

**Location:** Royall Hall, room 213 (Unless otherwise noted)

**Day & Time:** Wednesdays or Fridays, 2:00-2:50 pm (Unless otherwise noted)

[Campus Map for Talks](#) (PDF Format)

**Organizer:** [Dr. Liana Segal](#), 235-2849

**Email:** [segal@umkc.edu](mailto:segal@umkc.edu)

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### Dates, Titles, Speakers (with Abstracts as available)

- **Friday, Feb. 26**

**BARN: Bayesian Additive Regression Network**

**Sounak Chakraborty**, Department of Statistics, University of Missouri

Bayesian ensemble learning otherwise known as the Bayesian additive regression tree (Chipman, et al. 2005) is a pioneering work in terms of adopting the philosophy of the "slow learners" under a Bayesian setup. In this paper we describe two Bayesian ensemble methods for classification and regression. The first method is our Bayesian adaptive ensemble tree for multi-class classification. The number of trees is not fixed but we kept it free by putting a prior distribution. Thus the number of trees required to fit a model is selected adaptively and thus avoiding over fitting. The second model is based on neural network architecture. Based on an ensemble of small neural networks we develop our Bayesian ensemble network for regression. The number of required networks is selected adaptively using a prior. Success of both methods is demonstrated on simulated data sets and real data sets.

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- **Wednesday, Mar. 17**

**The Multifactor Term Structure of Interest Rates under Regime Shifts and Lévy Jumps**

**Xiangdong Liu**, Department of Statistics, Jinan University

We develop a general dynamic term structure models under jump-diffusion with Lévy Jumps and regime shifts with time varying transition probabilities. The model allows for regime-dependent jumps with jump risk and regime-switching risk. We study the bond pricing problem of this model under pseudo-affine structure and derive two types of solutions—an approximation (log-linear) solution and an exact solution under different conditions. Furthermore, for a special case, when the underlying process has two regimes and double Gamma jumps, we obtain a closed form expression for bond prices.

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- **Wednesday, Mar. 24**

**Weller Overstreet Lectures in Science**

Note room: Royall Hall 104

**Statistical Meta Modeling for Complex System Simulations:**

**Kriging, Alternatives and Design**

**C. F. Jeff Wu**, School of Industrial and Systems Engineering, Georgia Institute of Technology

[\(Poster / Bio\)](#)

With the advances in computing technologies and sophisticated modeling, it has been increasingly practical and popular to simulate a complex system or product on a computer. This new *modus operandi* has seen many applications in science, technology, medicine, environment and humanities. One key technical problem for implementing the simulations of large and complex systems is the incredible amount of computing time required. To tackle this challenge, statisticians and engineers have proposed the use of meta-models as a supplement to expensive computations like finite element simulations. The most commonly used technique for building a meta (or called surrogate or approximate) model is kriging, which originated in geo-statistics. A quick review will be made on kriging and its limitations, especially its numerical instability for large samples and/or dimensions. Alternative techniques to circumvent this problem have been proposed in recent years. Some of them will be described. Finally the issue of designing computer experiments will be discussed and its difference from traditional design for physical experiments will be highlighted. Real world examples will be given throughout the talk.

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- **Wednesday, Apr. 7**  
**Feynman-Kac formula for stochastic partial differential equations driven by fractional Brownian noises**  
Yaozhong Hu, Department of Mathematics, University of Kansas

In this talk I will present a recent work jointly with David Nualart and Jian Song on a version of Feynman-Kac formula for the multidimensional stochastic heat equation driven by a multiplicative fractional Brownian noise. We use the techniques of Malliavin calculus to prove that the process defined by the Feynman-Kac formula is a weak solution of the stochastic heat equation. From the Feynman-Kac formula we establish the smoothness of the density of the solution, and the Holder regularity in the space and time variables. We also derive a Feynman-Kac formula for the stochastic heat equation in the Skorohod sense and we obtain the Wiener chaos expansion of the solution.

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- **Thursday, Apr. 15, 1:00-1:50pm** Royall Hall 404  
(Note unusual time and room.)  
**How Interest Rate Affects Stochastic Lifestyling**  
Allanus Tsoi, Department of Mathematics, University of Missouri

This talk considers retirement scheme in the framework of stochastic control and filtering. We employ the Hull-White model for interest rate. The control is the fraction of the employee's salary invested on a risky asset chosen by the employee in his retirement scheme. The goal is to maximise stochastic lifestyling- defined as the employee's total wealth divided by the final salary at the time point of his retirement. The mean reversion parameter of the interest rate which comes up in the solution of the control problem, as well as the volatility of the interest rate, are approximated using classical stochastic filtering techniques. These will help us in the investigation of how stochastic interest rate affects the quality of our retirement years.

