简　　报

第三届 “Workshop on Markov Processes and Related Topics” 国际研讨会于 2004 年 8 月 10 至 14 日在北京师范大学国际学术会议交流中心召开, 共有 89 人参加此次研讨会, 其中有来自美、日、英、法、德、新加坡、香港以及内地 32 所大学和研究院所的 60 位专家, 另外还吸引了附近 8 所大学和研究院所的29位研究生前来交流学习. 会议期间，来自国内外 29 所大学和研究院所的 32 位专家分别作 45 分钟演讲, 报告各自领域的最新研究进展. 内容涉及金融数学、马氏过程、粒子系统、随机分析、测度值马氏过程等概率论及相关领域的多个分支.

在陈木法院士的主持下, 会议圆满召开, 王梓坤院士、严加安院士以及马志明院士均出席了本次会议, 其中严加安院士以及马志明院士还应邀分别作了精彩的研究报告.

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The 3rd Workshop on

MARKOV PROCESSES AND RELATED TOPICS

August 10 - 14, 2004

Center For International Academic Exchange (Room 1012A)

Beijing Normal University

Scientific Committee:

Mu-Fa Chen, Zhi-Ming Ma, Zi-Kun Wang, Jia-An Yan

Organizers:

Mu-Fa Chen, Zeng-Hu Li, Feng-Yu Wang

Supported by National Natural Science Foundation of China(10121101)

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Schedule

	August 10	August 11	August 12	August 13	August 14
Chairman	Mu-Fa Chen	I. Shigekawa	Zhi-Ming Ma	Shi-Ge Peng	Min-Ping Qian
Speaker	I. Shigekawa 8:30–9:15	Jia-An Yan 8:30–9:15	Zhen-Ting Hou 8:30–9:15	Zhi-Ming Ma 8:30–9:15	Li-Ming Wu 8:30–9:15
	Jin-Wen Chen 9:15–10:00	Shi-Zan Fang 9:15–10:00	An-Yue Chen 9:15–10:00	T.S. Zhang 9:15–10:00	Yao-Zhong Hu 9:15–10:00
	Break				
	W. Stannat 10:30–11:15	Y. Lam 10:30–11:15	Huo-Nan Lin 10:30–11:15	Jie Xiong 10:30–11:15	Xiang-Dong Li 10:30–11:15
	H.Z. Zhao 11:15–12:00	Song Liang 11:15–12:00	Feng Wang 11:15–12:00	Da-Yue Chen 11:15–12:00	Xian-Yuan Wu 11:15–12:00
Lunch					
Chairman	Jia-An Yan	Zhen-Ting Hou		J.-D. Deuschel	
Speaker	G. Grimmett 14:00–14:45	J.-D. Deuschel 14:00–14:45		Shi-Ge Peng 14:00–14:45	
	Jiang-Lun Wu 14:45–15:30	Zeng-Hu Li 14:45–15:30		S.J. Tang 14:45–15:30	
	Break				
	Y. Hariya 15:50–16:35	Yong-Hua Mao 15:50–16:35		Yi-Jun Hu 15:50–16:35	
	C.S. Wang 16:35–17:20	Y.N. Sun 16:35–17:20		Elton P. Hsu 16:35–17:20	
	Reception (18:00-19:30)				

August 10

08:30-09:15 I. Shigekawa (Kyoto University)

Schrödinger operators on the Wiener space

09:15-10:00 Jin-Wen Chen (Tsinghua University)

Mixture of large deviation systems

10:30-11:15 W. Stannat (Universität Bielefeld)

On the stability of genetic algorithms - a variational approach

11:15-12:00 H.Z, Zhao (Loughborough University)

Generalized Itô formulae using local time and applications in analysing asymptotics of heat equations in the presence of caustics

14:00-14:45 G. Grimmett (Churchill College, Cambridge)

(Non-)uniqueness of random-cluster measures

14:45-15:30 Jiang-Lun Wu (University of Wales Swansea)

