Fall 2014

2014 (Fall)

University of Dayton. Department of Mathematics

Abstracts from the Colloquium: Fall 2014

Date	Speaker and Title	Time/Location
Thursday, Sep 18	Jonathan Brown, University of Dayton Determining if C*-algebras are simple	3:00 PM, SC 323
Thursday, Sep 25	Jonathan Brown, University of Dayton Simplicity of the irrational rotation algebra	3:00 PM, SC 323
Thursday, Oct 2	Lance Lijian Chen, University of Dayton Two topics on stochastic programming and their applications	3:00 PM, SC 323
Thursday, Oct 16	Paul Eloe, University of Dayton Multi-Term Linear Fractional Nabla Difference Equations with Constant Coefficients	3:00 PM, SC 323
Thursday, Oct 23	Jireh Loreaux , University of Cincinnati Extracting hidden information: the interplay between operators and their diagonal sequences	3:00 PM, SC 323
Thursday, Oct 30	Gang Yu, Kent State University Sequences with bounded auto-correlations	3:00 PM, SC 323
Thursday, Nov 6	Zhifeng Kuang, Universal Technology Corporation & Air Force Research Laboratory Solving a Class of NP-Hard Optimization Problems Using Coupled Monte Carlo and Molecular Dynamics Simulations	3:00 PM, SC 323
Tuesday, Nov 11	Tracy Hwang, Risk Manager in Residence	3:00 PM, Sc 323
Thursday, Nov 20	Michael A. Radin, Rochester Institute of Technology Dynamics of a discrete population model for extinction and sustainability in ancient civilizations	3:00 PM, SC 323
Tuesday, Nov 25	Chenyu Qiu, University of Dayton An Analysis of American Companies (1990 - 2000) Using the KMV Model	3:00 PM, SC 323
Thursday, Dec 4	Jing Dan Zhang, University of Dayton Pricing Options Using the Tree Method in a Switching Model with State Dependent Switching Rates	3:00 PM, SC 323
Thursday, Dec 4	Zhiyang Zhang, University of Dayton Pricing Options in Jump Diffusion Models Using the Fast Fourier Transform	3:30 PM, SC 323
Tuesday, Dec 9	Jing Nie, University of Dayton Efficiency comparison of Moody's KMV model and Altman's Z-score model predicting corporate default with empirical U.S. data	3:00 PM, SC 323
Thursday, Dec 11	Hanan Aljubran, University of Dayton Asset Pricing in Policy Uncertainty Periods	3:00 PM, SC 323

Thursday, Dec 11	Mohammed Aldandani, University of Dayton A Green's function for a Two-Term Second Order Differential Operator	3:30 PM, SC 323

Determining if C*-algebras are simple
Jonathan Brown
Abstract: A C*-algebra is an infinite dimensional analogue of the set of square matrices of a fixed dimension. C*-algebras were introduced to aid in the study of group representations and then shortly were used to provide a mathematical framework for quantum mechanics. In these studies it is important to determine if two C*-algebras are isomorphic. This is an intractable question in general but for certain simple C*-algebras complete classification results are known. However it is often difficult to determine if a C*-algebra is simple. In recent work with my collaborators Clark, Farthing and Sims, we were able to completely characterize when members of a large class of C*-algebras are simple. In this talk, I will introduce C*-algebras through important examples and explain how our result can be applied to some of these examples.

Simplicity of the Irrational Rotation Algebra
Jonathan Brown
Abstract: When the integers act on the circle by rotation through an irrational angle, the orbit is a dense subset of the circle. In this talk we will show how to construct a C*-algebra from this action. We will then discuss how the movement inherent in this action shows that the C*-algebra so constructed is simple.

Two topics on the stochastic programming and their applications
Lance Lijian Chen
Abstract: We will talk about two increasingly important topics on the stochastic programming, the chance constrained optimization and the sample size reduction method along with their applications. We will focus mostly on methodological advances and computational performances. The chance constrained optimization is solved by an approximation scheme based on Bernstein polynomial and the sample size reduction is developed by the maximum volume inscribe ellipsoid to the polyhedron. Their applications are ranging from air traffic control, supply chain management, inventory control, and many other industries.

Multi-term Linear Fractional Nabla Difference Equations with Constant Coefficients
Paul Eloe
Abstract: We shall consider a linear fractional nabla (backward) difference equation with constant coefficients. We apply a transform method to construct formal solutions. Sufficient conditions in terms of the coefficients are given so that the formal solutions are convergent and thus, solutions. Of interest, we consider fractional equations with three or more terms. As a corollary, we exhibit new summation representations of discrete exponential functions defined on the nonnegative integers.

Extracting hidden information: the interplay between operators and their diagonal sequences
Jireh Loreaux

Abstract: Given a continuous linear operator on a Hilbert space (the basic objects in operator theory), the choice of an orthonormal basis for the underlying space provides a matrix representation for that operator which yields an associated diagonal sequence. Here we explore the relationship between the operator and its diagonal sequences including both well-known results and new research in the area.