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**Organizer:** [Dr. Noah Rhee](#), 235-2854

**Email:** rheen@umkc.edu

- [The Other Department Series of Expository Talks and Videos/Films](#)
  - [Last Semester Schedule of the Graduate Seminar Series](#)
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**Dates, Titles, Speakers (with Abstracts as available)**

- **Friday, Sept. 17**  
**A Three-Current Model of Cardiac Action Potential**  
Ian Besse, Department of Mathematics & Statistics, UMKC

Proper heart function results from the periodic execution of a series of coordinated interdependent mechanical, chemical, and electrical processes within the cardiac tissue. Central to these processes is the action potential—the electrochemical event that initiates contraction of the individual cardiac muscle cells. While many mathematical models of cardiac action potential exist, most have been designed to simulate the whole array of electrophysiological characteristics exhibited by the cell. In this talk, I examine one such physiologically detailed model of rat cardiac action potential consisting of 26 coupled, nonlinear ordinary differential equations and use a Monte Carlo method-based approach to parameter optimization in order to develop a three-variable approximation. I will discuss the advantages and disadvantages this simplified model has relative to more physiologically detailed models, the results of a preliminary analysis of this model, and my plans for this model in future research.

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- **Friday, Sept. 24**  
**Stein Paradox and Estimation of the Covariance Matrix**  
Thomas Fisher, Department of Mathematics & Statistics, UMKC

In the 1950s, Charles Stein demonstrated that when the dimensionality is non-negligible the unbiased maximum likelihood estimator for the mean is not always the best estimator with respect to mean squared error. In this talk, we highlight this phenomenon with a classic example of analyzing baseball batting averages. We then explore its effects on the modern problem of estimating the covariance matrix. We highlight recent results from the literature and introduce a new set of Stein-type shrinkage estimators for the covariance matrix.

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- **Friday, Oct. 8**

- **Some Applications of Clark-Ocone Representation Formula**

- David Nualart, Department of Mathematics, University of Kansas

The purpose of this talk is to discuss some applications of the Clark-Ocone representation formula. This formula provides an explicit expression for the stochastic integral representation of functionals of the Brownian motion in terms of the derivative in the sense of Malliavin calculus. We will compare this formula with the classical Ito formula and we will discuss some of its applications, including hedging contingent claims in finance. In the last part of the talk we present a recent proof of a central limit theorem for the modulus of continuity in the space variable of the Brownian local time, based on Clark-Ocone formula.

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- **Friday, Oct. 22**

- **Krylov Matrices and Functions of a Matrix**

- Hongguo Xu, Department of Mathematics, University of Kansas

Krylov matrices and functions of a matrix play a fundamental role in matrix computations. They are key players in analysis and development of Krylov subspace methods for systems of linear equations and QR algorithms for eigenvalue problems. In this talk we focus on their relations. We show some well-known results as well as some new observations from recent work.

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- **Friday, Oct. 29**

- **Nonparametric tests and test-based genome partitioning for longitudinal DNA copy number data**

- Haiyan Wang, Kansas State University

Array comparative genomic hybridization (aCGH) and single nucleotide polymorphism (SNP) array data are becoming commonly available for scientists to study genetic mechanisms involved in complex biological processes. Such data typically contain a large number of probes observed repeatedly over time. Due to cost concern, the number of replicates is often very limited. Effective hypothesis testing tools need to take into account of the high dimensionality and small sample sizes. In this talk, I will present a set of nonparametric hypothesis testing theory to test for main and interaction effects related to a large number of probes for longitudinal DNA copy number data from aCGH or SNP arrays. The asymptotic distributions of the test statistics are obtained under a realistic model setup that allows distribution-free robust inference in presence of temporal correlations for heteroscedastic high dimensional low sample size data. The results of these tests are used to recursively partition the genome to identify event regions. We anticipate this work would provide a flexible tool for a wide range of scientists to accelerate novel gene discovery such as identification of genome regions of aberration to control tumor progression. Simulations and applications of the new methods to DNA copy number aberration from Wilm's tumor relapse study will be presented.

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- **Friday, Nov. 5**  
**On existence, uniqueness and numerical approximation of solutions for nonlinear filtering equations**  
**Wei Sun, Concordia University**

Filtering is a method of estimating the conditional probability distribution of a signal based upon a sequence of partial and noisy observations. Recently, there is an increasing interest in applying filtering theory to real-world problems in areas such as target detection and tracking, communication networks, mathematical finance and quantum information technologies. In this talk, we will discuss the existence, uniqueness and numerical approximation of solutions for nonlinear filtering equations. In particular, we will introduce some recent results obtained by using the method of Wiener and Poisson chaos expansions.

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- **Friday, Nov. 12**  
**Methods of reducing a commutative local ring: exact zero divisors versus nonzero divisors.**  
**Liana Segal, Department of Mathematics & Statistics, UMKC**

If  $R$  is a commutative local ring and  $f$  is a non-unit element, then the ring  $R/(f)$  is in certain ways simpler than  $R$ . One may hope to reduce the study of the original ring and its modules to the simpler ring. A well known case when such a reduction is meaningful is when  $f$  is a nonzero divisor, meaning that  $f$  is nonzero and  $fg=0$  implies  $g=0$ . By successively reducing the ring  $R$  by means of a sequence of nonzero divisors, one can reduce the study of  $R$  to the study of a ring whose maximal ideal consists entirely of zero divisors. If we want to further reduce the ring, then we need to consider those zero divisors  $f$  which allow for a meaningful translation of properties between  $R$  and  $R/(f)$ . I will introduce the notion of exact zero divisor and discuss how the properties of  $R$  and  $R/(f)$  are related when  $f$  is an exact zero divisor.

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- **Friday, Dec. 3**  
**Hongying Dai, Children's Mercy Hospital**