Fractal Burgers equation with stable white noise

15:50-16:35 Y. Hariya (Kyoto University)

Integration by parts formulae for the Wiener measure restricted to domains in $\mathbb{R}^d$

16:35-17:20 C.S. Wang (Huazhong University of Science and Technology)

δ-Function of an Operator: A White Noise Approach

August 11

08:30-09:15 Jia-An Yan (Chinese Academy of Sciences)

Mean-Risk Portfolio Selection Models in Continuous Time

09:15-10:00 Shi-Zan Fang (University of Bourgogne)

Analysis in free Riemannian path spaces

10:30-11:15 Y. Lam (University of Hong Kong)

Geometric Process

11:15-12:00 Song Liang (Tohoku University)

A Bounded Property for Gradients of Diffusion Semigroups on Euclidean Spaces

14:00-14:45 J.-D. Deuschel (Technische Universität Berlin)

Scaling limits of equilibrium wetting models in $(1+1)$*-dimension*

14:45-15:30 Zeng-Hu Li (Beijing Normal University)

On the regularity of affine Markov processes

15:50-16:35 Yong-Hua Mao (Beijing Normal University)

Strong ergodicity: some new results

16:35-17:20 Y.N. Sun (National University of Singapore)

Independent Random Matching and Markov Chains

August 12

08:30-09:15	Zhen-Ting Hou (Central South University)
	Markov skeleton processes and their applications
09:15-10:00	An-Yue Chen (University of Greenwich)
	From Markov Branching Processes to Collision Branching Processes
10:30-11:15	Huo-Nan Lin (Fujian Normal University)
	Some Multifractal Properties and the Local Phenomenon for Occupation Measure of Transient Brownian Sheet
11:15-12:00	Feng Wang (Capital Normal University)
	Quasi-factorization of $I_\alpha(f)$ and Latała-Oleszkiewicz's inquality for Gibbs random fields
Afternoon	Break

August 13

08:30-09:15 Zhi-Ming Ma (Chinese Academy of Sciences)

Reflected alpha-stable processes

09:15-10:00 T.S. Zhang (University of Manchester)

Perturbations of symmetric Markov processes

10:30-11:15 Jie Xiong (University of Tennessee Knoxville)

Mean-variance portfolio selection under partial information

11:15-12:00 Da-Yue Chen (Peking University)

The Reversible Nearest Particle System on a Finite Set

14:00-14:45 Shi-Ge Peng (Shandong University)

Filtration Consistent Nonlinear Expectations and Evaluations

14:45-15:30 S.J. Tang (Fudan University)

Characterization of Optimal Investment and Consumption by Backward Stochastic Parabolic Partial Differential Equations

15:50-16:35 Yi-Jun Hu (Wuhan University)

Asymptotic ruin probabilities for discrete time risk models with heavy-tailed claims

16:35-17:20 Elton P. Hsu (Northwestern University)

Characterizing Brownian Motion Through Integration by Parts

August 14

08:30-09:15 Li-Ming Wu (Université Blaise Pascal)

On the uniqueness of Kolmogorov forward equations

09:15-10:00 Yao-Zhong Hu (University of Kansas)

Numerical Solution of Stochastic Delay Equation

10:30-11:15 Xiang-Dong Li (Université Paul Sabatier)

Liouvill theorem and Feller property for diffusion operator

11:15-12:00 Xian-Yuan Wu (Capital Normal University)

Edge-Negative Association in Random Spanning Forests and Connected Subgraphs on Connected Finite Graphs

ABSTRACT OF TALKS

Schrödinger operators on the Wiener space

Ichiro SHIGEKAWA

Department of Mathematics, Graduate School of Science, Kyoto University, Kyoto, 606-8502, JAPAN

Abstract We consider a Schrödinger operator $-L+V$ on an abstract Wiener space (B, H, μ). Here L is the Ornstein-Uhlenbeck operator and V is a scalar potential. We discuss the following problems:

1. Essential self-adjointness of a Schrödinger operator.
2. The domain of the Schrödinger operator.
3. Spectral gap of the Schrödinger operator.

