**Lingju Kong**

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

**Thursday, September 29, EMCS, 4:30-5:20 pm.**

***Positive almost periodic solutions for a first order functional differential equation with time-varying delays and a forcing term***

**Abstract:** In this paper, we study the forced first order functional differential equation with multiple time-varying delays \begin{equation*} u'(t)=-\alpha(t)u(t)+\sum_{i=1}^{m}\beta_i(t)f_i(t,u(t-\tau_i(t)))+\gamma(t). \end{equation*}

Existence and uniqueness criteria are obtained for the positive almost periodic solutions when f_i(t,x) is singular at x=0. The applications of our results to several well-known mathematical models such as the Nicholson blowflies model, the Lasota-Wazewska model, and the Mackey-Glass model, are also presented.

*This talk is based some recent joint work with Dr. John R. Graef of UTC.*

*This presentation would be appropriate to the graduate students as well as to the senior undergraduate students.*

**Sumith Gunasekera**

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

**Friday, October 7, EMCS 422, 2:00-2:50 pm.**

***Generalized Inferences for the Common Shape Parameter of Several Pareto Populations***

**Abstract:** It is well known that highly-positively-skewed thick- upper tail parametric distributions are frequently used in modeling loss payment data in actuarial and insurance industries. These loss payment data typically arise due property damages caused by fire, flood, hurricane, earthquake, tornadoes, and etc. The key parametric distribution for modeling larger loss payment data is the positive-skewed, power-law, fractal, and heavy-tailed Pareto distribution (also referred to as the "Bradford distribution"). This Pareto has been defined in terms of the mode (which is also referred to as the `scale' or the `location' parameter) and a shape parameter (which is also referred to as the 'index of inequality'). Furthermore, several Pareto populations are widely used in Computer Networking and Data Transmission to model self -similar network traffic that can be generated by aggregating or multiplexing several Pareto distributed ON/OFF sources. One of the problems of interest in this presentation is statistical inferences concerning the common shape parameters of the several Pareto distributions based on the Generalized Variable Method (GVM). In this regard, we have developed generalized tests and generalized confidence intervals for the common shape Pareto parameter based on the GVM. The resulting procedures are easy to compute and are also applicable to small samples. We have also compared this test to a large sample test. An example is given in order to illustrate results. A limited simulation study is carried out to compare the performance of these generalized procedures based on the Generalized Variable Method with the approximate procedures (or asymptotic procedures) based on the Large Sample Method. In particular, using an example, it is pointed out that simply comparing the classical and generalized p-values can produce a different conclusion and, therefore, the generalized pivotal quantities and generalized test variables have proved to be very useful tools for making inference in practical problems.

*This presentation would be appropriate to the graduate students as well as to the senior undergraduate students.*

**Michael Penn**

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

**Friday, October 14, EMCS 422, 2:00-2:50 pm.**

***Vertex Algebras: Background, Motivation, and Examples***

*Abstract:* Introduced in 1986, vertex algebras have wide reaching applications into the representations of Lie algebras, the theory of sporadic simple groups, and string theory. While reviewing some necessary background material we will discuss some possible research projects for advanced undergraduates and grad students. We will also explore the basic definitions as well as some standard examples, including those built from integral lattices. Finally, there will be a discussion of some recent results involving the so called principal subalgebra of a lattice vertex (operator) algebra. These results have applications into the representation theory of affine Kac-Moody Lie algebras and may lead to the construction of new generalized Rogers-Ramanujan q-series identities.

*This talk will be appropriate for graduate, as well as advanced undergraduate students.*

**Antun Milas**

**Department of Mathematics**
**University at Albany, State University of New York**
**New York**

**Thursday, December 1, EMCS 216, 4:25-5:25 pm.**

***Lie Algebras and Their Representations for Non-Experts***

*Abstract.* Famous Norwegian mathematician Sophus Lie once said about his work "I'm certain, absolutely certain that...these theories will be recognized as fundamental at some point in the future." Indeed, more than a century after we know that he was absolutely right. The notions of "Lie groups" and "Lie algebras" are important tools across the entire mathematical spectrum, from mathematical physics to combinatorics, from number theory to geometry.

