Titles and Abstracts for the SIAM SEAS 2008

(BA= Business Administration Building)

Ugur G. Abdulla (abdulla@fit.edu) – Florida Institute of Technology, Department of Mathematical Sciences, 150 West University Blvd., Melbourne, FL 32901-6975. Saturday 9:15am BA221

Wiener's Criterion at Infinity for the Heat Equation and its Measure-theoretical Counterpart

Abstract: For an arbitrary unbounded open set we introduce a notion of regularity (or irregularity) of the point at infinity concerning the heat equation, according as whether the parabolic measure of ∞ is zero (or positive). A necessary and sufficient condition for the existence of a unique bounded solution to the parabolic Dirichlet problem in arbitrary unbounded open set is established. It is expressed in terms of the Wiener's criterion for the regularity of infinity. The probabilistic counterpart of the Wiener test at infinity presents the final form of the asymptotic law for the multi-dimensional Brownian motion at infinity.

Ravi P. Agarwal (agarwal@fit.edu) – Florida Institute of Technology, Department of Mathematical Sciences, 150 West University Blvd., Melbourne, FL 32901-6975. Saturday 8:45am BA221

Singular Integral Equations with Real World Applications

Abstract: We shall provide easily verifiable sufficient conditions which guarantee the existence of solutions to some singular integral equations. The motivation of these problems comes from real world applications, particularly, in communications theory, and the Homann flow.

Farid AitSahlia (farid@ise.ufl.edu) – Department of Industrial and Systems Engineering, University of Florida, Gainesville, FL 32611. Saturday 8:45am BA220

Efficient Pricing of American Option in a Stochastic Volatility Model with Jumps

Abstract: Several models have recently been developed in order to account for various imperfections with the standard Black-Scholes-Merton option pricing paradigm. Most prominently are those that attempt to capture the occurrence of random jumps (jump-diffusion assumption) and volatility clustering or correlated adjacent returns (stochastic volatility) for the underlying asset. In this talk I present a new numerical procedure to evaluate an American option when the underlying asset returns have a stochastic volatility and are subject to random shocks that occur according to a counting process. The technique relies on the efficient combination of (i) the American option price decomposition formula, which expresses the Doob-Meyer property of supermartingales involving the early exercise surface, and (ii) a coarse approximation of the latter through the least-squares algorithm of Carriere/Longstaff and Schwartz.

Michael O. Albertson (Albertson@math.smith.edu) – Department of Mathematics, Smith College, Northampton, MA 01063. Friday 4:00pm BA107

The Distinguishing Number of a Graph

Abstract: A labeling $\ell : V(G) \to \{1, 2, \ldots, r\}$ is said to be r-distinguishing if the only automorphism of G that preserves the labels is the identity. The distinguishing number, denoted by $D(G)$, is the minimum r for which G has an r-distinguishing labeling. Recently, there has been considerable work showing that $D(G) = 2$ for all "large" members of many families of graphs. This talk will give a brief introduction to distinguishing, offer several avenues for future research, and provide context for these questions.

Akram Aldroubi (akram.aldroubi@vanderbilt.edu) – Department of Mathematics, 1326 Stevenson Center, Vanderbilt University, Nashville, TN 37240. Saturday 11:00am BA107

Non-linear signal representations, compressed sensing, sampling and dictionary design

Abstract: Recent research and new paradigms in mathematics, engineering, and science assume non-linear signal models of the form $\mathcal{M} = \cup_{i \in I} V_i$ consisting of a union of subspaces V_i instead of a single subspace $\mathcal{M} = V$. For example, these models have been used in 1) Sampling and reconstruction of signals with finite rate of innovation; 2) The Generalized Principle Component Analysis and the subspace segmentation problem in computer vision; and 3) Problems related to sparsity, compressed sensing, and dictionary design.

These new paradigms give rise to the following problem: Given a set of data $\mathcal{F}$ (e.g., a set of signals, images, or videos) how can we find the non-linear signal model that is "optimally" compatible with the observed data?

In this talk, we will discuss the above problem, present a mathematical framework for its analysis, and provide an abstract algorithm for solving it. We will then particularize and discuss 1) the case where the data set $\mathcal{F}$ consists of m vectors in $\mathbb{R}^d$; and 2) the case where the data $\mathcal{F}$ consists of m signals in an infinite dimensional space. These two cases have applications to several problems in engineering and biomedicine including data mining, data classification, segmentation, and tracking moving objets in video sequences (e.g., face recognition, brain morphology, DNA sequence comparison, movement tracking). It also has direct applications to data compression, denoising, and data transmission.

Brian Arbic (arbic@ig.utexas.edu) – Institute for Geophysics, J.J. Pickle Research Campus, 10100 Burnet Road (R2200), Austin TX 78758-4445. Saturday 9:15am BA212

Global energy dissipation rate of oceanic low-frequency flows by quadratic bottom drag: Results from observations and 1/32 degree models

Abstract: The energy budget of the deep ocean is a subject of great current interest, because of the potential implications for the strength of the overturning circulation. An important energy source is the 1 TW wind power input into geostrophic (low-frequency) flows. How these flows dissipate is largely unknown. Here we discuss one potential dissipation mechanism, namely bottom boundary layer drag. First, we show that eddy kinetic energy in idealized geostrophic turbulence models has realistic length scales, vertical structure, and amplitudes only if the nondimensional bottom friction strength is of order one. This is true for both linear and quadratic bottom drag (Arbic and Scott, in press). Next, we estimate the global energy dissipation rate of oceanic low-frequency flows by quadratic bottom drag (Sen et al., in review). We use data from

290 moored near-bottom current meters. We also utilize satellite altimetry data, 1) to estimate the bias in the global integral due to the poor sampling of the ocean by current meters, and 2) to estimate global maps of bottom velocity, given relationships computed at the mooring locations between surface and bottom flows. Finally, the dissipation rate is estimated from the output of a global ocean model run at 1/32 degree resolution (Arbic et al., in review). The model is validated by comparison to the current meter dataset. Our estimates of the dissipation rate range from 0.14 to 0.83 TW, with both the low and high ends likely being unrealistic. While uncertainty remains, we can say that bottom boundary layers very likely dissipate a substantial fraction of the 1 TW wind-power input into geostrophic flows.

Dan Archdeacon (dan.archdeacon@uvm.edu) – Department of Mathematics & Statistics, University of Vermont, Burlington VT 05405-0156, USA. Friday 3:30pm BA107

Monohedral Tilings

Abstract: Given infinitely many copies of a single tile, when does it tile the plane? The answer is not as simple as you think. In this talk I'll survey results in this area, including some recent work with Carsten Thomassen.