To solve the first problem, we use the logarithmic Sobolev inequality and the theory of positive generalized functions. For the second problem, we use the intertwining property of operators of the form $\sqrt{V}(-L+V) = A\sqrt{V}$. Here A is a non-symmetric operator. For the third problem, we use the approximation method and show the norm convergence of associated resolvents. The uniform estimate of the Schrödinger operators plays an essential role.

Mixture of large deviation systems

Jin-Wen Chen

Tsinghua University

Abstract Large deviation estimates for mixture of large deviation systems will be provided. Application to Laplace asymptotic integral will be illustrated.

On the stability of genetic algorithms - a variational approach

Wilhelm Stannat

Fakultät für Mathematik, Universität Bielefeld Postfach 100131 D-33501 Bielefeld Germany

Abstract We introduce a variational approach to study existence and uniqueness of stationary states and stability of evolution equations governing the evolution of empirical measures of genetic algorithms (with possibly interactive selection) in the limit of a large number of individuals. The variational approach leads to a new interpretation of the rate of convergence of the underlying algorithms. Applications to the simulation of ground states, stochastic optimization algorithms and to filtering theory are discussed.

References:

[1] W. Stannat, On the convergence of genetic algorithms - a variational approach, Probab. Theory Relat. Fields, Vol. 129, 113-132, 2004.

[2] W. Stannat, On the stability of time-dependent genetic algorithms, Bielefeld 2004, submitted.

[3] W. Stannat, Stability of the pathwise filter equation on $\mathbb{R}^d$, Bielefeld 2004.

Generalized Itô formulae using local time and applications in analysing asymptotics of heat equations in the presence of caustics

Huai-Zhong Zhao

Department of Mathematical Sciences, Loughborough University

Abstract I will first present a new generalized Ito formula for $f(t,x)$ using the two-dimensional Lebesgue-Stieltjes integral of local time with respect to $\frac{\partial^-}{\partial t} f(t,x)$ of locally bounded variation in (t,x). I will discuss the application of the formula e.g. to the stochastic elementary formula and asymptotics of heat equation in the presence of caustic. Finally I will discuss the extension to

multi-dimensions and define the stochastic Lebesgue-Stieltjes integral $\int_{-\infty}^{\infty}\int_0^t f(s,a)d_{s,a}h(s,a)$. Here $s \mapsto h(s,a)$ is a continuous martingale and $\langle h(a), h(b)\rangle_s$ is of locally bounded variation in (a,b).

The talk is based on the following articles:

[1] K.D. Elworthy, A. Truman and H.Z. Zhao, Generalized Itô formulae and Space-Time Lebesgue-Stieltjes Integrals of Local times.

[2] K.D. Elworthy, A. Truman and H.Z. Zhao, Asymptotics of heat equations with caustics in one-dimension.

[3] C.R. Feng and H.Z. Zhao, A generalized Itô formula in two-dimensions and stochastic Lebesgue-Stieltjes integrals.

(Non-)uniqueness of random-cluster measures

G. Grimmett

Churchill College, Cambridge

Abstract The random-cluster model is a generalisation of percolation, and it provides a basic method for studying models for ferromagnetism including Ising and Potts models. One of the main questions is to determine conditions under which there exists a unique random-cluster measure. This problem will be discussed for lattices and trees, and new results of the speaker and Svante Janson will be included.

Fractal Burgers equation with stable white noise

Jiang-Lun Wu

Department of Mathematics, University of Wales Swansea, UK

Abstract In this talk, we consider the following fractal Burgers equation forced by stable space-time white noise

$$(\partial_t - \nu\Delta_\alpha)u + \lambda\partial_x(|u|^r) = \gamma|u|^\beta M_{t,x}, \quad (t,x) \in (0,\infty)\times\mathbf{R}$$

where $\nu, \lambda, r, \gamma, \beta$ are positive constants, $\Delta_\alpha := -(-\frac{d^2}{dx^2})^{\frac{\alpha}{2}}$ is the fractional Laplacian on $\mathbf{R}$ with $\alpha \in (0,2)$, and $M_{t,x}$ is p-stable space-time white noise with $p \in (0,2)$. We discuss mainly the existence of a weak solution (as a superprocess) to the initial problem for this equaiton. The talk is based on a recent joint work with Aubrey Truman.