In this talk, starting from basic matrix algebra, I will explain how to arrive to structurescalled semisimple Lie algebras, and give an outline of their classification. Then I will go on to discuss several fundamental results of Hermann Weyl on their internal structure. Finally, as an application of these concepts, I will show how to use Lie theory to prove several classical results (going back to Euler and Jacobi), and their generalizations.

*This talk is meant to be elementary and accessible to anyone with a background in linear algebra*

**Matt Matthews***

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

**Friday, January 20, EMCS 422, 2:00-3:00 pm.**

***A Comparison of Local Methods for an Inverse Problem on a Semi-axis***

**Abstract.** This talk compares two methods for recovering an unknown potential on a semi-axis: a local version of Gelfand-Levitan and a newer approach, also local, that comes from the theory of boundary control. In both cases, appropriate data from the forward problem must be produced, and two methods are given for this problem as well, one spectral and the other dynamical. The efficacy of these methods is shown through numerical experiments.

*This talk would be appropriate for advanced undergraduates and graduate students, especially those with an interest in differential equations and numerical analysis.*

** in co-authorship with Boris Belinskiy*

**Min Wang**

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

**Friday, February 10, EMCS 422, 2:00-3:00 pm.**

***Positive solutions of nonlinear fractional boundary value problems with Dirichlet boundary conditions***

**Abstract**. In this talk, we study the existence and multiplicity of positive solutions of a class of nonlinear fractional boundary value problems with Dirichlet boundary conditions. By applying the fixed point theory on cones we establish a series of criteria for the existence of one, two, any arbitrary finite number, and an infinite number of positive solutions. A criterion for the nonexistence of positive solutions is also derived. Several examples are given for demonstration.

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

**Andrew Ledoan**

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

**Friday, February 17, EMCS 422, 2:00-2:50 pm.**

***Zeros of partial sums of the Riemann zeta-function***

**Abstract.** It was Riemann's ingenious contribution to number theory to point out how the distribution of the non-trivial zeros of a special function of a complex variable, called the zeta-function, are linked to the distribution of the prime numbers. In his only one but outstanding and far-reaching paper on number theory from 1859, Riemann outlines how Gauss' conjecture (the assertion that the number of prime numbers up to a given magnitude is well-approximated by the logarithmic integral) could be proved by using the zeta-function. However, at Riemann's time the theory of functions of a complex variable was not developed sufficiently far, but the open questions concerning the zeta-function pushed the research in this field swiftly forward. In this colloquium talk, I shall briefly discuss Riemann's memoir and present some results on the distribution of the zeros of the partial sums of the zeta-function, which provide a good approximation to the zeta-function. (This is based on joint work with Professor S. M. Gonek at the University of Rochester.)

*This talk would be appropriate for undergraduate and graduate students who have taken a course in complex analysis.*

**Yu Tian**

**Department of Mathematics**
**Beijing University of Posts and Telecommunications, Beijing, China**
**Visiting Scholar at Baylor University, Waco TX, USA**

**Tuesday, February 28, EMCS 232, 3:00-3:50 pm.**

***Applications of Variational methods and Critical Point Theory to Impulsive Boundary Value problems***

**Abstract.** One of the important research branch of impulsive differential equations is existence theory. The main research tool of existence theory is the theory and methods in nonlinear functional analysis. In this talk we discuss how to apply the theory and methods of nonlinear functional analysis to impulsive boundary value problem. In particular, we discuss how to apply variational methods and critical point theory to impulsive differential equation with Sturm-Liouville boundary conditions. At the same time, several sufficient conditions are presented in guaranteeing several existence results.

The first part of talk is some definitions and basic theory in variational methods and critical point theory. The second part is recent work in impulsive boundary value problems. The third part is open problems.