Sequences with bounded auto-correlations
Gang Yu
Abstract: For a sequence of complex numbers $a_0, a_1, \cdots a_{n-1}$, its aperiodic autocorrelation sequence $\{c_k\}$ is defined by

$$c_k := \sum_{j=0}^{N-1-k} \overline{a_j}\, a_{j+k}$$

for $0 \leq k < N$ and, $c_k := \overline{c_k}$.

We are interested in several special (real) sequences $\{a_j\}$ with almost all autocorrelations explicitly bounded. In particular, Barker sequences and generalized Sidon sets will be discussed.

Solving a Class of NP-Hard Optimization Problems Using Coupled Monte Carlo and Molecular Dynamics Simulations
Zig Kuang
Abstract. In computational bio-nano materials design, it is highly demanded to identify the most stable conformer of a macrobiomolecule on nanostructured surfaces. Mathematically, it can be modelled as a global optimization problem in which the potential energy function of the system is the objective function while the coordinates used for representing the structural arrangement of the system are the variables. Due to the combinatorial explosion nature, they are considered as NP-hard optimization problems. In this talk, I will show the mathematical formulation of the optimization problem and a powerful algorithm to obtain optimal solution comparable to experimental result using coupled Monte Carlo and Molecular Dynamics simulations.

Tracy Hwang, Risk Manager in Residence -- **No Abstract provided**

Michael A. Radin, Rochester Institute of Technology
Dynamics of a discrete population model for extinction and sustainability in ancient civilizations—No Abstract provided

An Analysis of American Companies (1990 - 2000) Using the KMV Model
Chenyu Qiu
Abstract: In this article, we address two main questions: i) what is the KMV model and how does it predict the default probability of listed companies in America and ii) after obtaining the probability of default of a listed American company, is there a relation between the returns and the probability of default? By testing the performance of listed American companies, we obtain the result that companies with larger probability of default have larger returns.

Pricing Options Using the Tree Method in a Switching Model with State Dependent Switching Rates

Jing Dan Zhang

Abstract: In this project we develop and test a tree method for pricing both European and American options in a regime-switching model where the switching rates depend on the underlying price process. The tree grows linearly as the number of time steps increases. Thus it enables us to use large number of time steps to obtain more accurate approximations of the true option prices. A number of examples are reported.

Pricing Options in Jump Diffusion Models Using the Fast Fourier Transform

Zhiyang Zhang

Abstract: The Fast Fourier Transform (FFT) can be used to calculate option prices from the characteristic function of the underlying price process. This project develops and numerically tests the FFT method for pricing European options in jump diffusion models. Three different types of jump sizes are examined. Numerical results are reported and compared.

Efficiency comparison of Moody's KMV model and Altman's Z-score model predicting corporate default with empirical U.S. data

Jing Nie

Abstract: After a revolution in credit risk measurement has taken place in 1990, credit ratings have been an essential part of global financial market for decades. In this article, we talk about a comparative analysis of effectiveness of KMV model and Z-score model in predicting corporate default in U.S. Market. We use Moody's KMV model and Altman's Z-score model to predict and estimate the default probability. We use Logistic Regression method to test the predicting power of the two models. To do all of these, we try to solve two main questions in this paper: first, how accurate the Moody's KMV model and Altman's Z-score model can predict the default probability; second, which one is more effective in default probability prediction between KMV model and Z-score model. Following all those questions in our mind, we find the answers. In order to avoid the noises and make more accurate, we get all data winsorized. We find that Moody's KMV model performs better then Altman's Z-score performs in predicting corporate failures in U.S. financial market by testing the performance of Logit-KMV and Logit-Z. We also construct the cumulative accuracy profiles (CAP) and the receiver operating characteristic (ROC) to test the two models performs. We got the same result. By creating a control sample to make the bankrupt sample and non-bankrupt sample more comparable, the testing result is same.

Asset Pricing in Policy Uncertainty Periods

Hanan Aljubran

Abstract: This project focuses on studying the relation between stock market beta and average returns depending on policy uncertainty level, which is the level of uncertainty of maintaining the government policy. Also, we examine the behavior of Capital Asset Pricing Model (CAPM) during high vs. low uncertainty periods. We focus our study in 25 Fama-French size and Book-to-market sorted portfolios for the period 1985-2013.

A Green's function for a Two-Term Second Order Differential Operator

Mohammed Aldandani

Abstract: A series representation of the Green's function associated with the boundary value problem,

$$-u''(t) = a(t)u = w(t)f\big(t, u(t)\big), 0 < t < 1,$$

$$u(0) = 0, \;\; u'(1) = 0,$$

is constructed. Sufficient conditions on a are given such that the series representation converges absolutely and uniformly. An application of the contraction mapping principle is given to provide sufficient conditions for the existence and uniqueness of solutions of the boundary value problem.