Integration by parts formulae for the Wiener measure restricted to domains in $\mathbb{R}^d$

Yuu Hariya

Research Institute for Mathematical Sciences, Kyoto University

Sakyo-ku, Kyoto 606-8502 Japan

Abstract In [2], Zambotti explored an integration by parts formula for the pinned Wiener measure over a time interval $[0,1]$ restricted to the path space $D = C([0,1];\Omega)$, where $\Omega = (0,\infty) \subset \mathbb{R}$. It is pointed out that, similarly to the divergence theorem in finite dimension, there appears a certain boundary term in the formula, which is explicitly expressed in terms of pinned 3-dimensional Bessel processes.

In this talk, we shall discuss an extension of his result to the case of general $\Omega's$ in $\mathbb{R}^d$: Let Ω be an open region in $\mathbb{R}^d$. For $a, b \in \Omega$, let B and $\hat{B}$ be independent d-dimensional Brownian motions starting respectively at a and b. Let $\tau_\Omega(\hat{B})$ (resp. $\tau_\Omega(\hat{B})$) be the first exist time from Ω of B (resp. of $\hat{B}$). Given $\tau_\Omega(B) + \tau_\Omega(\hat{B}) = 1, B_{\tau_\Omega(B)} = x$, and $\hat{B}_{\tau_\Omega(\hat{B})} = x$, define the process $Y = (Y_t)_{0\le t\le 1}$ by

$$Y_t = \begin{cases} B_t, & 0 \le t \le \tau_\Omega(B), \\ \hat{B}_{\tau_\Omega(B)+\tau_\Omega(\hat{B})-t}, & \tau_\Omega(B) \le t \le \tau_\Omega(B) + \tau_\Omega(\hat{B}). \end{cases}$$

Let $\mathbb{P}_{a,x,b}$ denote the law of Y and $\mathbb{E}_{a,x,b}$ the expectation with respect to $\mathbb{P}_{a,x,b}$. For an element ω in the support of $\mathbb{P}_{a,x,b}$, let $S_x(\omega) \in (0,1)$ be the time at which $\omega(S_x(\omega)) = x$. Let H_Ω be the minus one half of the Dirichlet Laplacian for Ω, and $e^{-tH_\Omega}(y,z)$ the integral kernel

of the semigroup e^{-tH_Ω} generated by H_Ω. For the pinned Wiener measure $\mathcal{W}^{a,b}_{[0,1]}$ over $[0,1]$ with boundary conditions a, b at each end, we may prove the following formula under a certain condition on Ω: for a smooth functional F, and for $h = (h_i)_{1\le i\le d}, h_i \in C_0^\infty((0,1))$,

$$\int_D \partial_h F(\omega)\mathrm{d}\mathcal{W}^{a,b}_{[0,1]}(\omega) = -\int_D F(\omega)\sum_{i=1}^d \int_0^1 h_i''(s)\omega_i(s)\mathrm{d}s\mathrm{d}\mathcal{W}^{a,b}_{[0,1]}(\omega) + (\textit{boundary term}),$$

where the boundary term is given by

$$-\sqrt{2^{d-2}\pi^d}e^{|a-b|^2/2}\int_{\partial\Omega}\sigma(\mathrm{d}x)\mathbb{E}_{a,x,b}[\mathbf{n}_x\cdot h(S_x)F]\times\int_0^1 \mathrm{d}u\frac{\partial}{\partial\mathbf{n}_x}e^{-uH_\Omega}(a,x)\frac{\partial}{\partial\mathbf{n}_x}e^{-(1-u)}H_\Omega(b,x).$$

Here σ denotes the surface measure on the boundary $\partial\Omega$, $\mathbf{n}_x$ denotes the inward normal vector at $x\in\partial\Omega$, and $\partial/\partial\mathbf{N}_x$ denotes the normal derivative at x.

