**Min Wang**
Department of Mathematics
University of Tennessee at Chattanooga
Chattanooga, TN

**Friday, September 14, EMCS 422, 2:00-3:00 pm.**

## Fractional Boundary Value Problems with Integral Boundary Conditions

**Abstract**. In this talk, we study a type of nonlinear fractional boundary value problem with integral boundary conditions. By constructing an associated Green's function, applying spectral theory, and using fixed point theory on cones, we obtain criteria for the existence, multiplicity, and nonexistence of positive solutions.

*This talk would be appropriate for graduate students with an interest in differential equations.*

**Sergei Avdonin**
Department of Mathematics
University Tennessee at Chattanooga
Chattanooga, TN

**Friday, September 21, EMCS 422, 2:00-2:50 pm.**

## Boundary Control Approach to Inverse Spectral and Dynamical Problems

**Abstract**. The Boundary Control (BC) method is based on the deep connection between control theory for partial differential equations and inverse problems of mathematical physics and offers an interesting and powerful alternative to previous identification techniques based on spectral or scattering methods. This approach has several advantages: (i) it is applicable to a wide range of linear lumped and distributed systems and reconstruction situations; (ii) it is, in principle, dimension-independent; (iii) it lends itself to straightforward algorithmic implementations. Being originally proposed for solving the boundary inverse problem for the multidimensional wave equation, the BC method has been successfully applied to all main types of linear equations of mathematical physics. In this talk we discuss connections between the BC method and the classical Gelfand--Levitan and Krein theories, and the recently proposed Simon and Remling approaches. We also demonstrate how our approach can be extended to inverse problems on graphs.

*This talk will be appropriate for graduate students with an interest in analysis and differential equations.*

**Xuhua (Roy) Liu**

Department of Mathematics University
Tennessee at Chattanooga
Chattanooga, TN

**Friday, October 5, EMCS 422, 2:00-2:50 pm.**

## Connectedness, Hessian, and Generalized Numerical Range

**Abstract.** For any complex square matrix A, the classical numerical range W(A) of A is the set of all complex numbers of the form x*Ax, where x is a complex unit vector. One of the many nice properties of numerical range is that W(A) is always convex for any A. There are many generalizations of the classical numerical range motivated by theories and applications in the last decades. This talk is a brief survey on some generalized numerical range associated with a semisimple Lie algebra. We give another proof of the convexity of a generalized numerical range associated with a compact Lie group via a connectedness result of Atiyah and a Hessian index result of Duistermaat, Kolk and Varadarajan.

*This talk will be appropriate for graduate students with an interest in matrix theory and Lie theory.*

**Aniekan Ebiefung**
Department of Mathematics
University Tennessee at Chattanooga
Chattanooga, TN

**Friday, November 9, EMCS 422, 2:00-2:50 pm.**

## Choice of Technology and Industrial Pollution

**Abstract**. A mathematical model for controlling the generation of industrial pollution by choosing the right set of technologies is provided. The method is based on the Leontief input – output techniques. It is shown that the model is equivalent to a vertical linear complementarity problem, an optimization problem with many areas of applications. Using results from complementarity theory, we provide conditions for existence of solutions for the model.

*This talk will be appropriate for all students.*

**Katya Nurtazina**
Department of Mathematics
L.N. Gumilyov Eurasian National University
Astana, Kazakhstan

**Friday, November 30, EMCS 422, 2:00-2:50 pm.**

## Mathematical Models of Economics

**Abstract**. Dr. Katya Nurtazina will tell us a little about modern Kazakhstan, its capital, Astana, her university, and her department.
In the second part of her talk she will briefly describe her research in mathematical models of economics.

Dr. Katya Nurtazina came to UTC for a short period of time to work with the Chair of Excellence in Applied Mathematics, Prof. Sergei Avdonin.

*This talk will be appropriate for all students.*

**Cuilan (Lani) Gao**

Department of Mathematics
University Tennessee at Chattanooga

**Friday, January 25, EMCS 422, 2:00-2:50 pm.**

## Empirical Bayesian Selection of Hypothesis Testing Procedures for Exploring the Miracle of Human Genetic Sequencing Data

**Abstract.** Differential expression analysis of genetic sequencing data involves performing a large number of hypothesis tests that compare the expression count data of each gene or transcript across two or more biological conditions. It is very unlikely that the assumptions of any specific hypothesis testing method will be valid for every single gene. Thus, computational evaluation of assumptions should be incorporated into the analysis to select an appropriate hypothesis testing method for each gene. Here, we generalize earlier work to introduce two novel procedures that use estimates of the empirical Bayesian probability (EBP) of overdispersion to select or combine results of a standard Poisson likelihood ratio test and a quasi-likelihood test for each gene. These EBP-based procedures simultaneously evaluate the Poisson-distribution assumption and account for multiple testing. The new procedures outperformed previously published methods in many simulation studies. How the framework used to develop the new procedures to further enhance performance will be discussed through a real world data analysis.

*This talk will be appropriate for graduate students with an interest in statistics or biomedical research.*

**Betsy Darken**
Department of Mathematics
University of Tennessee at Chattanooga
Chattanooga, TN

**Friday, February 1, EMCS 422, 2:00-2:50 pm.**

## Critical Thinking, Mathematics, and Quantitative Literacy

**Abstract**. Critical thinking is the process of conceptualizing, applying, and analyzing information to make reasoned judgments. It is a key goal of university education—and a weakness of UTC students. Quantitative literacy is knowledge of and confidence with basic mathematical concepts required for problem-solving, decision-making, economic productivity and real-world applications. It is also a weakness of UTC students. In this talk, intended for general audiences, I will address how we can improve our students' critical thinking and quantitative literacy within the study of mathematics as well as other disciplines.

