

**Sumith Gunasekera**

Department of Mathematics

University of Tennessee at Chattanooga

Chattanooga, TN

Tuesday, September 10, EMCS 211, 4:25-5:15 pm.

**Inference for Alternative Measures of Income Inequality \*\***

**Abstract.** The Theil, Pietra, Éltetö and Frigyes measures of income inequality associated with the Pareto distribution function are expressed in terms of parameters defining the Pareto distribution. Inference procedures based on the generalized variable method (GV-Method), large sample method (LS-Method), and the Bayesian method (B-Method) for testing of, and constructing confidence interval for, these measures are discussed. The results of Monte Carlo study are used to compare the performance of the GV-Method, LS-Method and B-Method for data generated from a population characterized by a Pareto distribution.

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

**Lingju Kong**

Department of Mathematics

University of Tennessee at Chattanooga

Chattanooga, TN

Thursday, October 3, EMCS 211, 4:25-5:15 pm.

### **On a Fourth Order Elliptic Problem with a $p(x)$ -Biharmonic Operator**

**Abstract.** Differential equations and variational problems with nonstandard  $p(x)$ -growth conditions have many applications in mathematical physics such as in the modelling of electrorheological fluids and of other phenomena related to image processing, elasticity, and the flow in porous media. In this work, we study the fourth order nonlinear eigenvalue problem with a  $p(x)$ -biharmonic operator

$$\Delta^2_{p(x)} u + a(x) |u|^{p(x)-2} u = \lambda w(x) f(u) \quad \text{in } \Omega, \quad u = \Delta u = 0 \quad \text{on } \partial\Omega,$$

where  $\Omega$  is a smooth bounded domain in  $\mathbb{R}^N$ ,  $p \in C(\overline{\Omega})$  with  $p(x) > 1$  on  $\overline{\Omega}$ ,  $\Delta^2_{p(x)} u = \Delta(|\Delta u|^{p(x)-2} \Delta u)$  is the  $p(x)$ -biharmonic operator, and  $\lambda > 0$  is a parameter. Under some appropriate conditions on the functions  $p$ ,  $a$ ,  $w$ ,  $f$ , we prove that there exist  $\overline{\lambda} > 0$  and  $\underline{\lambda} > 0$  such that any  $\lambda \in (0, \overline{\lambda})$  and  $\lambda \in (\underline{\lambda}, \infty)$  is an eigenvalue of the above problem. Our analysis mainly relies on variational arguments in critical point theory and some recent theory on the generalized Lebesgue--Sobolev spaces  $L^{p(x)}(\Omega)$  and  $W^{k,p(x)}(\Omega)$ .

*This talk will be appropriate for graduate students with an interest in Differential Equations.*

**Min Wang**

Department of Mathematics

University of Tennessee at Chattanooga

Chattanooga, TN

Thursday, October 10, EMCS 203, 4:25-5:15 pm.

**Uniqueness and Parameter Dependence of Positive Doubly Periodic Solutions of Nonlinear Telegraph Equations**

**Abstract.** In this talk, we study a type of second order nonlinear telegraph equations. The existence and uniqueness of positive doubly periodic solutions are discussed. The parametric dependence of the solutions is also investigated. Two examples are given as applications of the results.

*\*\* This talk will be appropriate for graduate students with an interest in Differential Equations.*

## **Roger Nichols**

Department of Mathematics

University of Tennessee at Chattanooga

Chattanooga, TN

Thursday, October 17, EMCS 203, 4:25-5:15 pm.

### **On Square Root Domains for Non-Self-Adjoint Operators Under Additive Perturbations \*\***

**Abstract.** In 1961, Kato published the first of what was to be a series of papers on fractional powers of linear operators. Kato's impetus for studying fractional powers stemmed from his seemingly unrelated interest in abstract first-order evolution equations, where fractional powers arise in connection with the existence of solutions. Perhaps surprisingly, Kato's papers show that, when domain questions are considered, the square root (i.e., the  $1/2$ -fractional power) can be particularly elusive. In fact, the problem of square root domains was left unanswered by Kato. In the case of uniformly elliptic divergence form partial differential operators, this question became known as the Kato Square Root Problem. The Kato Square Root Problem remained open for 30 years, before being solved in 2002 by a team of mathematicians. The first half of this talk will be introductory in nature and provides a brief overview of fractional powers, sesquilinear forms, and some history on the square root problem. In the second half of the talk, I will present recent results, obtained in collaboration with Fritz Gesztesy and Steve Hofmann (University of Missouri), on stability of square root domains under additive perturbations. Finally, I will present some applications to non-self-adjoint Schrodinger-type operators--including additive perturbations of uniformly elliptic divergence form partial differential operators by singular complex potentials on domains--where our results answer the corresponding square root domain question.

*\*\* This talk will be appropriate for graduate students with an interest in functional analysis, operator theory, or (partial) differential equations.*

**Lani Gao**

Department of Mathematics

University of Tennessee at Chattanooga

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

**A Phenotype-driven Approach to Genes Cluster Analyses with Application to Childhood Cancer Study**

**Abstract.** Among the 12 major types of childhood cancers, leukemias (blood cell cancers) is the most common childhood cancer, which accounts about one-third of childhood cancers. The most common type of leukemia in children is acute lymphoblastic leukemia (ALL). The causes of childhood ALL are largely unknown, while American Cancer Association data shows ALL cancer are related to genes. To find the causal genes are clearly critical to seek new treatment for cancer patients. Genes do not work alone, but in a group which are called clusters. Each cluster works tightly together to perform a particular function. Therefore to detect such gene clusters is essentially very important. Clustering genes is an efficient technique can be used to predict human disease-related gene clusters (networks). Predicting ALL cancer gene clusters is critical to gain understanding of disease mechanism which will lead to in new treatment approaches. However, most of the current gene cluster methods are either computationally expensive or not efficient. In this talk, a more effective and computationally cheaper algorithm for detecting gene clusters will be introduced. A validation algorithm is also proposed to valid the association between the identified gene clusters and ALL cancer.