This formula may be used to construct Funaki strings [1] moving in Ω with the help of the Dirichlet form theory.

[1] Funaki, T.: Random motion of strings and related stochastic evolution equations. Nagoya Math. J. **89**, 129-193 (1983).

[2] Zambotti, L.: Integration by parts formulae on convex sets of paths and applications to SPDEs with reflection. Probab. Theory Relat. Fields **123**, 579-600 (2002).

δ-Function of an Operator: A White Noise Approach

Cai-Shi Wang and Zhi-Yuan Huang

Department of Mathematics, Huazhong University of Science & Technology

Wuhan, Hubei 430074, P. R. China

Abstract Let $(E)\subset(L^2)\subset(E)^*$ be the canonical framework of white noise analysis over the Gel'fand triple $S(\mathbb{R})\subset L^2(\mathbb{R})\subset S^*(\mathbb{R})$ and $\mathcal{L}\equiv\mathcal{L}[(E),(E)^*]$ be the space of continuous linear operators from (E) to $(E)^*$. Let Q be a self-adjoint operator in (L^2) with spectral representation $Q=\int_{\mathbb{R}}\lambda P_Q(\mathrm{d}\lambda)$. In this paper, it is proved that under appropriate conditions upon Q, there exists a unique linear mapping $Z: S^*(\mathbb{R})\mapsto\mathcal{L}$ such that $Z(f)=\int_{\mathbb{R}}f(\lambda)P_Q(\mathrm{d}\lambda)$ for each

$f \in S(\mathbb{R})$. The mapping is then naturally used to define $\delta(Q)$ as $Z(\delta)$, where δ is the Dirac δ-function. Finally properties of the mapping Z are investigated and several results are obtained.

Mean-Risk Portfolio Selection Models in Continuous Time

Jia-An Yan

Chinese Academy of Sciences

(This is a joint work with H. Jin and X. Zhou of Chinese University of Hong Kong)

Abstract This paper is concerned with continuous-time portfolio selection models where the objective is to minimize the risk subject to a prescribed expected payoff at the terminal time. The risk is measured by the expectation of a certain function of the deviation of the terminal payoff from its mean. First of all, a model where the risk has different weights on the upside and downside variance is solved explicitly. The limit of this weighted mean—variance problem, as the weight on the upside variance goes to zero, is the mean–semivariance model which is shown to admit *no* optimal solution. This negative result is further generalized to a mean– downside-risk portfolio selection problem where the risk has non-zero value only when the terminal payoff is lower than its mean. Finally, a general model is investigated where the risk function is convex. Sufficient and necessary conditions for the existence of optimal portfolios are given. Moreover, when the existence is assured, optimal solutions are obtained.

Geometric Process

Yeh LAM

Department od Statistics and Actuarial Science, The University of Hong Kong, Hong Kong

Northeastern University at Qinhuangdao, 066004, China

Abstract Geometric process (GP) was introduced by Lam(1988a,b) as a generalization of renewal processes. A stochastic process $\{X_n, n = 1, 2, \cdots\}$ is called a GP if the exists a real number $a > 0$, such that $a^{n-1}X_n, n = 1, 2, \cdots\}$ forms a renewal processes. In this talk, we shall study the probability properties of GP, including the limit theorems in GP and the Wald

equation in GP. Furthermore, a function $M(t,a)$ is defined as the expected number of events ocuurred by time t in the GP. The existence and the properties of function $M(t,a)$ are then considered.