*This talk would be appropriate for undergraduate and graduate students who have taken a course in differential equations.*

**Cuilan "Laney" Gao**
**Postdoctoral Research Associate**

**Department of Biostatistics**
**St. Jude Children's Research Hospital, Memphis, TN**

**Monday, March 5, EMCS 232, 10:00-10:50 am.**

***A Statistical Procedure to Evaluate the Fidelity of Mouse Model of Human Disease***

**Abstract.** An important problem in translational genomics is to evaluate the fidelity of an animal model of a human disease. By doing that, drug safety and efficacy can be pre-tested before conducting clinical trials on human. A statistical procedure (called AGDEX) is developed to evaluate the agreement of the results of a differential gene expression level between control and tumors in mouse with those of in humans. AGDEX uses agreement statistics to measure the similarity of expression differences for pre-defined sets of ortholog-matched genes. Significance is determined by permutation test. In a pediatric cancer genomics studies, AGDEX was used to determine that a brain tumor in a mouse model showed a similar gene expression profile to that of a specific human brain tumor subtype. In both studies, these results were confirmed by subsequent laboratory investigation which revealed that the model shows remarkable histological similarities to the identified human tumor. The result leads to the identification of the cell of origin for this type of pediatric brain cancers and as well as some fundamental biological questions.

*Dr. Gao is interviewing for a Tenure-track Statistics faculty position.*

**S. G. Sajjadi***
**Professor of Theoretical Fluid Mechanics and Director of Research**
**Department of Mathematics**
**Embry-Riddle Aeronautical University, FL**

**Thursday, March 22, EMCS 402, 2:00-3:00 am.**

***Numerical Simulation of a Tornado Vortex around Complex Topographies***

**Abstract.** A numerical simulation of tornado vortex through a populated urban area is presented. This study is motivated by an F2 tornado which struck the Embry-Riddle Aeronautical University (ERAU), Daytona Beach campus, in December 2006. The computational domain for this study is that of the ERAU campus comprising of different buildings. Various turbulence models is adopted for computation of the turbulent flow around these complex shaped buildings. The model includes an artificial tornado vortex being generated using pressure gradient. This study also aims to answer some questions about the character of turbulent transport due to interaction of a tornado vortex with surfaces, The result of simulations obtained serves as a first step towards a more complete and realistic tornado model.

**Professor Sajjadi is a candidate for the position of Unum Chair of Excellence in Applied Mathematics.*

**Bruce Landman***
**College of Science and Mathematics**
**University of West Georgia, Carrollton, GA**

**Thursday, March 29, EMCS 402, 2:00-3:00 am.**

***Ramsey Functions Related to Van der Waerden's Theorem on Arithmetic Progressions***

**Abstract.** Ramsey theory may be loosely described as the study of the preservation of properties under set partitions. A classical theorem of van der Waerden, proved in 1927, states, in particular, that for every positive integer k, there is a least positive integer w(k) such that for every partition of {1,2,…,w(k)} into two subsets, at least one of the subsets contains an arithmetic progression of length k. Moreover, the theorem holds for partitions into r subsets, for any finite r; the corresponding numbers, w(k; r), are referred to as the *van der Waerden numbers*. Finding the rate of growth of the van der Waerden numbers has been a notoriously difficult problem. The best known lower bound on w(k) is (k-1)2^(k-1), for k prime, while the best upper bound is 2^{2{^{2^{2^{2^{(k+9)}}}}}}. More generally, for a family, *F*, of sequences of positive integers, define f(***F***,k;r) be the least positive integer n (if it exists) such that whenever {1,2,…,n} is partitioned into r sets, at least one of the sets contains a k-term member of *F*. If f(*F*, k; r) exists for all k and r, we say that *F* is *regular*; otherwise, the largest value of r such that f(*A*, k; r) exists for all k is called the *degree of regularity* of *A*. In this talk, we consider f(*A*, k; r) and the degree of regularity of *A* for some select families *A*, including some generalizations of the van der Waerden numbers. We conclude with some results on the van der Waerden numbers themselves.

