on singular perturbation analysis for discrete-time or continuous-time Markov chains. We extend the drift condition method, well known for regular perturbation, to develop a new framework for singular perturbation analysis. Our results extend and improve the corresponding ones in Altman etal (2004) for singularly perturbed Markov chains by allowing a general perturbation form, less restrictive conditions, and more computable bounds. Our analysis covers the regular perturbation analysis, and hence unifies singular and regular perturbation analysis. Furthermore, our results are illustrated by two two-dimensional Markov chains, including a discrete-time queue and a continuous-time level dependent quasi-birth-death process.

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Lyapunov Exponents and Chaotic Behavior for Random Dynamical Systems in a Banach Space

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Abstract: We study the Lyapunov exponents and their associated invariant subspaces for infinite dimensional random dynamical systems in a Banach space, which are generated by, for example, stochastic or random partial differential equations. We prove a multiplicative ergodic theorem. We also prove that for an infinite dimensional random dynamical system with a random invariant set such as random attractor, if its topological entropy is positive, then the dynamics on the random invariant set is chaotic. This is based on joint works with Wen Huang and Zeng Lian.

The Itô SDEs and Fokker–Planck Equations with Osgood and Sobolev Coefficients

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KEY WORDS: Stochastic differential equation, Osgood and Sobolev condition, DiPerna–Lions theory, Fokker–Planck equation, stochastic flow

MATHEMATICAL SUBJECT CLASSIFICATION: 60H10, 35Q84

Abstract: We study the degenerated Itô SDE whose drift coefficient only fulfills a mixed Osgood and Sobolev regularity. Under suitable assumptions on the gradient of the diffusion coefficient and on the divergence of the drift coefficient, we prove the existence and uniqueness of generalized stochastic flows associated to such equations. We also prove the uniqueness of solutions to the corresponding Fokker–Planck equation by using the probabilistic method.

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Some Limit Theorems for CBI Processes

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Abstract: We prove some limit theorems for continuous time and state branching processes with immigration (CBI processes). The results in law are obtained by studying the Laplace exponent and the almost-sure ones by exploiting a martingale. As an application, we also consider the coupling for the CB processes.

On the Asymptotic Stability and Numerical Analysis of Solutions to Stochastic Differential Equations with Jumps

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Abstract: This talk concerns the stability and numerical analysis of solution to highly nonlinear stochastic differential equations with jumps (SDEwJs). The classical linear growth condition is replaced by polynomial growth conditions, under which there exists a unique global solution and the solution is asymptotic stable in the pth moment and almost sure exponential stable. In addition, we study the Euler-Maruyama approximate solutions of SDEwJs. By applying some useful lemmas, we establish a new criterion on the convergence in probability of the Euler-Maruyama approximate solutions.

Williams Decomposotion for Superprocesses

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Key words: Superprocess, Williams' decomposition

Mathematical Subject Classification: 60J80, 60E10

Abstract: We are interested in a spinal decomposition for superprocesses involving the ancestral lineage of the last individual alive (Williams' decomposition).

For superprocesses with homogeneous branching mechanism, the spatial motion is independent of the genealogical structure. As a consequence, the law of the ancestral lineage of the last individual alive does not distinguish from the original motion. Therefore, in this setting, the description of $X^{(h_0)}$ may be deduced from Abraham and Delmas (2009) where no spatial motion is taken into account.

For nonhomogeneous branching mechanisms on the contrary, the law of the ancestral lineage of the last individual alive should depend on the distance to the extinction time h_0. Using the Brownian snake, Delmas and Hénard (2013) provide a description of the genealogy for superprocesses with the following non-homogeneous branching mechanism

$$\psi(x, z) = a(x)z + \beta(x)z^2$$

with the functions a and β satisfying some conditions.

We would like to find conditions such that the Williams' decomposition works for superprocesses with general non-homogeneous branching mechanisms. The conditions should be easy to check and satisfied by a lot of superpossess. The talk is based on a working paper with Renming Song and Rui Zhang.

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Stabilization of Regime-Switching Processes by Feedback Control Based on Discrete Time Observations

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Abstract: This work aims to extend X.R. Mao's work (Automatica 2013) on stabilization of hybrid stochastic differential equations by discrete-time feedback control. In X.R. Mao's work, the feedback control depends on discrete-time observation of the state process but on continuous time observation of the switching process. While, in this work, we study the feedback control depending on discrete-time observations of the state process and the switching process. Our criteria depend explicitly on the regular conditions of the coefficients of stochastic differential equations and on the stationary distribution of the switching process. The sharpness of our criteria is shown through studying the stability of linear systems, which also shows explicitly that the stability of hybrid stochastic differential equations depends essentially on the long time behavior of the switching process.