A Bounded Property for Gradients of Diffusion Semigroups on Euclidean Spaces

Song LIANG

Graduate School of Information Sciences, Tohoku University, Japan

Abstract Consider the stochastic differential equation (SDE) on Euclidean space $\mathbb{R}^d$ given by

$$\begin{cases} \mathrm{d}X^i(t,x) = \sum_{j=1}^d \sigma_{ij}(X(t,x))\mathrm{d}B_t^j + b_i(X(t,x))\mathrm{d}t, \quad i = 1, \cdots, d, \\ X(0,x) = x, \end{cases} \tag{1}$$

where $(B_t^1, \cdots, B_t^d)$ is a d-dimensional Brownian motion. We assume that all of the coefficients are smooth, and that the diffusion term is uniformly elliptic. Under some conditions with respect to the drift term $b = (b_1, \cdots, b_d)$, we give a non-uniform estimate of $\nabla P_t f$, with the power of $1/t$ smaller than1. Here P_t is the operator given by $P_t f(x) = E[f(X_t)]$. More precisely, we show that for any $\alpha \geq 0$ and $\beta > 0$, there exists constants $d_\beta \in (0,1)$ and $C_{\alpha,\beta} > 0$ such that

$$|\nabla P_t f(x)| \leq (1+|x|^2)^\gamma \frac{C_{\alpha,\beta}}{t^{d_\beta}} \|(1+|\cdot|^2)^{-\frac{\alpha}{2}} f\|_\infty$$

for any $t \in (0,1], x \in \mathbb{R}^d$ and $f \in C(\mathbb{R}^d)$ satisfying $(1+|\cdot|^2)^{-\frac{\alpha}{2}} f \in C_b(\mathbb{R}^d)$. Here γ is a constant depending on b.

Scaling limits of equilibrium wetting models in $(1+1)$-dimension

J. D. Deuschel, G. Giacomin and L. Zambotti

Abstract We study the path properties for the δ-pinning wetting model in $(1+1)$-dimension. In other terms, we study a random walk model with fairly general continuous increments conditioned to stay in the upper half plane and with a δ-measure reward for touching zero, that is the boundary of the forbidden region. It is well known that such a model displays a localization/delocalization transition, according to the size of the reward. Our focus is on getting

a precise pathwise description of the system, in both the delocalized phase, that includes the critical case, and in the localized one. From this we extract the (Brownian) scaling limits of the model.

On the regularity of affine Markov processes

Zeng-Hu Li

Beijing Normal University

Abstract The concept of affine processes unifies a wide class of Markov processes including Ornstein-Uhlenbeck processes and continuous state branching processes with immigration. Those processes involve rich common mathematical structures and the unification of them develops interesting connections between several areas in the theory of probability. The "affine property" is roughly that the logarithm of the characteristic function of the transition semigroup is given by an affine transformation of the initial sate. A complete characterization of affine processes was given by Duffie et al (Ann. Appl. Probab., 2003) under a regularity assumption, which requires that the coefficients in the affine relationship are differentiable. Based on this characterization, Duffie et al (2003) discussed a wide range of applications of affine processes as interest rate models. In this work, we formulate the general affine Markov semigroup as the convolution of a homogeneous one with a skew convolution semigroup. Under some conditions on the first moments, we establish the regularities of the homogeneous affine semigroup and the skew convolution semigroup. These give a partial solution of a problem of Duffie et al (2003).

Strong ergodicity: some new results

Yong-Hua Mao

Beijing Normal University

Abstract In this talk, we review some new results related to strong ergodicity, which include the estimates fo the convergence rate in strong ergodicity, explicit formulas for discrete spectrum in

L^∞. Some applications are given to concrete processes such as branching processes and random walks on the trees.

Independent Random Matching and Markov Chains

Darrell Duffie (Stanford University) and Yeneng Sun* (National University of Singapore)

Abstract We provide micro-foundations for independent random matching of a large population, as widely used in the economics and genetics literatures. We consider both static and dynamic systems with random mutation, partial matching arising from search, and type changes induced by matching. Under independence assumptions at each randomization step, we show that there is an almost-sure constant cross-sectional distribution of types in a large population, and moreover that the time evolution of the cross-sectional type process is completely determined from a Markov chain with known transition matrices. We also construct a joint agent-probability space, and randomized mutation, partial matching, and match-induced type-changing functions that satisfy the required independence conditions.