Miguel A. Arcones (arcones@math.binghamton.edu) – Department of Mathematical Sciences, Binghamton University, Binghamton, NY 13902. Saturday 4:00pm BA121

Minimax Estimators of the Coverage Probability of the Impermissible Error for a Location Family

Abstract: We consider estimation for a multivariate location family. Between all confidence regions with volume less than a fixed value L, we find the equivariant confidence region with the biggest coverage probability. This region maximizes the infimum of the coverage probability over all confidence regions with volume less than L. As an application, we find an estimator of parameter of location with the property that minimizes the supremum of the probability that the error of the estimation exceeds a fixed constant. We also find a confidence region and an estimator having the previous properties, but based on the m.l.e. We find the Bahadur slope of the two obtained estimators. We show that except for certain families of distributions, the estimator based on the whole sample is superior to the estimator based on the m.l.e. Hence, we get that m.l.e.'s are not asymptotically sufficient.

Beyza Caliskan Aslan (aslan@math.uab.edu) – Department of Mathematics, University of Alabama at Birmingham, 1300 University Blvd., Birmingham, AL 35294-1170. Friday 4:30pm BA110

A Generalized Eigenproblem for the Laplacian and Its Application to the Lightning Discharge

Abstract: Maxwell's equations in three dimensions are analyzed. The change in the electric potential due to lightning is evaluated, and an explicit formula in terms of the eigenfunctions for a generalized eigenvalue problem for the Laplacian operator is obtained. The potential in the lightning channel can be expressed in terms of a harmonic function which is constant in the lightning channel while the change in the potential outside the lightning channel is a harmonic function whose boundary conditions are expressed in terms of the pre-flash potential and the post-flash potential along the lightning channel.

Sergey Belov (belov@math.duke.edu, student speaker) – Mathematics Department, Duke University, Box 90320, Durham, NC 27708-0320. Friday 3:00pm BA126

Numerical studies of the semiclassical limit of the focusing NLS near a catastrophic collision

Abstract: We discuss numerical issues with the semiclassical asymptotic solution to a (cubic) focusing NLS. In the case of initial data with solitons, we show how extending the problem to a Riemann surface helps to compute a catastrophic collision curve in the space-time plane, including simplifications in the long-time limit. This is a joint work with Alexander Tovbis and Stephanos Venakides.

Arthur Berg (berg@ufl.edu) – Department of Statistics, University of Florida, P.O. Box 110339, Gainesville, FL 32611-0339. Saturday 3:00pm BA121

Nonparametric Function Estimation with Infinite-Order Kernels

Abstract: Higher-order polyspectral estimation (in Time Series) and hazard function estimation (in Survival Analysis) are obtained using a class of infinite-order kernels together with a specialized bandwidth selection algorithm. Estimation of the cumulative distribution function and survival function will also be addressed. Interesting mathematics is abound with connections to group representations and generalized functions being presented.

Marco Bertola (bertola@mathstat.concordia.ca) – Department of Mathematics, Concordia University, 1455 de Maisonneuve Blvd. West Montreal, Quebec, H3G 1M8, Canada. Saturday 3:30pm BA126

G-functions and equilibrium measures without a variational problem

Abstract: The nonlinear steepest descent method for rank-two systems relies on the notion of g-function. For the case of asymptotics of generalized orthogonal polynomials with respect to varying * complex* *weights *we can recast the requirements for the Cauchy-transform of the equilibrium measure into a problem of algebraic geometry and harmonic analysis and completely solve the existence and uniqueness issue without relying on the minimization of a functional. This addresses and solves also the issue of the "free boundary problem", determining implicitly the curves where the zeroes of the orthogonal polynomials accumulate in the limit of large degrees and the support of the measure. A numerical algorithm to find these curves in some cases is also explained. (With animations!)

Hatim Boustique (hboustique@valenciacc.edu, student speaker) – Department of Mathematics, University of Central Florida, Orlando, FL 32816-1364. Friday 2:30pm BA225

Lattice-Valued Convergence

Abstract: A fuzzy set is a function from set X into the unit interval I. This notion is generalized to the case whenever I is replaced by a complete lattice possessing a distributive law. Lattice-valued convergence spaces are defined in this context, and the corresponding categorical properties are investigated. In particular, this

category possesses initial and final structures, as well as suitable function spaces. Moreover, a characterization of quotient objects is given, and it is shown that quotient maps are productive under arbitrary products (unlike the category of all topological spaces with continuous maps as morphisms).

Anne Boutet de Monvel (aboutet@math.jussieu.fr) – Mathematiques, Universite Paris Diderot Paris 7, 2 place Jussieu, 75251 Paris Cedex 05, France. Saturday 2:30pm BA126

Riemann-Hilbert problem approach to long-time asymptotics for some nonlinear integrable problems

Abstract: We develop a Riemann–Hilbert approach to the focusing nonlinear Schrödinger equation $iq_t + q_{xx} + 2|q|^2q = 0$, on the first quarter plane $x > 0$, $t > 0$ for fast decaying initial data $q_0(x)$ and time-periodic boundary data $g_0(t)$. This approach allows us to study the long-time behavior of solutions of this initial boundary value problem. Regions of the quarter plane $x \geq 0$, $t \geq 0$ with different long-time behavior are specified.

However, this approach requires certain a priori information about the long-time behavior of the boundary values which do not involved in the formulation of a well-posed initial boundary value problem (for example, the Neumann boundary values for the Dirichlet problem). Various possibilities for this are discussed and illustrated numerically in the case of one-frequency boundary data.

We will also give analogous results for the Camassa–Holm equation $u_t - u_{txx} + 2u_x + 3uu_x = 2u_xu_{xx} + uu_{xxx}$ on the line $-\infty < x < \infty$, and also on the half-line $x \geq 0$ with time decaying boundary conditions at $x = 0$.

Work in collaboration with Alexander Its and Vladimir Kotlyarov (NLS), with Chunxiong Zheng (numerics), and with Dmitry Shepelsky (CH).

Debra Boutin (dboutin@hamilton.edu) – Department of Mathematics, Hamilton College, 198 College Hill Road, Clinton, NY 13323. Saturday 3:00pm BA107

Determining Sets, Resolving Sets, and the Exchange Property

Abstract: A set of vertices D of a graph is called a *determining set* if every automorphism is uniquely determined by its action on the vertices of D. That is, each vertex of the graph is uniquely identified by its graph theoretic properties and its relationship to the vertices of D. A subset R is called a *resolving set* if every vertex in the graph is uniquely determined by its distances to the vertices of R. Resolving sets are determining sets, but not necessarily conversely. Note that these sets have properties analogous to those of a basis in a vector space or matroid. To see how far this analogy extends, we will examine the Exchange Property (which holds for bases) in the context of determining sets and resolving sets.

