COLLOQUIUM Fall 2009

Lingju Kong

Department of Mathematics

University of Tennessee at Chattanooga

Wednesday, September 23, EMCS 211, 2:00-3:00 pm.

Uniqueness and Dependence Results for Second Order Boundary Value Problems

Abstract. We consider the boundary value problem with nonhomogeneous multi–point boundary condition

$$u + a(t)f(u) = 0,\ 0 < t < 1,$$

$$u(0) = \sum_{i=1}^{m} a_i u(t_i) + \lambda,\ u(1) = \sum_{i=1}^{m} b_i u(t_i) + \mu.$$

A sufficient condition is obtained for the existence and uniqueness of a positive solution. The dependence of the solution on the parameters λ and μ is also studied. Our work complements some recent results in the literature, especially those in our earlier papers [L. Kong, Q. Kong, Second order boundary value problems with nonhomogeneous boundary conditions (I), Math. Nachr. 278 (2005), 173193; L. Kong, Q. Kong, Second order boundary value problems with nonhomogeneous boundary conditions (II), J. Math. Anal. Appl. 330 (2007), 1393–1411].

This talk is based on some recent joint work with Professor Qingkai Kong from Northern Illinois University.

COLLOQUIUM Fall 2009

Miroslav Bartusek

Department of Mathematics

Masaryk University
Brno, The Czech Republic
Tuesday, October 6, EMCS 422, 3:00-3:50 pm.

On Noncontinuable Solutions of Differential Equations with Delays

Abstract. In this lecture, noncontinuable solutions (i.e., solutions that are defined on a finite interval only and can not be defined for large t) of n-th order differential equations with delays are studied. Necessary and sufficient conditions for their existence are presented.

COLLOQUIUM Fall 2009

Francesco Barioli

Department of Mathematics

University of Tennessee at Chattanooga

Friday, October 23, EMCS 422, 2:00-3:00 pm.

Delta Conjecture and GCC Conjecture on Minimum Rank Problems

Abstract. A Minimum Rank Problem asks for the minimum among the ranks of all matrices in a prescribed class. In particular, we will study the Minimum Rank Problem for the class of symmetric matrices and the class of positive semidefinite matrices, under an additional zero-pattern constraint. As the zero-pattern defines in a natural way an undirected graph, we may investigate how graph parameters, like the degree of a vertex, diameter, path cover number and others, may determine lower and upper bounds for the minimum rank.

In this talk I will present an overview on the currently two main conjectures on the topic: the Delta Conjecture, which connects the minimum rank with the minimum degree of a graph, and the Graph Complement Conjecture (GCC) which connects the minimum rank of a graph with the minimum rank of its complement.

Students with some interest in research and no particular background other than Math 212 are strongly encouraged to attend this talk.

COLLOQUIUM Fall 2009

Deborah Shepherd

Department of Mathematics

University of Tennessee at Chattanooga

Friday, October 30, EMCS 422, 2:00-3:00 pm.

Using Copulas in Quality Control

Abstract. Multivariate quality control charts and procedures have been developed to monitor processes in which one or more dependent quality characteristics are of concern. There have been several popular methods suggested in order to monitor this type of process. The Hotelling T^2 control chart for monitoring the mean vector of the process is one of the most popular methods used when the underlying variables are assumed to have a bivariate normal distribution. Methods for constructing control charts and procedures for monitoring dependent quality characteristics with underlying distributions that are not bivariate normal are not as prevalent in the literature. This talk will present the concept of using copulas to model bivariate processes in which the underlying distribution of the quality characteristics are known but are not normal.

Copulas, first introduced by Sklar in 1956, provide a way to represent the cumulative distribution function of two or more dependent random variables in such a way that the marginal cumulative distribution functions of each of the random variables and the dependence structure may be separated. This talk will present an overview of copulas and some basic properties of copulas. An example of how copulas may be used to monitor processes will hopefully (still working on it!) be presented.

Students that have taken at least math 151 with an interest in statistics or actuarial science may find this talk of interest.

COLLOQUIUM Fall 2009

Meg Kiessling and Matt Matthews

Department of Mathematics

University of Tennessee at Chattanooga
Friday, November 6, EMCS 422, 2:00-3:00 pm.

Computer-Based Homework Trials in MATH 151 and MATH 136

Abstract. Online homework has become widely available for many disciplines and textbooks, including the texts adopted by the UTC Department of Mathematics for its Calculus and Business Calculus courses. We present our initial classroom experiences with the two different online homework products, MyMathLab (used with MATH 151) and MathZone (used with MATH 136). Data on grades will be presented along with commentary on how students use the systems and how the homework relates to the coursework. The use of MathZone with Math 136 this term provided a unique opportunity to compare students in the same class who did and did not use the on-line homework program.

COLLOQUIUM Spring 2010

Sumith Gunasekera

Department of Mathematics

University of Tennessee at Chattanooga

Wednesday, January 27, EMCS , 2:00-3:00 pm.

Generalized Inferences for the Common Location Parameter of Several Exponential Populations

Abstract. The Generalized Statistical Inferences of the common location parameter θ of several exponential distributions in the face of unknown and possibly unequal scale parameters are discussed. Using the Generalized $p-$ value Approach based on the Generalized Variable Method, Exact Confidence Intervals and the Exact Tests for testing the common location parameter θ are given. This new approach is compared with the existing Classical Approach as well the Inverse Normal Approach through Examples. A limited simulation study is given to demonstrate the performance of the proposed procedure.

This talk is appropriate for students who have taken Math 307.