Dissipation in Parabolic SPDEs

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Key words: Dissapation, PAM, SHE

Mathematical Subject Classification: 60H15

Abstract: We consider the following stochastic heat equation (SHE)

$$\frac{\partial}{\partial t}u(t,x) = \triangle u(t,x) + \lambda\sigma(u(t,x))\frac{\partial^2}{\partial t \partial x}\xi(t,x), \quad x \in [-1,1]$$

with the periodic boundary condition and the initial data is a constant. Kim and Khoshnevisan [2] and Foondun and Joseph [1] proved that the second moment of the solution $u(t,x)$ grows like $\exp(\lambda^4 t)$ as λ goes to ∞. However, we [3] can show that $\sup_{x\in[0,1]} u(t,x)$ converges to 0 in probability as λ goes to ∞. When λ is fixed, we show that $\sup_{x\in[-1,1]} u(t,x)$ converges to 0 a.s. when t goes to ∞. All together really says the solution is really intermittent. This is joint work with Kunwoo Kim, Davar Khoshnevisan and Carl Meuller.

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Heat Kernels of Non-Symmetric Jump Processes: beyond the Stable Case

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Key words: Heat kernel estimates, subordinate Brownian motion, symmetric Lévy process, non-symmetric operator, non-symmetric Markov process

Mathematical Subject Classification: 60J35, 60J75

Abstract: Let J be the Lévy density of a symmetric Lévy process in $\mathbf{R^d}$ with its Lévy exponent satisfying a weak lower scaling condition at infinity. Consider the non-symmetric and non-local operator

$$\mathcal{L}^{\kappa} f(x) := \lim_{\epsilon \downarrow 0} \int_{\{z \in \mathbf{R^d} : |\mathbf{z}| > \epsilon\}} (f(x+z) - f(z)) \kappa(x,z) J(z) \, dz \,,$$

where $\kappa(x,z)$ is a Borel measurable function on $\mathbf{R^d} \times \mathbf{R^d}$ satisfying $0 < \kappa_0 \leq \kappa(x,z) \leq \kappa_1$, $\kappa(x,z) = \kappa(x,-z)$ and $|\kappa(x,z) - \kappa(y,z)| \leq \kappa_2 |x-y|^{\beta}$ for some $\beta \in (0,1)$. We construct the heat kernel $p^{\kappa}(t,x,y)$ of $\mathcal{L}^{\kappa}$, establish its upper bound as well as its fractional derivative and gradient estimates. Under an additional weak upper scaling condition at infinity, we also establish a lower bound for the heat kernel p^{κ}.

Gaussian Estimates of the Density of Systems of Non-Linear Stochastic Heat Equations

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Abstract: In this talk, we consider a system of non-linear stochastic heat equations on R^d driven by a Gaussian noise which is white in time and has a homogeneous spatial covariance. This system has been proved that the solution has smooth joint density under some suitable regularity and non degeneracy conditions by E. Nualart (2013). The purpose of this paper is to study the lower and upper bounds of the density. The main tool is Malliavin calculus. This is a joint work with Yinghui Shi.

Pointwise Characterizations of Curvature and Second Fundamental Form on Riemannian Manifolds

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Key words: Curvature, second fundamental form, diffusion process, path space

Mathematical Subject Classification: 60H07

Abstract: Let M be a complete Riemannian manifold possibly with a boundary M. For any C^1-vector field Z, by using gradient/functional inequalities of the (reflecting) diffusion process generated by $L := \Delta + Z$, pointwise characterizations are presented for the Bakry-Emery curvature of L and the second fundamental form of M if exists. These extend and strengthen the recent results derived by A. Naber for the uniform norm $\|\mathbf{Ric}_Z\|_{\infty}$ on manifolds without boundary. A key point of the present study is to apply the asymptotic formulas for these two tensors found by the first named author, such that the proofs are significantly simplified. This is a joint work with Professor Fengyu Wang.

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On Stochastic Scalar Conservation Laws with Boundary Conditions

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KEY WORDS: Scalar conservation law, renormalized entropy solutions, Itô's formula, L^1-theory

MATHEMATICAL SUBJECT CLASSIFICATION: 60H15, 60H40

Abstract: In this talk we will review recent results for stochastic scalar conservation laws on bounded domains. We start with the well-posedness theory for stochastic scalar conservation laws with boundary conditions. We then discuss various type of solutions to the boundary value problems. Finally, we will give a positive answer to an open problem posed by Bauzet, Vallet and Wittbold in "The Dirichlet problem for a conservation law with a multiplicative stochastic perturbation", J. Funct. Anal. 266 (2014) 2503-2545. The talk is based on joint work with Guangying Lv (Henan University, China).