John Bowman (bowman@math.ualberta.ca) – Department of Mathematical Sciences, University of Alberta Edmonton, Alberta Canada, T6G 2G1. Friday 3:30pm BA212

Casimir Cascades in Two Dimensional Turbulence

Abstract: The Kraichnan-Leith-Batchelor theory of two-dimensional turbulence is based on the fact that the nonlinear terms of the two-dimensional Navier-Stokes equation conserve both energy and enstrophy. In an infinite domain and in the limit of infinite Reynolds number, the net energy and enstrophy transfers out of a low-wavenumber forcing region must consequently be independent of wavenumber. The resulting dual cascade of energy to larger scales and enstrophy to smaller scales is readily observed in numerical simulations of two-dimensional turbulence in a finite domain.

While it is well known that the nonlinearity also conserves the global integral of any arbitrary C_1 function of the scalar vorticity field, the direction of transfer of these quantities in wavenumber space remains unclear. Numerical investigations of this problem are hampered by the fact that pseudospectral simulations, which necessarily truncate the wavenumber domain, do not conserve these higher-order Casimir invariants. In this work we develop estimates for the degree of nonconservation of the Casimir invariants and demonstrate that with sufficiently well-resolved simulations, their cascade directions can in fact be numerically determined.

Joseph Brennan (jpbrenna@mail.ucf.edu) – Department of Mathematics, University of Central Florida, Orlando, FL 32816.
Friday 4:30pm BA146

Degrees of generators of cut ideals

Abstract: We show that the ideal of cut ideals for books and outerplanar graphs is generated in degree 2.

Robert Buckingham (robbiejb@umich.edu) – Department of Mathematics, University of Michigan, Ann Arbor, MI 48109-1043.
Saturday 4:30pm BA126

Total integrals of global solutions to Painleve II

Abstract: Definite integrals of solutions of the Painleve II equation appear in the Tracy-Widom distributions, which naturally occur in the study of random matrix theory, weighted paths, and other probabilistic models. We introduce a new method that computes the total integral (the definite integral on the entire real line) for global solutions of Painleve II using Riemann-Hilbert analysis, and discuss applications to random matrix theory and other integrable equations. This is joint work with Jinho Baik, Jeffery DiFranco, and Alexander Its.

Les Butler (lbutler@lsu.edu) – Department of Chemistry, Louisiana State University, Baton Rouge, LA 70803.
Saturday 8:15am BA 207

Synchrotron X-ray and Neutron Tomography: 3D Imaging for Chemical and Materials Science Projects

Abstract: Advances in tomography with X-rays and neutrons offer new methods for rapid, informative imaging and spectroscopy of complex solid structures. At this time, instrumentation, mathematics, and computer software are all under rapid development. The results are evolving from one-up tests to routine measurements, bordering on high- throughput analysis. Imaging examples to be discussed include polymer blends, biological samples (cat claws), and geological samples. Most images are acquired with X-ray, but neutrons have special advantages, especially with respect to hydrogen sensitivity, penetration through metal, and, potentially, sensitivity to crystallographic phases.

Michael R. Caputo (mcaputo@bus.ucf.edu) – Department of Economics, University of Central Florida, P.O. Box 161400, Orlando, FL 32816-1400. Friday 3:30pm BA110

The Intrinsic Qualitative Properties of Intertemporal Optimizing Agents are Invariant to the Functional Form of the Discount Function

Abstract: The intrinsic qualitative properties of dynamic optimizing but time inconsistent agents are derived for a ubiquitous class of optimal control problems, and are shown to take the preferred form of a symmetric and semidefinite matrix. An upper bound to the rank of the matrix is also provided. A rather surprising conclusion is that the said qualitative properties are invariant to the functional form of the discount function. Consequently, if one limits econometric tests of an intertemporal model to its qualitative properties, one cannot determine the form of the discount function used by the decision maker. Hence, standard econometrics tests of a models qualitative properties cannot be used to determine if the agents under investigation are time-consistent or time-inconsistent intertemporal optimizers.

Guantao Chen* Johannes Hattingh, and Xue Wang (gchen@gsu.edu) – Department of Mathematics and Statistics, Georgia State University, Atlanta, GA 30303. Saturday 8:45am BA107

Small 3-connected dominating sets in a 3-connected graph

Abstract: Let G be a graph with n vertices, $\delta := \delta(G)$ be minimum degree of G and $\gamma(G)$ be the domination number of G. Arnautov, Lovász, and Payan, independently, showed that $\gamma(G) \leq \frac{1+\ln(\delta+1)}{\delta+1} \cdot n$. For any k-connected graph G, let $\gamma_k(G)$ be the minimal k-connected domination number of G. Caro, West and Yuster showed that $\gamma_1(G) \leq (1+o_\delta(1))\frac{\ln\delta}{\delta} \cdot n$. Based on these two results, Caro and Yuster conjectured that $\gamma_k(G) \leq (1+o_\delta(1))\frac{\ln\delta}{\delta} \cdot n$ and they further confirmed the conjecture for $k = 2$. We established the conjecture for $k = 3$. In this talk, we will present the proof with emphasis on the difference our proof techniques and the previous ones.

Vani Cheruvu (vcheruvu@scs.fsu.edu) – School of Computational Science, Florida State University, Tallahassee, FL 32306, USA. Friday 3:30pm BA209

High-order Methods for Centroidal voronoi Tessellations on a Sphere

Abstract: It is well known that voronoi tessellations and their dual Delaunay tessellations are useful tools in the construction of unstructured mesh. Centroidal voronoi tessellations and their dual centroidal voronoi Delaunay triangulations can help with grid generation and optimization and nodal distribution in meshfree computing. These could be very useful in atmosphere and ocean modeling. In this talk, we discuss about high-order methods on these grids.

John Chrispell (jchrisp@clemson.edu, student speaker) – Department of Mathematical Sciences, Clemson University, Clemson, SC 29634-0975. Saturday 10:15am BA209

A Fractional Step θ-Method for Time Dependent Viscoelastic Fluid Flow

Abstract: The accurate numerical approximation of viscoelastic fluid flow poses two difficulties: the large number of unknowns in the approximating algebraic system (corresponding to velocity, pressure, and stress), and the different mathematical types of the modeling equations. An appealing approximation approach is to use an operator splitting method which decouples the conservation of momentum equation from the constitutive equation. This split reduces the size of the linear systems that need to be solved and separates the parabolic and hyperbolic equations into different substeps. In this presentation, we describe the approximation method for the viscoelastic modeling equations, present numerical simulations, and give a-priori error estimates.