**Professor Landman is a candidate for the position of Unum Chair of Excellence in Applied Mathematics.*

**Sergei Avdonin***
**Department of Mathematics**
**University of Alaska Fairbanks**

**Monday, April 2, Holt 124**, 2:00-3:00 pm.**

***Nonharmonic Fourier Series in Control Theory and Signal Processing***

**Abstract.** The goal of this talk is to describe connections between nonharmonic Fourier series, control theory, inverse problems of mathematical physics, and signal processing. In particular, we describe some classical and recent results on exponential bases and their applications to control theory. We discuss also an approach to inverse problems (the so-called Boundary Control Method) which is based on deep connections between controllability and identification problems and is applicable to a wide range of linear systems.

As an example of the approach, we consider control and inverse problems for differential equations on graphs. We suppose that on each edge of the graph the wave (or heat, or Schrödinger) equation is defined, and that some compatibility conditions are satisfied at the internal vertices. We investigate boundary controllability and boundary identifiability of the system.

We demonstrate effectiveness of the Boundary Control Method on a classical problem of signal processing --- the spectral estimation problem. Sampling and interpolation problems of band-limited and multi-band signals will also be discussed.

**Professor Avdonin is a candidate for the position of Unum Chair of Excellence in Applied Mathematics.*

**Johannes Hattingh**
**Mathematics Department**
**East Carolina University**
**Greenville, NC**

**and**

**Lucas Van der Merwe, Ossama Saleh, and Terry Walters**
**Department of Mathematics**
**University of Tennessee at Chattanooga**
**Chattanooga, TN**

**Thursday, May 17, EMCS 422, 2:00-2:50 pm.**

***Nordhaus-Gaddum Results for the Sum of the Induced Path Number of a Graph and its Complement***

**Abstract.** The induced path number $\rho(G)$ of a graph $G$ is defined as the minimum number of subsets into which the vertex set of $G$ can be partitioned so that each subset induces a graph. Broere {\it et al showed that if $G$ is a graph of order $n$, then $\sqrt{n\leq \rho(G)+\rho(\overline{G)\leq\lceil{{3n\over 2\rceil$. In this paper, we characterize the graphs $G$ for which $\rho(G)+\rho(\overline{G)=\lceil{{3n\over 2\rceil$, improve the lower bound on $\rho(G) +\rho(\overline{G)$ by one when $n$ is the square of an odd integer, and determine bounds for $\rho(G)+\rho(\overline{G)$ when neither $G$ nor $\overline{G$ has isolated vertices.

*This presentation would be appropriate to the graduate students as well as to the senior undergraduate students.*

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

**Tuesday, May 22, 2012, EMCS 422, 2:00-2:50pm**

***New Generalizations of the Field of Values to Pairs of Matrices***

**Abstract.** The classical field of values of a square matrix A (F(A)) is the range of the Hermitian quadratic form of A over the unit sphere in C_n. It is of both theoretical and applied (e.g. pde's) interest. Two generalizations to pairs of matrices have arisen recently, one, the ratio field, because of need for assessing convergence of a numerical computational scheme. The two are the product field and the ratio field. Unlike the classical field, neither is convex, but we concentrate on giving results about the shape of each. In both cases, the shape is "convex-like."

*This presentation would be appropriate to the graduate students as well as to the senior undergraduate students.*

**Francesco Barioli**
**Department of Mathematics**
**University of Tennessee at Chattanooga**
**Chattanooga, TN**

**Tuesday, May 29, EMCS 422, 2:00-2:50 pm.**

***Parameters Related to Tree-Width, Zero Forcing, and Maximum Nullity of a Graph***

**Abstract.** Tree-width, and variants that restrict the allowable tree decomposition, play an important role in the study of graph algorithms and have application to computer science. The zero forcing number is used to study the maximum nullity/minimum rank of the family of symmetric matrices described by a graph. We establish relationships between these parameters, including several Colin de Verdière type parameters, and introduce numerous variations, including the minor monotone floors and ceilings of some of these parameters. This leads to new graph parameters and to new characterizations of existing graph parameters.

*This presentation would be appropriate to the graduate students as well as to the senior undergraduate students.*