Markov skeleton processes and their applications

Zhen-Ting Hou

Central South University

Abstract A stochastic process $X(t)$ is called a Markov skeleton process(MSP) if it has the Markov property on a sequence of stopping times. The usual Markov process, semi-Markov process, deterministic Markov process and semi-regenerative process can be regarded as special cases of MSP. In this paper, first, backward and forward equations with which we can compute one-dimensional distribution is derived, and then formulas to compute finite-dimensional distribution and the existence and computation of limit distribution are also obtained. Based ourselves upon the above the results, we give a tentative study of queueing system, reliability system, and storage system. Transient distribution and formulas to compute limit distribution of the stochastic processes introduced for studying these system are presented in the latter half the paper.

From Markov Branching Processes to Collision Branching Processes

An-Yue Chen

University of Greenwich

Abstract This talk focuses on addressing some basic properties of two new models, the Weighted Markov Branching Process (WMBP) and the Collision Branching Processes (CBP). The emphasis will be put upon the methodological aspect, particularly the powerful random time change technique.

WMBP is a natural generalisation of the ordinary Markov Branching Process (MBP). Two approaches, the analytic as well as the probabilistic approaches, in tackling such process are explained in detail. First, using the analytic method particularly the recently developed Generalised Reuter Lemma, the regularity and uniqueness criteria, which are very easy to verify, are established. The extinction probability of such structure is obtained. The closed forms for the mean extinction time and the conditional mean extinction time are presented. The explosion behaviour is also investigated and the mean explosion time is derived. Then the probabilistic approaches, in particular, the technique of random time changes and the Lamperti Transforms are used to tackle these models. Using such methods, the deep relationship between these newly developed processes and the well-known compound Poisson processes is revealed. It is proved that any Weighted Markov Branching Process can be viewed as a random time change of a compound Poisson process. As a consequence, most of results obtained by analytic method can be regained using these probabilistic approaches.

The second new branching model, the Collision Branching Process (CBP), differs from the traditional branching model in that branching events are effected by the interaction/collision of pairs of particles, rather than by the particles individually. This new model allows one to study the effect of collision, or interaction, between particles or individuals and thus can be used outside the present context. We illustrate that some new interesting questions are arisen from such models. A particular interesting problem is that, different from the ordinary branching structure, there exist two absorbing states and hence it is necessary to evaluated probabilities of absorbing for these states individually. The regularity and uniqueness criteria are also firstly established. The explicit expressions are obtained for the extinction and explosion probabilities,

as well as the associated expected hitting times. The likelihood of using the similar probabilistic approach as in WMBP for these models is also highlighted.

Some Multifractal Properties and the Local Phenomenon for Occupation Measure of Transient Brownian Sheet

Huo-Nan Lin

Fujian Normal University

Abstract The localization phenomenon of occupation time for transient Brownain sheet is dicussed.We obtain the localization phenomenon and its applications in asymptotic laws and mutltifractal decomposition for Occupation Measure of Transient Brownian Sheet. Because of the partially-ordered nature in the multi-parameter index space , we can't determine the accurate constants as well as Brownian motion's.

Quasi-factorization of $I_\alpha(f)$ and Latała-Oleszkiewicz's inquality for Gibbs random fields

Feng Wang

Mathematical Department, Capital Normal University

Abstract We show $I_\alpha(f)$ exhibits a quasi-factorization property with respect to a pair of weakly dependent σ-algebras. As an application under uniform mixing condition , Gibbs specification with translation invariantand and finite range summable interaction has uniform Latała-Oleszkiewicz's ineqalities.