Elena Constantin (constane+@pitt.edu) – Department of Mathematics, University of Pittsburgh at Johnstown, Johnstown, PA 15904. Saturday 9:45am BA110

Higher Order Optimality Conditions for Nonsmooth Functions

Abstract: The goal of this talk is to give some higher order conditions for the existence of an isolated local minimizer for a constrained optimization problem with nonsmooth data using some higher order generalized directional derivatives. Our optimality conditions are formulated in terms of the contingent vectors to the constrained set at the minimum point. The examples analyzed illustrate the applicability of our results.

Justin Davis (justinkdavis@gmail.com, student speaker) – Department of Mathematics, University of Central Florida, Orlando, FL 32816-1364. Saturday 8:45am BA 225

Classification of animal signals: a comparison of rival signal processing procedures

Abstract: To date, comparisons of groups of animal signals have been largely restricted to analyses of features chosen on a subjective basis. In this study we examined the performance of objective methods in classifying the signals from five species of electric fish. As alternatives to the subjective "landmark" procedure, we utilized seven digital procedures commonly found in signal processing. We tested their performance in an exhaustive Monte Carlo simulation.

This is joint work with William Crampton (Dept. of Biology) and Marianna Pensky

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P.P.B. Eggermont*, V.N. LaRiccia, M.Z. Nashed (eggermon@udel.edu) – Food and Resource Economics, University of Delaware, 19716 Newark, DE, USA. Saturday 10:15am BA110

Ill-posed operator equations with weakly bounded noise

Abstract: We study Tikhonov regularization of ill-posed operator equations with noisy data. However, rather than assuming the usual strong bounds on the error in the data, we consider the case where asymptotically, the error converges weakly to 0. On the appropriate compact subset, we may then assume rates of weak convergence. In Sobolev spaces parlance, this is equivalent to assuming error bounds in "negative" Sobolev norms. Under the usual source conditions, we derive optimal convergence rates on the approximate solution. As an example, we consider ill-posed integral equations with discrete data corrupted by zero mean, uncorrelated random noise.

Mark Ellingham*, **Adam Weaver** (mark.ellingham@vanderbilt.edu) – Department of Mathematics, 1326 Stevenson Center, Vanderbilt University, Nashville, TN 37240, U. S. A. Friday 3:00pm BA107

Constructing all minimum genus embeddings of $K_{3,n}$

Abstract: One of us (Ellingham) has been involved (with Chris Stephens and Xiaoya Zha) in a project to determine the orientable genus of complete tripartite graphs. Minimum genus embeddings of $K_{3,n}$ with special properties are employed, and this led us to investigate the general structure of minimum genus embeddings of $K_{3,n}$. We discovered that they can be represented in terms of certain Tait colorings of cubic graphs. Using results of Kotzig, we can then show that all minimum genus embeddings of $K_{3,n}$, orientable or nonorientable, can be constructed using simple operations based on adding one crosscap or one handle at a time. We describe these constructions.

Adel Faridani (faridani@math.orst.edu) – Department of Mathematics, Oregon State University, Orgeon, USA. Saturday 8:45am BA207

Numerical and theoretical explorations in helical and fan-beam tomography

Abstract: Katsevich's inversion formula for helical tomography is explored in the limit of vanishing pitch, yielding a general reconstruction formula for fan-beam tomography. The relationship of this formula to other formulas in the literature is explored. For the case of curved detector coordinates several numerical implementations of a related fan-beam formula that shares a number of features with Katsevich's formula are proposed, numerically implemented, and compared with the standard fan-beam algorithm. This gives insight into some numerical questions also encountered in the three-dimensional case, including a theoretical explanation of the usefulness of a shift in the convolution kernel for removal of ringing artifacts.

Lisa Fauci (ljf@math.tulane.edu) – Department of Mathematics, Tulane University, New Orleans, LA 70118. Friday 12:10pm BA107

Interface problems inspired by the biofluidmechanics of reproduction

Abstract: Complex fluid-structure interactions are central to mammalian fertilization. Motile spermatozoa, muscular contractions of the uterus and oviduct, as well as ciliary beating generate forces that drive fluid motion. At the same time, the dynamic shapes of these biostructures are determined by the fluid mechanics. In many of these systems, the fluid exhibits non-Newtonian characteristics. While much progress has been made in the development of mathematical models and numerical methods for fluid-structure interactions in a Newtonian fluid, much work needs to be done in the case of complex fluids. In this talk we will give an overview of the classical work in fluid dynamics that has been applied to reproduction. We will also present recent computational models, based upon an immersed boundary framework, that promise to provide insight into these complex, coupled dynamical systems.

Francesco Fedele (ffedele3@gtsav.gatech.edu) – Civil and Environmental Engineering, Georgia Institute of Technology at Savannah. Saturday 9:45am BA212

Rogue waves in oceanic turbulence and solitons in axisymmetric turbulent flow: an extreme view

Abstract: In the first part of the talk, a stochastic model of wave groups is presented to explain the formation of abnormal waves (rogue waves) in oceanic turbulence. The latter state is defined as the chaotic state of a sea of weakly nonlinear coupled dispersive waves in evolution according to the Zakharov equation. Finally, the stochastic wave group theory is extended to characterize the nonlinear dynamics of disturbances in axisymmetric Poiseuille pipe turbulence. For large Reynolds numbers Re, it is shown that for disturbance's amplitudes of $O(Re^{-3/2})$, the latter state is characterized by the chaotic behavior of a sea of weakly nonlinear coupled cnoidal solitons obeying a non-Hamiltonian system of perturbed Korteweg-de Vries Equations.

Jean-Pierre Gabardo (gabardo@univmail.cis.mcmaster.ca) – Department of Math. & Stat. McMaster University, 1280 Main Street West Hamilton, Ontario Canada L8S 4K1. Saturday 3:00pm BA218

Weighted irregular Gabor tight frames and dual systems

Abstract: We give a characterization for the weighted irregular Gabor tight frames or dual systems in $L^2(\mathbb{R}^n)$ in terms of the distributional symplectic Fourier transform of a positive Borel measure on $\mathbb{R}^{2n}$ naturally associated with the system and the short-time Fourier transform of the windows in the case where the window (or at least one of the windows in the case of dual systems) belongs to the Schwartz class.

This result implies the impossibility of constructing "discrete" weighted irregular Gabor tight frames with certain families of windows such as generalized Gaussians or "extreme-value" windows (or even dual systems with both windows in the same family). Furthermore, we show that, if a weighted irregular Gabor system admits a dual which is of Gabor type, then the Beurling density of the associated measure exists and is equal to one.