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On the Waiting Time for a Non-Markovian M/M/1 Queueing System

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MATHEMATICAL SUBJECT CLASSIFICATION: Primary 60K25, 60F05; Secondary 93A30

Abstract: This paper focuses on the problem of modeling the correspondence pattern for ordinary people. We consider a M/M/1 queueing system with the following service discipline: for some constant T, a customer leaves the queue when his waiting time exceeds T, and the

remains are served on the *last in first out* principle. Let W_n be the waiting time of the n-th served customer. It is proved that W_n converges in distribution as $n \to \infty$, furthermore, the explicit expression of the limit distribution is obtained.

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On the Martingale Problem and Feller and Strong Feller Properties for Weakly Coupled Lévy Type Operators

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KEY WORDS: Weakly coupled Lévy type operator, martingale problem, Feller property, strong Feller property, coupling method

MATHEMATICAL SUBJECT CLASSIFICATION: 60J25, 60J27, 60J60, 60J75

Abstract: This work considers the martingale problem for a class of weakly coupled Lévy type operators. It is shown that under some mild conditions, the martingale problem is well-posed and therefore uniquely determines a strong Markov process (X, Λ). The process (X, Λ), called a regime-switching jump diffusion with Lévy type jumps, is further shown to posses Feller and strong Feller properties via the coupling method.

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A Dichotomy for CLT in Total Variation

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Key words: Total variation distance, non-singular distribution, Berry-Esseen bound, Stein's method

Mathematical Subject Classification: Primary 60F05; Secondary 62E17, 62E20

Abstract: Let η_i, $i \geq 1$, be a sequence of independent and identically distributed random variables with finite third moment, and let Δ_n be the total variation distance between the distribution of $S_n := \sum_{i=1}^{n} \eta_i$ and the normal distribution with the same mean and variance. We establish the dichotomy that either $\Delta_n = 1$ for all n or $\Delta_n = O\left(n^{-1/2}\right)$.

Singular Stochastic Differential Equations Driven by Markov Processes

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Abstract: We prove the pathwise uniqueness for strong solutions of singular stochastic differential equation driven by a family of Markov process, whose generator is a non-local and non-symmetric Lévy type operator of the form

$$\mathcal{L}\varphi(x) = \int_{\mathbf{R}^d} \left[\varphi(x+z) - \varphi(x) - 1_{\{|z|\le 1\}} z \cdot \nabla\varphi(x)\right] \sigma(x,z)\nu(\mathrm{d}\, z) + b(x) \cdot \nabla\varphi(x), \quad \forall \varphi \in C_0^\infty(\mathbf{R}^d).$$

Optimal Control under Partial Information: A Brief Introduction

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KEY WORDS: Optimal control, partial information, stochastic maximum principle

MATHEMATICAL SUBJECT CLASSIFICATION: 93E11

Abstract: In this talk, we will first present a couple of examples from mathematical finance which call for the combined study of stochastic filtering and control. We will survey some methods for the decoupling of the two problems and the solutions to each of them.

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Quadratic Covariations for the Solution to a Stochastic Heat Equation

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Abstract: Let $u(t,x)$ be the solution to a stochastic heat equation

$$\frac{\partial}{\partial t} u = \alpha \frac{\partial^2}{\partial x^2} u + \frac{\partial^2}{\partial t \partial x} X(t,x), \quad t \ge 0, x \in \mathbb{R}$$

with initial condition $u(0,x) \equiv 0$, where X is a time-space white noise. In this paper, we study the generalized quadratic variations of the solution u, and by using the generalized quadratic variations we give two asymptotic unbiased estimators of α and introduce their asymptotic normality.

Maximum Likelihood Estimator for Discretely Observed CIR Model with Small α-Stable Noises

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Abstract: The maximum likelihood estimation of the drift and volatility coefficient parameters in the CIR type model driven by α-stable noises is studied when the dispersion parameter $\varepsilon \to 0$ and the discrete observations frequency $n \to \infty$ simultaneously. The joint density of the sample is approximated by using the stable distributions.

Stochastic SIR Models

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Key words: SIR model, extinction, permanence, ergodicity

Mathematical Subject Classification: 34C12, 60H10, 92D25

Abstract: We present a joint work with Dieu, Nguyen, and Du on a stochastic SIR epidemic model represented by a system of stochastic differential equations with a degenerate diffusion. We focus on asymptotic behavior of the system, provide sufficient conditions that are very close to necessary for the permanence, and develop ergodicity of the underlying system. It is proved that the transition probabilities converge in total variation norm to the invariant measure. Rates of convergence are also ascertained.

