Semester Spring 2008
Location: Flarsheim Hall, Room 260 (Unless otherwise noted)
Day & Time: Wednesdays, 12:30-1:20 pm (Unless otherwise noted)
Campus Map for Talks (PDF Format)

Organizer: Dr. Yong Zeng, 235-5850
Email: zengy@umkc.edu

Dates, Titles, Speakers (with Abstracts as available)

Wednesday Jan. 23
An Application of a Stochastic Control System to Modeling the Risk Reserves
Bozenna Pasik-Duncan, Mathematics Department, Univeristy of Kansas.

A discrete time, linear stochastic control system is constructed to model the risk reserves for insurance companies. The model has the autoregressive form. A control is used to regulate the risk reserves. The sequence of controls is determined by two approximations, the normal power approximation of order two and a log normal approximation. These approximations use the first three moments which incorporate the skewness of the distributions that is important for these problems. The examples of insurance companies are considered to compare these two approximations with the proposed control laws. It is shown that the two approximations are close.

Friday Feb. 08, **Ergodicity of Filtering Processes**
Lukasz Stettner, Institute of Mathematics, Polish Academy of Sciences

Assume that the state of a Markov process $X = (x(t))$ is partially observed i.e. we observe the process $y(t) = h(x(t))+w(t)$, where $(w(t))$ is the noise. One can define then so called filtering process i.e. a measure valued process of conditional probabilities $\pi(t)(A) = P\{ x(t) \in A \mid y(s), s \le t \}$. It can be shown that it is a Markov process. In 1972 H. Kunita formulated necessary and sufficient conditions for ergodicity i.e. existence of unique invariant measures for $(\pi(t))$. In the beginning of the XXI century an error in Kunita paper was found. The researchers started to try to fill in this gap. The problem in general seems to be still open. The talk will be based on the results of L.S. and G. B. Di Masi published in 2004 and 2008 which provide certain sufficient conditions for ergodicity of $(\pi(t))$.

Wednesday Apr. 2

Regression Analysis of Longitudinal Data with Dependent Observation Process

Tony Sun, Department of Statistics, MU.

Longitudinal data frequently occur in many studies such as longitudinal follow-up studies. To develop statistical methods and theory for the analysis of them, independent or noninformative observation process is typically assumed, which naturally leads to inference procedures conditional on the observation process. In many situations, however, this may not be true or realistic. This talk considers situations where the assumption does not hold and a joint modeling approach that uses some latent variables to characterize the correlations is presented.

Wednesday Apr. 9

Wiener Chaos Approach to SPDEs

Boris Rosovski, Division of Applied Mathematics, Brown University.

I will discuss stochastic parabolic and elliptic PDEs driven by purely spatial white noise. Even the simplest equations driven by this noise often do not have a square-integrable solution and must be solved in special weighted spaces. It will be shown that the Cameron-Martin version of the Wiener chaos decomposition is an effective tool to study both stationary and evolution equations driven by space-only noise. Recent results about solvability of such equations in weighted Wiener chaos spaces and the long-time behavior of the solutions of evolution equations with space-only noise will be presented.

Semester Fall 2008
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. Hristo Voulov, 235-5851
Email: voulovh@umkc.edu

Dates, Titles, Speakers (with Abstracts as available)

Wednesday Sept. 10
The *n*-dimensional Pythagorean Theorem via the Divergence Theorem
Noah Rhee, Department of Mathematics and Statistics, UMKC

The theorem of Pythagoras relating the squares of the lengths of the sides of a right triangle is well known. Its generalization to 3 dimensions is known as de Gua's theorem. The generalization of this result to *n* dimensions has appeared many times in the literature. In this talk, we present a proof of the n-dimensional Pythagorean theorem using the divergence theorem.

Wednesday Sept. 17
On the Global Asymptotic Stability of Dissipative Maps in the Plane
Hristo Voulov, Department of Mathematics and Statistics, UMKC

We consider area-contracting maps in the plane, which are often called dissipative maps. If a smooth map has an asymptotically stable fixed point *P*, the area-contracting property seems necessary at least locally around *P*. Here we find sufficient conditions for global asymptotic stability of planar dissipative maps. Then, we apply this result to a 15 year old open problem about a second order rational difference equation, posed by G. Ladas.

Friday Sept. 26

Miron Bekker, Department of Mathematics and Statistics, UMKC

Wednesday Oct. 8

A Maximum Principle for Partial Information Backward Stochastic Control Problems with Applications

Jie Xiong, Department of Mathematics, University of Tennessee

In this talk, we will introduce the partial information control problems of backward stochastic systems. First, we obtain a stochastic maximum principle for partial information control problems. Our method relies on a direct calculation of the derivative of the cost functional. Second, we introduce two classes of partial information linear-quadratic backward control problems for the first time and then investigate them using the maximum principle. Complete and explicit solutions are obtained in terms of some forward and backward stochastic differential filtering equations. Finally, we study a class of full information stochastic pension fund optimization problems which can be viewed as a special case of our general partial information ones. Applying the aforementioned maximum principle, we derive the optimal contribution policy in closed-form and present some related economic remarks.