John R. Cannon and Daniel J. Galiffa* (Da786917@pegasus.cc.ucf.edu, student speaker) – Department of Mathematics, University of Central Florida, Orlando, FL 32816. Friday 3:00pm BA225

On a Numerical Method for a Homogeneous Nonlinear, Nonlocal Elliptic Boundary Value Problem

Abstract: In this work we develop a numerical method for the equation: $-\alpha\left(\int_0^1 u(t)dt\right)u''(x)+[u(x)]^{2n+1}=0,\ \ x\in(0,1),\ \ u(0)=a,\ \ u(1)=b$. We begin by establishing the existence of the solution to a nonlinear auxiliary problem via the Schauder fixed point theorem. We then establish the uniqueness of the solution to this nonlinear auxiliary problem by defining a continuous compact mapping and utilizing a priori estimates. From this analysis, we then prove the existence and uniqueness of the solution to the problem defined above via the Brouwer fixed point theorem. Next, we analyze a discretization of the above problem and show that the solution of the nonlinear difference problem exists and is unique. We conclude with some examples of the numerical process.

Shanzhen Gao*, John M Freeman (sgao1@fau.edu, student speaker) – Department of Mathematical Sciences, Florida Atlantic University, Boca Raton, FL 33431. Friday 3:30pm BA225

Shift Operators On Polynomials

Abstract: We will discuss (1) Shifts, Variables, and Basic Sequences; (2) The Commuting Algebra of a Shift; (3)The Rato/Rodrigues Formula; (4) The Uncertainty Algebra; (5) Connection Constants; (6) Substitution of Variables; (7) The Automorphism Theorem; (8) Shifts as Derivations; (9) Non-homogenous Variables and (10) Eulidian Shifts.

Luis David Garcia-Puente (lgarcia@shsu.edu) – Department of Mathematics and Statistics, Sam Houston State University, Huntsville, TX 77341-2206. Saturday 10:15am BA146

Linear precision for toric patches

Abstract: In 2002, Krasauskas generalized the standard Bezier and tensor product patches of geometric modeling to multi-sided toric patches. These patches are based on the geometry of toric varieties and depend on a polytope and some weights. While these offer the promise of greater design flexibility, it is not clear whether they possess the desirable properties of the standard patches. One such property is linear precision, which is the ability to replicate a linear function. I will discuss work with Frank Sottile on linear precision. We show that every patch has a reparametrization having linear precision. The reparametrization is not rational unless the patch has a very singular geometry. For toric patches, the existence of such rational reparametrizations has an appealing mathematical reformulation in terms of Cremona transformations. Moreover, this reparametrization can be numerically computed using a standard method in statistical inference known as iterative proportional scaling.

Eleftherios Gkioulekas (lf@mail.ucf.edu) – Department of Mathematics, University of Central Florida, Orlando, FL 32816. Friday 4:00pm BA212

Locality and stability of the cascades of two-dimensional turbulence

Abstract: In my talk, I will discuss the notion of locality as it pertains to the cascades of two-dimensional turbulence. The mathematical framework underlying our analysis is the infinite system of balance equations that govern the generalized unfused structure functions, first introduced by L'vov and Procaccia. As a point of departure we use a revised version of the system of hypotheses that was proposed by Frisch for three-dimensional turbulence. We show that both the enstrophy cascade and the inverse energy cascade are local in the sense of non-perturbative statistical locality. We also investigate the stability conditions for both cascades. We have shown that statistical stability with respect to forcing applies unconditionally for the inverse energy cascade. For the enstrophy cascade, statistical stability requires large-scale dissipation and a vanishing downscale energy dissipation. I will conclude with a careful discussion of the subtle notion of locality.

Yevgeny Goncharov (kercheval@math.fsu.edu) – Department of Mathematics, Florida State University, Tallahassee, FL 32306-4510. Saturday 9:15am BA220

On Resolving Curse of Dimensionality of Mortgage Rate Modeling

Abstract: The mortgage rate is one of the most potent refinancing predictors. Many prepayment models state it explicitly. Usually, a 10-year Treasury (or similar) heuristic is used for this purpose, thus, effectively making such models merely variants of an empirical approach popular on Wall Street. The computational complexity was likely one of the reasons why the mortgage modeling has been mostly absent in the mortgage literature. In the talk, we describe a new algorithm which makes the complexity of the problem equivalent to the basic problem of MBS valuation, thus making endogenous mortgage rate modeling accessible for real-life applications.

Manisha Goswami (mansonu@ufl.edu, student speaker) – Department of Industrial and Systems Engineering, University of Florida, Gainesville, FL 32611-6595. Saturday 9:15am BA225

American Option Pricing under Stochastic Volatility: A Model Comparison

Abstract: Over the past few years model complexity in quantitative finance has increased substantially in response to earlier models that did not capture critical events for risk management. However, it is still not clear that the increased complexity is matched by additional accuracy in the ultimate result. In the specific context of option pricing addressed in this paper we compare the pricing accuracy of two models: one that consists of the standard geometric Brownian motion with constant coefficients, and another where the volatility coefficient is itself a stochastic process. The data for the study are based on S&P 100 index options; the estimation methodology on indirect inference, and the pricing approach is an extension of the regression-based simulation method of Carrière (1996) and Longstaff and Schwartz (2001). Our study indicates that stochastic volatility models are particularly accurate for in-the-money options.

joint work with F. AitSahlia and S. Guha.

Ronald J. Gould (rg@mathcs.emory.edu) – Dept of Mathematics and Computer Science, Emory University, Atlanta, GA 30322. Saturday 8:15am BA107

Distributing Vertices on Hamiltonian Cycles

Abstract: Let G be a graph of order n and $3 \leq t \leq \frac{n}{4}$ be an integer. Recently, Kaneko and Yoshimoto provided a sharp $\delta(G)$ condition such that for any set X of t vertices, G contains a hamiltonian cycle H so that the distance along H between any two vertices of X is at least $n/2t$. In this paper, minimum degree and connectivity conditions are determined such that for any graph G of sufficiently large order n and for any set of t vertices $X \subseteq V(G)$, there is a hamiltonian cycle H so that the distance along H between any two consecutive vertices of X is approximately $\frac{n}{t}$. Furthermore, we determine the δ threshold for any t chosen vertices to be on a hamiltonian cycle H in a prescribed order, with approximately predetermined distances along H between consecutive chosen vertices.

This is joint work with Ralph Faudree, Michael Jacobson and Colton Magnant.

Suchandan Guha (sguha@ufl.edu, student speaker) – Department of Industrial and Systems Engineering, University of Florida, Gainesville, FL 32611-6595. Saturday 9:45am BA225

American Option Pricing under Stochastic Volatility: An Efficient Numerical Approach

Abstract: In this talk I present a new numerical technique to price an American option written upon an underlying asset that follows a bivariate diffusion process. The technique presented here exploits the super-martingale representation of an American option price with a coarse approximation of its early exercise surface that is based on an efficient implementation of the least-squares method of Carriere and Longstaff-Schwartz. Our extensive numerical results show that this method yields very accurate prices in a computationally efficient manner.

joint work with F. AitSahlia and M. Goswami.