Reflected alpha-stable processes

Zhi-Ming Ma

Chinese Academy of Sciences

(The talk is based on my joint work with Q.Y.Guan and with Z.C.Hu respectively)

Abstract In recent years there has been an increasing interest in the study of non-Gaussian Levy processes which are now widely used in physics, operations research, queuing theory, mathematical finance, risk estimation, and others. In this talk I shall present some new results concerning a class of reflected non-Gaussian Levy processes–reflected alpha stable processes. We show that the generators of the reflected alpha-stable processes are regional fractional Laplacian which we described as a class of integral operators. We obtained integral by parts formula for regional fractional Laplacian which serves as the Gauss-Green formula for the classical Laplacian. We obtained also the semi-martingale decomposition of reflected alpha astable processes which will be particularly useful in the study of stochastic integrals driven by discontinuous reflected Levy processes. I shall also present an extension of Levy-Khinchine formula which will be available for a wide class of Dirichlet processes on general state spaces.

Perturbations of symmetric Markov processes

Tu-Sheng Zhang

Abstract In this talk I will discuss lower order perturbations of symmetric Markov processes and probabilistic representations of the associated semigroups.

The Reversible Nearest Particle System on a Finite Set

Dayue Chen, Juxin Liu and Fuxi Zhang

School of Mathematical Sciences, Peking University, Beijing 100871, China

Abstract We study the one-parameter family of attractive reversible nearest particle systems on $\{1, 2, \cdots, N\}$. Denote by σ_N the time that the system first hits the empty set. Then, σ_N has a logarithmic increasing rate as the parameter λ is small enough, but an exponential increasing rate as λ is large enough. Especially, it has a polynomial increasing rate in the critical case, i.e. $\lambda = 1$.

Characterization of Optimal Investment and Consumption by Backward Stochastic Parabolic Partial Differential Equations

Shan-Jian Tang

Fudan University

ABSTRACT An optimal investment and consumption problem is considered without assumption of Markov asset prices. The optimal investment and consumption is characterized by backward stochastic parabolic partial differential equations. The relevant backward stochastic HJB equation is also studied.

Asymptotic ruin probabilities for discrete time risk models with heavy-tailed claims

Xiao Wei and Yi-Jun Hu

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ABSTRACT Consider a discrete time risk model $U_n = (U_{n-1} + X_n)(1 + I_n) - Y_n$, $n = 1, 2, \cdots$, where $U_0 := M > 0$ is the initial reserve of an insurance company, X_n the total amount of premiums, Y_n the total amount of claims, I_n the interest rate and U_n the reserve at time n. Define the time of ruin by $\tau_M := \inf\{n \geq 1; U_n < 0\}$. Assume that $\{Y_n\}$ are heavy-tailed. Our main objective is to give reasons for the asymptotic estimate $P(\tau_M < \infty) \approx M^{-\lambda}$ where λ is a specific positive parameter. A more general risk model from Nyrhinen (1999) is also discussed, and similar asymptotic estimate for ruin probabilities is given.

On the uniqueness of Kolmogorov forward equations

Li-Ming Wu

ABSTRACT We study the notion of several uniqueness on the space of bounded and measurable functions. The relations with nonnegative uniqueness, Q-uniqueness, Markov uniqueness and martingale uniqueness are established. A quite complete picture is given for jumps processes (especially birth-death processes), and for one-dimensional Schrodinger operators.

Numerical Solution of Stochastic Delay Equation

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Abstract we develop a strong Milstein approximation scheme for solving stochastic delay differential equations (SDDE's). The scheme has convergence order 1. In order to establish the scheme, we prove an infinite-dimensional Ito formula for "tame" functions acting on the segment process of the solution of an SDDE. It is interesting to note that the presence of the memory in the SDDE requires the use of the Malliavin calculus and the anticipating stochastic analysis of Nualart and Pardoux. Given the non-anticipating nature of the SDDE, the use of anticipating calculus methods in the context of strong approximation schemes appears to be novel.

Edge-Negative Association in Random Spanning Forests and Connected Subgraphs on Connected Finite Graphs

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Abstract Let G be a connected finite graph. We consider three types of probability measures on $\mathcal{G}$, the set of subgraphs of G, which govern a random spanning tree, a random spanning forest, and a random connected subgraph respectively. Based on the edge-negative association in uniform spanning tree, we construct a family of random spanning forests and random connected subgraphs on G which are edge-negative associated.

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