Friday Oct. 17

Risk Assessment and Asset Allocation with Gross Exposure Constraints for Large Portfolios

Jianqing Fan, Department of Operation Research and Financial Engineering, Princeton University

Markowitz (1952, 1959) laid down the ground-breaking work on mean-variance analysis without gross exposure constraints. Under this framework, the theoretical optimal allocation vector can be different from the estimated one due to intrinsic difficulty of estimating a large covariance matrix and return vector. This can result in adverse performance in portfolio selected based on empirical data due to noise accumulation on estimation errors (Jagannathan and Ma, 2003; Fan, Fan and Lv, 2008). We address this problem by introducing the gross-exposure constrained mean-variance portfolio selection. We show that with gross-exposure constraint the theoretical optimal portfolios have similar performance as empirically selected ones based on estimated covariance matrices and there is no noise accumulation effect from estimation of covariance matrices. This gives theoretical justification to the empirical results in Jagannathan and Ma (2003). As the constraint on short sales relaxes, the number of selected assets varies from 1 to all stocks, when tracking or selection portfolios. This achieves the optimal sparse portfolio selection, which has close performance to the theoretical optimal. Among 2000 stocks, for example, we are able to identify all optimal subsets of portfolios of different sizes, their associated allocation vectors, and their estimated risks. The utility of our new approach is illustrated by simulation and empirical studies.

Thursday Oct. 23

4:00 pm, in Haag Hall room 201. (Note time, date, room change)

Hypothesis test for Normal Mixture Models: the EM Approach
Jiahua Chen, Department of Statistics, University of British Columbia

Normal mixture distributions are arguably the most important mixture models, and also the most challenging technically. The likelihood function of the normal mixture model is unbounded based on a set of random samples unless an artificial bound is placed on its component variance parameter. Moreover, the model is not strongly identifiable so it is hard to differentiate between over-dispersion caused by the presence of a mixture and that caused by a large variance; and it has infinite Fisher information with respect to mixing proportions. There has been extensive research on finite normal mixture models, but much of it addresses merely consistency point estimation or useful practical procedures, and many results require undesirable restrictions on the parameter space. We show that an EM-test for homogeneity is effective at overcoming many challenges in the context of finite normal mixtures. We find that the limiting distribution of the EM-test is a simple function of the $0.5x_0^2 + 0.5x_1^2$ and x_1^2 distributions when the mixing variances are equal but unknown, and the x_2^2 when variances are unequal and unknown. Simulations show that the limiting distributions approximate the finite sample distribution satisfactorily. Two genetic examples are used to illustrate the application of the EM-test.

Friday Nov. 7
Dynamical Geometry: From Order to Chaos and Sierpinski Pedal Triangles
Jiu Ding, Department of Mathematics, Mississippi State University

We give an introduction to discrete dynamical geometry, an iterated dynamical system of geometric figures, and we present some joint research with Dr. Xin-Min Zhang of the University of South Alabama and other co-authors.

A regular behavior is observed for some kinds of interated triangles and cyclic polygons, and it can be proved via the Perron-Frobenius theory of nonnegative matrices. But an irregular or chaotic behavior appears when a sequence of pedal triangles of a given triangle are generated. Using pedal triangles, we construct new fractals called Sierpinski pedal triangles since they are reduced to the famous Sierpinski triangle when the initial triangle is equilateral. The fractal dimensions of Sierpinski pedal triangles are also calculated and it is proved that the well known dimension ln 3/ln 2 of the Sierpinski triangle is a local minimum of those of Sierpinski pedal triangles. It is also proved that this local minimum is also a global minimum.

This talk serves as a sightseeing on the way from order to chaos in the garden of dynamical geometry, and it also provides a way of looking at the classic Euclidean geometry from a modern mathematics point of view.

Friday Nov. 14

Some recent Special Functions and their Applications to Time dependent Boundary Conditions Problems.

Mohammed Boudjelkha, Department of Mathematical Sciences, Rensselaer Polytechnic Institute

It has been discovered quite recently that the solutions of several heat conduction problems with time dependent boundary conditions could be written explicitly in terms of the Generalized Incomplete Gamma Function. In this talk we discuss different approximations and expansions of this special function as well as the particular values of the parameters which appear of interest to applications. We also discuss in this talk the mathematical properties of Riemann - Bessel function as well as its applications to time dependent boundary conditions problems for the wave equation.