William W. Hager*, Bernard A. Mair, Hongchao Zhang (hager@math.ufl.edu) – University of Florida, Department of Mathematics, Gainesville, FL 32611-8105. Friday 3:00pm BA110

An Affine-scaling Interior-point CBB Method for Box-Constrained Optimization

Abstract: An affine-scaling algorithm for box-constrained optimization is developed. The algorithm has the property that each iterate is a scaled cyclic Barzilai-Borwein (CBB) gradient iterate that lies in the interior of the feasible set. Global convergence is established for a nonmonotone line search, while there is local R-linear convergence at a nondegenerate local minimizer where the second-order sufficient optimality conditions are satisfied. Numerical experiments show that the convergence speed is insensitive to problem conditioning. The algorithm is particularly well suited for image restoration problems which arise in positron emission tomography where the cost function can be infinite on the boundary of the feasible set.

Douglas Hardin (doug.hardin@vanderbilt.edu) – Department of Mathematics, Vanderbilt University, Nashville, TN 37240. Saturday 3:30pm BA218

Orthogonal spline wavelets on irregular knots

Abstract: We present a construction of orthogonal piecewise polynomial wavelets that are ‘centered on a knot’ sequence. As an application we construct orthogonal, continuous, piecewise quadratic ‘golden mean’ wavelets that generalize the Haar τ-wavelets of Gazeau and Patera.

Jeffrey Andrew Hogan (jeffh@uark.edu) – Department of Mathematics, University of Arkansas, Fayetteville, AR 72701. Saturday 8:15am BA218

Sampling in shift-invariant, non-translation-invariant spaces

Abstract: The classical Paley-Wiener space, while itself a principal shift-invariant (PSI) space, has extra structure. In particular, it is translation-invariant. This makes the Paley-Wiener space a friendly space in which to do sampling since offset errors cause no significant difficulties. The situation is much different

in a general shift-invariant, non-translation invariant space. Here, offset errors can cause arbitrarily large errors in sampling reconstructions. In this talk, which includes joint work with Joseph Lakey (NMSU) and Karlheinz Grochenig (U. Vienna), we investigate possible remedies for this situation, give an algorithm for the determination of offsets of signals in PSI spaces, and provide a result which ensures the existence of a unique solution to the offset determination problem in the case of PSI spaces generated by wavelet scaling functions.

David J. Horntrop (horntrop@njit.edu) – Department of Mathematical Sciences, New Jersey Institute of Technology, University Heights Newark, NJ 07102. Friday 2:30pm BA218

Simulation of Mesoscopic Models for Self-Organization in Materials

Abstract: Self-organization of components of two phase mixtures through diffusion is known as Ostwald ripening. One way of describing this phenomenon is through mesoscopic models; these models are stochastic partial differential equations that have been derived from the microphysics underlying the system. In this talk, results from simulations using spectral schemes for stochastic partial differential equations are described. These simulation results are compared with theoretical results such as the Lifshitz-Slyozov growth law; the effect of adjusting the interaction length scale is also described.

Fang Jin (fjin@math.uci.edu) – Department of Mathematics, University of California at Irvine, Irvine, CA 92697-3875. Friday 4:00pm BA 218

Multiscale models of tumor growth and angiogenesis

Abstract: We present and investigate models for solid tumor growth that incorporate features of the tumor microenvironment including tumor-induced angiogenesis. Using analysis and nonlinear numerical simulations, we explore the effects of the interaction between the genetic characteristics of the tumor and the tumor microenvironment on the resulting tumor progression and morphology. We find that the range of morphological responses can be placed in three categories that depend primarily upon the tumor microenvironment. In nutrient-poor microenvironments, tumors tend to break into small fragments and invade the surrounding tissue, regardless of the mechanical properties of the surrounding tissue. When placed in a nutrient-rich tissue, the tumor morphology depends upon the biomechanical characteristics of the tissue. Tumors growing into mechanically unresponsive tissue develop buds that grow into long, invasive fingers. Tumors growing into softer, mechanically responsive tissue develop buds that do not grow, but rather connect with neighboring buds to capture external extracellular matrix (ECM). The overall morphology remains compact, with a large central abscess containing encapsulated ECM, fluid, and cellular debris similar to a necrotic core. We found that the qualitative behavior of the tumor morphologies was similar across a broad range of parameters that govern the tumor genetic characteristics. Our findings demonstrate the importance of the impact of microenvironment on tumor growth and morphology, and we discuss the implications for cancer therapy protocols.

Mathew Johnson (mjohns51@uiuc.edu, student speaker) – Department of Mathematics, University of Illinois at Urbana-Champaign, Urbana, IL 61801, USA. Saturday 5:00pm BA126

Krein Signatures for Eigenvalue Problems Associated to Integrable Systems

Abstract: There is a result of Klaus and Shaw which shows that the Zakharov-Shabat eigenvalue problem

has discrete spectrum which lies on the imaginary axis if the potential has a single critical point and decays monotonically away from this point (the potential is monomodal). We put this calculation in the context of the Krein signature (a tool for studying the stability of symplectic matrices) and prove an analogous theorem for the eigenvalue problem which solves the Sine-Gordon equation (in laboratory coordinates).

This is joint work with Jared Bronski.

Dorin Dutkay, Palle Jorgensen* **and Myung-Sin Song** (`jorgen@math.uiowa.edu`) – Department of Mathematics, The University of Iowa, Iowa City, IA 52242-1419, USA. Saturday 5:30pm BA218

Multiscale problems

Abstract: We show that a number of multiscale problems (including generalized multiresolutions) may be cast in the context of relations on a finite set of operators in Hilbert space. The Cuntz relations for sets of isometries is a prototype. Applications include the use of wavelet bases and Karhunen-Loeve analysis in the representation of fractional Brownian motion, and fractals more generally. As illustrations we outline how signal/image processing can be done this way. We show how the Hilbert space and spectral theory offer a unifying approach; as well as suggesting new problems.