*This talk will be appropriate for anyone interested in critical thinking, mathematics, or general quantitative reasoning abilities.*

**Sumith Gunasekera**
Department of Mathematics
University of Tennessee at Chattanooga
Chattanooga, TN

**Friday, February 15, EMCS 422, 2:00-2:50 pm**

## <u>Generalized Variable Method Inference for the Location Parameter of the Half-normal Distribution</u>

**Abstract.** This talk considers the development of inferential techniques for the location parameter of the half-normal distribution based on the generalized variable method. We are interested in hypothesis testing of, and interval estimation for, the location parameter. Body fat data and simulated data are used to illustrate the application and to demonstrate the advantages of the proposed generalized variable method over the large-sample method.

*This talk will be appropriate for graduate students with an interest in statistics research.*

**Roger Nichols**
Department of Mathematics
University of Tennessee at Chattanooga
Chattanooga, TN

**Thursday, February 28, EMCS 422, 3:00-4:00 pm.**

## Positivity Preserving Semigroups and Heat Kernel and Green's Function Bounds

**Abstract**. The property of positivity plays a prominent role in various mathematical contexts. The concept of a positivity preserving linear operator originally arose as a means for constructing an infinite dimensional vector space analog of the usual Frobenius--Perron theorems from elementary matrix theory. This positivity preserving notion can be exploited to prove non-degeneracy of the smallest eigenvalue and the existence of a corresponding positive eigenfunction for certain linear eigenvalue problems. In this talk, we review the basics of compact linear operators and the theory of positivity preserving operators. Then, exploiting these concepts along with operator domination techniques, we establish Gaussian upper bounds for the heat kernels of Schr\"odinger-type operators on bounded Lipschitz domains with (possibly, non-local) Robin-type boundary conditions. Green's function estimates are also discussed.

*This talk is based on joint work with Fritz Gesztesy (University of Missouri) and Marius Mitrea (University of Missouri).*

*The talk will be appropriate for graduate students with an interest in matrix/operator theory or partial differential equations.*

**Lingju Kong**
Department of Mathematics
University of Tennessee at Chattanooga
Chattanooga, TN

**Thursday, March 28, EMCS 422, 3:00-3:50 pm.**

**Infinitely Many Solutions for a Discrete Fourth Order Periodic Boundary Value Problem**

**Abstract.** The authors study the discrete fourth order periodic boundary value problem $(Lu)(t)=\lambda f(t,u(t))+\mu g(t,u(t))$, $t\in [1,N]_{Z}$, $\Delta^i u(-1)=\Delta^i u(N-1)$, $i=0, 1,2, 3$, where $(Lu)(t)=\Delta^4 u(t-2)-\Delta\big(p(t-1)\Delta u(t-1)\big)+q(t) u(t)$.

By using variational methods and critical point theory, they obtain some criteria for the existence of infinitely many solutions. Several consequences of the main theorems are also presented. One example is included to illustrate the applicability of the results.

*\* Joint work with John R. Graef, Yu Tian, and Min Wang.*

*The talk will be appropriate for graduate students with an interest in differential equations.*

**Ron Smith**
Department of Mathematics
University of Tennessee at Chattanooga
Chattanooga, TN

## <u>Principally Normal Matrices</u>

**Abstract**. Normal matrices in which all principal submatrices are normal are said to be principally normal. Various characterizations of irreducible matrices in this class are given. Notably, it is shown that an irreducible matrix is principally normal if and only if it is normal and all of its eigenvalues lie on a line in the complex plane. Such matrices provide a generalization of the Cauchy interlacing theorem.

*The talk will be appropriate for graduate students with an interest in Linear Algebra.*

**Andrew Ledoan**

Department of Mathematics

University of Tennessee at Chattanooga

Chattanooga, TN

## Differences between consecutive primes

**Abstract.** In 1976, Gallagher proved that the Hardy-Littlewood prime k-tuple conjecture implies that, for the primes up to x, the number of primes in the interval $(x, x + \lambda \log x]$ follows a Poisson distribution with mean $\lambda$, where $\lambda$ is any fixed positive constant. Very recently, Professor Daniel A. Goldston (San Jose State University) and I proved that the number of consecutive primes with difference $\lambda \log x$ has the Poisson distribution superimposed on the conjectured asymptotic formula for pairs of primes with this difference. In this talk, I will present an extension of Gallagher's theorem and more precise asymptotic formulas if $\lambda$ approaches zero as x tends to infinity. In order to establish these asymptotic formulas, we also proved new singular series average results.

*This talk is appropriate for all students with an interest in number theory.*

**Charles Johnson**
Department of Mathematics
College of William & Mary
Williamsburg, Virginia

**Friday, May 17, EMCS 211, 10:00-10:50 am.**

## Points, Lines, Planes and Totally Positive Matrices, the 3/2, 4/3 Mystery

**Abstract.** We mention a new connection between TP matrices and point/line incidences that helps to answer a question about Perturbation of totally nonnegative matrices to totally positive matrices.

*Students are welcome to attend the talk.*

**Boris Belinskiy ***
Department of Mathematics
University of Tennessee at Chattanooga
Chattanooga, TN

**Friday, July 12, EMCS 422, 1:00-2:00 pm.**

**On Controllability of a Linear Elastic String and Beam with Memory ****

**Abstract.** We are motivated by the problem of control for a non-homogeneous elastic string or beam with memory. We reduce the problem of controllability to a non-standard moment problem. The solution of the latter problem is based on an auxiliary Riesz basis property result for a family of functions quadratically close to the nonharmonic exponentials. This result requires the detailed analysis of an integro-differential equation and is of interest in itself for Function Theory.

*\* This is a joint research with Sergei Avdonin.*

*\*\* This talk would be appropriate for the graduate and senior undergraduate students.*