*This talk will be appropriate for anyone with an interest in biostatistics or bioinformatics.*

**Roy Liu**

Department of Mathematics

University of Tennessee at Chattanooga

Friday, October 25, EMCS 422, 2:00-2:50 pm

### **Geometric Mean for Symmetric Spaces of Noncompact Type**

**Abstract.** The geometric mean of two positive numbers is the square root of their product. In 1975, this concept of geometric mean was first extended for positive operators (and hence for positive definite matrices). Since then, geometric means have gained intensive and increasing interests from operator theorists and linear algebraists, resulting in many significant properties about them published in top journals. However, the very geometric meaning of geometric mean had not been known until 2005. It turns out that the space of positive definite matrices forms a non-Euclidean space of nonpositive curvature and the geometric mean of two points in this space is the middle point of the unique geodesic (a “straight line” to “curved space”) connecting the two points in this curved space. This geodesic is parametrized by  $t$ -geometric mean. In this talk, we will extend the concept of  $t$ -geometric mean of two positive definite matrices to symmetric spaces of noncompact type, which includes the space of positive definite matrices as a special example. The  $t$ -geometric mean of two points in the symmetric space yields the unique geodesic joining the points and the geometric mean is the midpoint. Inequalities about geometric mean and geodesic triangle are given in terms of Kostant's pre-order on semisimple Lie groups as well as on their Lie algebras. Further research on geometric mean for symmetric space of compact type will be discussed as well.

*This talk will be appropriate for graduate students with an interest in matrix theory, group theory, or differential geometry.*

**Andrew Ledoan**

University of Tennessee at Chattanooga

Department of Mathematics

Thursday, October 31, EMCS 203, 4:25-5:25 pm.

**Limit Points of the Sequence of Normalized Differences between Consecutive Prime Numbers**

**Abstract.** In 1955, Erdős proved that the set of limit points of the sequence of normalized differences between consecutive prime numbers has positive Lebesgue measure. At the same time, Ricci also proved independently the same result. The only known limit point at the time was infinity. Then, in 1988, Hildebrand and Maier proved that the set of limit points have arbitrarily large Lebesgue measure. In 2005, Goldston, Pintz, Yıldırım proved that zero is a limit point. Earlier this year, Pintz proved that the recent breakthrough method of Zhang on bounded differences between prime numbers produces an interval  $[0, c]$  of limit points, where  $c$  is an ineffective constant. We are interested in finding two real numbers  $a$  and  $b$  such that the interval  $[a, b]$  must contain at least one limit point. Using the 1966 work of Bombieri and Davenport on differences between prime numbers and the 1976 work of Gallagher on the distribution of primes in short intervals, we were able to obtain a number of intervals not covered by earlier results on limit points. (Based on joint work with Daniel Goldston, San José State University.)

*This talk will be appropriate for advanced undergraduate students and graduate students who have an interest in analysis and number theory.*

## **Marti Wayland**

Chair, Department of Mathematics  
Leadership Baylor  
Baylor School

Friday, November 1, EMCS 422, 2:00-2:50

### **The Life of a High School Math Teacher**

Abstract. It is has been thirteen years since I left UTC's math department to work ten hour days, have no office or phone, and communicate regularly with parents. The world of secondary math is vibrant. Although the basics do not change, the methods of teaching continue to evolve. SmartBoards, iPads, and Wifi enable students to experience mathematics rather than simply watching and listening. Standards in teaching math change as the pendulum is pushed by many factions. Some of the shifts are fabulous, some are infuriating. The high school teacher is in a position of constantly adapting. In my position, I research curriculum, support classroom teachers, and write lessons and units in addition to teaching. I look forward to sharing some of the life of a high school teacher.

Cory Fleming\*

Friday, November 1, EMCS 422, 3:00-3:50

**Schrodinger Equation for the Harmonic Oscillator**

**Abstract.** Schrodinger equation for the harmonic oscillator is considered and its connection with Hermite polynomials is analyzed. The energy levels are established.

*\*Cory Fleming is near the completion of his MS degree at the Applied Mathematics Program of the Math Department. This is a project he presented as a part of his studies.*

**Bo Yang**

Department of Mathematics  
Kennesaw State University  
Kennesaw, GA

Tuesday, November 19, EMCS 203, 4:25-5:15 pm.

**Upper and Lower Estimates for Positive Solutions of a Higher Order Fractional Boundary Value Problem**

**Abstract.** Some new upper and lower estimates are obtained for positive solutions of a higher order fractional boundary value problem. Sufficient conditions for the existence and nonexistence of positive solutions of the problem are established.

*This talk will be appropriate for graduate students with an interest in Differential Equations.*

## **Panel Discussion**

*PANELISTS: Matt Matthews, Betsy Darken, Francisco Barioli, Lani Gao, Meg Kiessling*

Department of Mathematics  
University of Tennessee at Chattanooga  
Chattanooga, TN

Tuesday, November 19, EMCS 422, 3:05-3:55 pm.

### **Panel Discussion on Online Homework: Pros and Cons**

**Abstract.** The widespread use of online homework in college classes is a relatively new development. Does it live up to publishers' promises of being a great boon to education? What are its advantages? What are its disadvantages? In discussing these questions, panelists will provide a literature review, information based their own classroom experiences, and specific suggestions regarding the use of online HW. Panelists may also ponder larger questions such as whether or not online HW promotes students' understanding of mathematical concepts.

*This discussion will be appropriate for everybody who is interested in the modern university education.*