Ibrahima Kaba (`kababaf@erau.edu`) – Department of Mathematics, Embry-Riddle Aeronautical University, 600 S Clyde Morris Blvd, Daytona Beach, FL 32118. Saturday 8:15am BA225

Repetitive Laser Pulse Heating of A Microsphere

Abstract: Heat transport at the microscale is the subject of intense investigation due to the growing need to fabricate microstructures for applications in nanotechnology. The need to control the spread of the thermal process zone has led to the development of high power short-pulse lasers. During thermal processing, impurities may form in the material. An amplification of the thermal energy around the impurities may result in severe damage occurring or in the failure of the thermal process. A thorough analysis of the way the impurities dissipates the thermal energy is therefore necessary to minimize the potential damage and optimize the thermal processing. The classical theory of heat diffusion, which is averaged over many grains, is inadequate in describing the transport phenomenon. Single energy equations developed to describe the transport phenomenon include a third-order mixed derivative with respect to space which makes them numerically inefficient. In this study, we will consider a microsphere subjected to a repetitive ultrafast laser pulse, the transport phenomenon is modeled by the two-step parabolic heat transport equations in spherical coordinates.

IOANNIS KARATZAS (`ik@math.columbia.edu`) – Department of Mathematics and Department of Statistics, Columbia University, New York, NY 10027, USA. Saturday 1:00pm BA107

Some Stochastic Control Problems in Mathematical Finance

Abstract: We shall formulate and review a class of stochastic control problems, collectively known under the rubric of portfolio optimization, that arise in the context of mathematical finance. Ideas from convex duality play a prominent role in the resolution of these problems; so does the theory of parabolic partial differential equations, under certain strong conditions on the financial market structure. Under less stringent conditions, stochastic analogues of the classical Hamilton-Jacobi-Bellman equation emerge as particularly relevant in this context, in connection with ideas and results from backwards stochastic equations and the Ito-Wentzell formula for random fields. Using such tools, feedback formulae become available for the investors optimal strategies, based on his current level of wealth. Recent progress on these issues will be surveyed, and some open questions will be mentioned.

Alexander Katsevich (akatsevi@pegasus.cc.ucf.edu) – Department of Mathematics, University of Central Florida, Orlando, FL 32816. Saturday 9:45am BA207

Motion compensated local tomography

Abstract: We develop local tomography (LT) for image reconstruction from motion contaminated data. It is assumed that motion is known. We propose a new LT function f_Λ, which is related to an original object f via an operator B: $f_\Lambda = Bf$. Because of motion, B may fail to be a pseudo-differential operator (PDO). We obtain the conditions that guarantee that B is a PDO. Under these consitions, similarly to the classical LT in R^2, B is a PDO of order 1. Computation of f_Λ depends on a weight function Φ. We show that Φ can be chosen in such a way that the operator B has principal symbol $|\xi|$. This result has an interesting corollary for conventional exact reconstruction. It suggests a novel frequency-split approach to finding f from motion contaminated data. In practice tomographic data are discrete, and derivatives are usually replaced by their mollified analogues. We consider how mollification affects the singularities of the LT function f_Λ. Using this approach we develop an algorithm for finding values of jumps of f using LT. We also consider various aspects of numerical implementation of LT and show the results of a numerical experiment.

Alec Kercheval and Juan F. Moreno (kercheval@math.fsu.edu) – Department of Mathematics, Florida State University, Tallahassee, FL 32306-4510. Saturday 9:45am BA220

Central Bank Impulse Control for Currency with Nonconstant Volatility

Abstract: Central Banks often wish to intervene in their country's currency exchange rate by purchasing or selling foreign currency reserves. We describe an optimal strategy for doing so when currency follows a geometric brownian motion, the bank has a target exchange rate away from which the economy pays a running cost, and interventions cause a market reaction that temporarily changes the market volatility.

Tariyel Kiguradze (tkigurad@fit.edu) – Department of Mathematical Sciences, Florida Institute of Technology, 150 West University Blvd., Melbourne, FL 32901-6975. Saturday 9:45am BA221

On periodic solutions of linear partial differential equations

Abstract: The problem on multiply periodic solutions for linear partial differential equations is studied. Existence and uniqueness theorems are proved and classes of well-posed and ill-posed (or conditionally well-posed) cases are described.

Soumendra Nath Lahiri (snlahiri@stat.tamu.edu) – 525J Blocker Hall, Department of Statistics, Texas A & M University, Colleage Station, TX 77843-3143. Saturday 8:45am BA121

Higher Order Properties of Empirical Likelihood Methods for Weakly Dependent Time Series Data

Abstract: In recent years, different versions of the Empirical Likelihood (EL) method have been proposed for inference on temporally correlated data. Although, with suitable rescaling, these lead to the same chi-squared limit law (Wilk's Theorem) as in the case of independence, higher order properties of these methods are little understood. In this talk, we will consider higher order properties of EL methods for weakly dependent time series data. We also discuss ways of improving the convergence rates.

Hong-Jian Lai*, **Rui Xu and Cun-Quan Zhang** (hjlai@math.wvu.edu) – Department of Mathematics, West Virginia University, Morgantown, WV 26506-6310, USA. Saturday 9:45am BA107

On circular flows of graphs

Abstract: For an undirected graph G, the circular flow index of G is defined by

$$\phi_c(G) = \min_D \max_{\emptyset \neq X \subset V(G)} \frac{|\delta(X)|}{|\delta_D^+(X)|},$$

where the minimum is taken over all orientations of G. Galluccio and Goddyn in [Combinatorica, 22 (2002), 455-459] proved that if $\kappa'(G) \geq 6$, then $\phi_c(G) < 4$, using linear programming. We present a graph theory proof for the same result. Our result implies other family of graphs which may have edge-connectivity less than 6 can also have $\phi_c(G) < 4$ ([Combinatorica, 27 (2007), 245-246]).

Joe Lakey (jlakey@nmsu.edu) – Mathematical Sciences, New Mexico State University, Las Cruces, NM 88003-8001. Saturday 8:45am BA218

Sampling and time-frequency localization for multi-bandlimited functions

Abstract: Sampling in the Paley-Wiener space is an old subject. Modern wireless applications suggest benefits of a rigorous time-frequency theory encompassing sampling and joint time-frequency localization. Bresler and Venkataramani, and independently Herley and Wong, provided conditions for periodic nonuniform sampling of multiband signals some years ago, while well before that, Landau and Widom provided some general results on time localization of multiband signals. We will outline some steps toward connecting the localization theory and the sampling theory, and provide some numerical examples. This is preliminary work with Scott Izu.

David Larson (larson@math.tamu.edu) – Department of Mathematics, Mailstop 3368, Texas A&M University, College Station, TX 77843-3368. Saturday 2:30pm BA218

Density and Orthogonality of wavelet frames

Abstract: We examine some recent results of Bownik on density and connectivity of the wavelet frames.

We use orthogonality (strong disjointness) properties of frame and Bessel sequences, and also properties of Bessel multipliers (operators that map wavelet Bessel functions to wavelet Bessel functions). In addition we obtain an asymptotically tight approximation result for wavelet frames, and discuss some open problems.