COLLOQUIUM Spring 2010

Davut Tuncer

Department of Mathematics

University of Tennessee at Chattanooga

Thursday, March 23, EMCS 422, 3:05-3:55 pm.

The Left-Definite Spectral Analysis of the Fourth-Order Legendre Type Differential Equation

Abstract. In this talk, we develop the left-definite spectral theory associated with the self adjoint operator T in $L_{\mu}^{2}[-1,1]$, generated from the fourth-order Legendre type differential equation

$$\ell[y](x) = \left(\left(1-x^{2}\right)y''(x)\right)'' - \left(8+4A\left(1-x^{2}\right)y'(x)\right)' + ky(x)$$
$$= \lambda y(x), \quad (x \in (-1,1))$$

that has the Legendre type polynomials $\{P_{m,A}\}_{m=0}^{\infty}$ as eigenfunctions. More specifically, for each $n \in \mathbf{N}$, we explicitly determine the unique left-definite Hilbert-Sobolev space H_n and its associated inner product $(\cdot,\cdot)_n$. Moreover, for each $n \in \mathbf{N}$, we determine the corresponding unique left-definite self-adjoint operator T_n in H_n and characterize its domain in terms of another left-definite space. The key to determining these spaces and inner products is in finding the explicit Lagrangian symmetric form of the integral composite power of $\ell[\cdot]$. In turn, the key to determining these powers is a remarkable new identity involving two sequences $\{a_n(j,k)\}$ and $\{b_n(j,k)\}$ of numbers which we call Legendre type-Stirling numbers of types 1 and 2.

This talk is appropriate for students who have taken some Analysis or Advanced Calculus.

COLLOQUIUM Spring 2010

Boris Belinskiy and Matt Matthews *

Department of Mathematics

University of Tennessee at Chattanooga

Monday, April 5, EMCS 219, 2:00-3:00 pm.

Some Nonlinear and Nonlocal Sturm-Liouville Problems Modeling Wing Stability

Abstract. In this talk we will discuss three Sturm-Liouville problems for nonlinear ordinary differential equations arising from the study of the aeroelastic stability of a wing. In particular, we analyze the solutions for the case in which a nonlocal term, similar to that used in engineering, is incorporated into the model. Along with asymptotic results, the spectrum and eigenfunctions are computed numerically using a modification of the shooting method.

This talk is appropriate for students who have had differential equations or numerical analysis.

* speaker

COLLOQUIUM Spring 2010

John R. Graef

Department of Mathematics

University of Tennessee at Chattanooga
Thursday, April 15, EMCS 219, 3:15-4:05 pm.

Modeling Fish Populations

Abstract. We give sufficient conditions for the existence and global attractivity of a positive periodic solution of the first order nonlinear differential equation

$$N'(t) = -a(t)N(t) + b(t)\frac{N(t)}{1 + \left(\frac{N(t)}{p(t)}\right)^{\gamma}},$$

where the coefficients are periodic functions. This equation is used to model fish populations where $N(t)$ is the population size at time t. The parameter $\gamma > 0$ affects how quickly population density dependence sets in. Examples showing the independence of the different results obtained will be presented. A good bit of the talk will be accessible to anyone who has taken Calculus II. Some open research problems of various difficulty will be indicated, and students who would be interested in working on an undergraduate or graduate research project are especially encouraged to attend.

COLLOQUIUM Spring 2010

Shahla Nasserasr

Graduate student

College of William and Mary
Friday, April 23, EMCS , 2:00-4:00 pm.

The Logarithmic Method and the Solution to the TP $_2$ -Completion Problem

Abstract. A matrix is called TP $_2$ if all 1-by-1 and 2-by-2 minors are positive. The TP $_2$ -completion problem asks which partial matrices have a TP $_2$ -completion. The Bruhat order on permutations and the notion of majorization are generalized to partial orders on nonnegative matrices. Using these partial orders, explicit conditions for TP $_2$ -completability of a given partial matrix are given. It is shown that an m -by- n partial TP $_2$ matrix $\mathcal{T}$ is TP $_2$ -completable if and only if

$$\prod_{t_{ij} \text{ specified}} t_{ij}^{a_{ij}} \geq 1$$

for every matrix $A = (a_{ij}) \in M_{m,n}$, having
(1) $a_{ij} = 0$ if t_{ij} is unspecified;
(2) each row sum and column sum of A is zero;
and (3)

$$\sum_{\substack{1<i\leq p \\ 1<j\leq q}} a_{ij} \geq 0,$$

for all $(p, q) \in \{1, 2, \ldots, m\} \times \{1, 2, \ldots, n\}$. The theory of cones and generators, and the logarithmic method are used to reduce these conditions to a set of minimal conditions. It is shown that the set of matrices used in the exponents of the inequalities forms a finitely generated cone with integral generators. This gives finitely many polynomial inequalities on the specified entries of a partial matrix of given pattern as conditions for TP $_2$ -completability. A computational scheme, along with an illustrative example, for explicitly finding the generators is given.

COLLOQUIUM Spring 2010

Johannes H. Hattingh,

Georgia State University and

Ossama A. Saleh, Lucas C. van der Merwe, and Terry J. Walters,

University of Tennessee at Chattanooga

Friday, May 7, EMCS 238, 2:00-3:00 pm.

A Nordhaus-Gaddum-type Result for the Induced Path Number

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. A Nordhaus-Gaddum-type result is a (tight) lower or upper bound on the sum of a parameter of a graph and its complement. If G is a subgraph of H, then the graph $H - E(G)$ is the complement of G relative to H. In this paper, we consider Nordhaus-Gaddum-type results for the parameter ρ when the relative complement is taken with respect to the complete bipartite graph $K(n, n)$.