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Some Properties of Neutral Stochastic Functional Differential Equations

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Key words: existence and uniqueness, EM numerical solutions, convergence rate, large deviation

Mathematical Subject Classification: 60H10, 60F10

Abstract: In this talk, I will present some properties of neutral stochastic functional differential

equations (NSFDEs), which include the existence and uniqueness, the EM-numerical solution, convergence rate of numerical solutions, and large deviation of NSFDEs.

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Quasi-Stationary Distributions and Their Applications

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Key words: Birth and death process, domain of attraction, quasi-stationary distribution

Mathematical Subject Classification: 60J27 , 60J80

Abstract: Let us begin with the talk by recalling the key three questions of quasi-stationary distributions (QSDs); and then we shall talk about many new progresses on above the key three questions of QSDs; and also talk about some open problems on QSDs. Finally we shall discuss the applications of QSDs.

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The Seneta-Heyde Scaling for Stable Branching Random Walk

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Abstract: We consider a discrete-time branching random walk in the bound case, where the associated one-dimensional random walk is stable. We prove the derivative martingale D_n converges to a non trivial limit D_∞ under certain moment conditions. Moreover, we study the additive martingale W_n and prove that $n^{\frac{1}{\alpha}} W_n$ converges in probability, but not almost surely, to cD_∞. This is a joint work with Hui He and Jingning Liu.

Stochastic Hamiltonian Flows with Singular Coefficients

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Key words: Stochastic Hamiltonian system, weak differentiability, Krylov's estimate, Zvonkin's transformation, Kinetic Fokker-Planck operator

Mathematical Subject Classification: 60H10

Abstract: In this work we study the following stochastic Hamiltonian system in R^{2d} (a second order stochastic differential equation),

$$d\dot{X}_t = b(X_t, \dot{X}_t)dt + \sigma(X_t, \dot{X}_t)dW_t, \quad (X_0, \dot{X}_0) = (x, v) \in R^{2d},$$

where $b(x, v) : R^{2d} \to R^d$ and $\sigma(x, v) : R^{2d} \to R^d \otimes R^d$ are two Borel measurable functions. We show that if σ is bounded and uniformly non-degenerate, and $b \in H_p^{2/3,0}$ and $\nabla\sigma \in L^p$ for some $p > 2(2d + 1)$, where $H_p^{\alpha,\beta}$ is the Bessel potential space with differentiability indices α in x and β in v, then the above stochastic equation admits a unique strong solution so that $(x, v) \mapsto Z_t(x, v) := (X_t, \dot{X}_t)(x, v)$ forms a stochastic homeomorphism flow, and $(x, v) \mapsto Z_t(x, v)$ is weakly differentiable with $\text{ess.sup}_{x,v}\, E\left(\sup_{t\in[0,T]} |\nabla Z_t(x, v)|^q\right) < \infty$ for all $q \geq 1$ and $T \geq 0$. Moreover, we also show the uniqueness of probability measure-valued solutions for kinetic Fokker-Planck equations with rough coefficients by showing the well-posedness of the associated martingale problem and using the superposition principle established by Figalli [3] and Trevisan [5].

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A Continuous State Branching Process with Population Dependent Branching Rates

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KEY WORDS: stochastic differential equation, continuous state branching process

Abstract: Consider the following stochastic differential equation

$$X_t = \sigma \int_0^t \sqrt{\gamma_1(X_{s-})} dB_s + \int_0^t \int_0^\infty \int_0^{\gamma_2(X_{s-})} x\tilde{N}(ds, dx, du),$$

where $\tilde{N}(ds, dz, du)$ is a compensated Poisson random measure on $[0,\infty)\times(0,\infty)\times[0,\infty)$ with compensator $ds\pi(dz)du$ such that $\int_0^\infty z \wedge z^2\pi(dz) < \infty$ and B is an independent Brownian motion. Such a process X can be treated as a critical continues state branching process with branching rates depending on the population size. We find conditions on functions γ_1 and γ_2 under which the process X hits 0 with probability one or stays positive with probability one, respectively. It generalizes a result in [1].

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On Feller and Strong Feller Properties of Regime-Switching Jump-Diffusion Processes with Countable Regimes

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KEY WORDS: Jump-diffusion, switching, existence, uniqueness, strong Feller property

MATHEMATICAL SUBJECT CLASSIFICATION: 60J25, 60J27, 60J60, 60J75

Abstract: This work focuses on a class of regime-switching jump-diffusion processes, in which the switching component has infinitely and countably many states or regimes. The existence and uniqueness of the underlying process are obtained by an interlacing procedure. Then we use the coupling method and an appropriate Radon-Nikodym derivative to study the Feller and strong Feller properties of such processes.

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