Nicole Lazar (nlazar@stat.uga.edu) – Department of Statistics, The University of Georgia, Athens, GA 30602-1952. Friday 3:00pm BA121

Quantile Estimation for Discrete Data via Empirical Likelihood

Abstract: Quantile estimation for discrete distributions has not been well studied, although discrete data are common in practice. Under the assumption that data are drawn from a discrete distribution, we examine the consistency of the maximum empirical likelihood estimator (MELE) of the p-th population quantile, with the assistance of a jittering method and results for continuous distributions. The MELE may or may not be consistent for the population quantile, depending on whether or not the underlying distribution has a plateau at the level of p. We propose an EL-based categorization procedure which not only helps in determining the shape of the true distribution at level p, but also provides a way of formulating a new estimator that is consistent in any case. Analogous to confidence intervals in the continuous case, the probability of a correct estimate (PCE) accompanies the point estimator. The PCE can be estimated using a simple bootstrap method. This is joint work with Jien Chen.

Hyesuk Lee (hklee@clemson.edu) – Department of Mathematical Sciences, Clemson University, Clemson, SC 29634-0975. Friday 3:00pm BA209

Analysis and Finite Element Approximation of an Optimal Control

Abstract: A boundary control problem for the quasi-Newtonian Fluid Flow will be discussed. The existence of an optimal solution is proved and an optimality system is derived by the first order necessary condition. We investigate finite element approximations to a solution of the optimality system, and a solution algorithm based on the gradient method.

Bing Li (bing@stat.psu.edu) – Department of Statistics, Penn State University, University Park, PA 16802. Saturday 3:30pm BA121

Dimension Reduction for Non-Elliptically Distributed Predictors

Abstract: Sufficient dimension reduction methods often require stringent conditions on the joint distribution of the predictor, or, when such conditions are not satisfied, rely on marginal transformation or reweighting to fulfill them approximately. For example, a typical dimension reduction method would require the predictor to have elliptical or even multivariate normal distribution. In this paper, we reformulate the commonly used dimension reduction methods, via the notion of central solution space, so as to circumvent the requirement such strong assumptions, while at the same time preserve the desirable properties of the classical methods, such as root-n consistency and asymptotic normality. Imposing elliptical distributions or even stronger assumptions on predictors is often considered as the necessary trade-off for overcoming the curse of dimensionality, but the development of this paper shows this need not be the case. The new methods will be compared with existing methods by simulation, and applied to a data set. This is joint work with Yuexiao Dong.

Runze Li (rli@stat.psu.edu) – Statistics Department, Penn State University, University Park, PA 16802, USA. Saturday 10:15am BA 121

Local Polynomial Composite Quantile Regression

Abstract: Nonparametric regression is a useful statistical tool to explore fine features in the data, and has been applied for various disciplines. In this paper, we propose local polynomial composite quantile regression for nonparametric regression models. The sampling properties of the proposed estimation procedure are studied. We derive the asymptotic bias, variance and normality of the proposed estimate. Asymptotic relative efficiency of the proposed estimate to the local polynomial regression under the least squares loss is investigated. It is shown that the proposed estimate can be much more efficient than the local polynomial regression estimate with the squared loss for various non-normal errors, and is almost as efficient as the LS estimate for normal error. Simulation is conducted to examine the performance of the proposed estimates. The simulation results are consistent with our theoretic findings. A real data example is used to illustrate the proposed procedures.

D. Han, X. Li*, **M. Michalak, R.N. Mohapatra, R. Muise, Z. Nashed** (xli@math.ucf.edu) – Department of Mathematics, University of Central Florida, Orlando, FL 32816. Saturday 3:00pm BA110

Refining Algorithms in Correlation Filter Design for Target Detection

Abstract: In Automatic Target Recognition (ATR), correlation filters are widely used to detect target signature variations. In this paper we concentrate on a particular case: target pose angle. For the traditional maximum average correlation height (MACH) filter method, only a few special angles can be used due to the limitation of the training data and the requirement on efficiency for real-time applications. In order to improve performance and save computation time, we propose an approximation approach to the filter functions. Based on a band-width assumption on the filter functions, we derive an optimal number of the filters required to achieve the same performance that can be obtained with a much larger filter bank. Furthermore, we develop a refining algorithm for the filter designs based on the sinc-function approximation to the filter bank. This allows for a classification result over the continuum of a design parameter rather than the discrete possibilities represented by standard filter bank implementation. The filters we designed here are easy to compute and have good performance. Our method allows us to use the smallest number of MACH filters without losing performance to even gain fidelity in classification.

Zhihua Liu* and Lianfen Qian (zliu@fau.edu, student speaker) – Department of Mathematical Sciences, Florida Atlantic University, Boca Raton, FL 33431. Saturday 10:15am BA225

Change-point Estimation via Empirical Likelihood

Abstract: For a segmented linear regression system obeying two different linear regression lines over two domains of a predictor, a nonparametric method based on the empirical likelihood ratio is utilized to estimate the change point between the two domains. A new empirical likelihood ratio test statistic is proposed. Under null hypothesis of no change, the simulation results show that the proposed test statistic is asymptotically Gumbel extreme value distributed. The location and scale parameters of this asymptotic distribution are non-sensitive to the different settings of parameter vector and different types of error terms. Under the

alternative hypothesis, the frequency distribution table of the estimated time of the change is reported. This proposed method is illustrated through modeling the plasma osmolality data set.

Hongwei Long (hlong@fau.edu) – Department of Mathematical Sciences, Florida Atlantic University, Boca Raton, Florida 33431. Saturday 10:15am BA220

Least Squares Estimator for Ornstein-Uhlenbeck Processes Driven by Stable Levy Motions

Abstract: We study the problem of parameter estimation for generalized Ornstein-Uhlenbeck processes driven by stable Levy motions, observed at discrete time instants. Least squares method is used to obtain an asymptotically consistent estimator. The strong consistency and the rate of convergence of the estimator have been studied. The estimator has a higher order of convergence in the general stable, non-Gaussian case than in the classical Gaussian case.

Wen-Xiu Ma (mawx@math.usf.edu) – Department of Mathematics and Statistics, University of South Florida, 4202 East Fowler Avenue, PHY 114, Tampa, FL 33620-5700. Friday 4:00pm BA126

Solving integrable equations by the Wronskian and Casoratian

Abstract: We will show how to use Wronskian and Casoratian determinants to solve integrable equations. The key steps are to apply Hirota's bilinear forms and the Pluecker relations. Illustrative examples contain the celebrated Korteweg-de Vries equation, the Toda lattice equation and the Volterra lattice equation. Various solutions such as solitons, positions and complexitons are constructed from their corresponding Hirota's bilinear equations.

Paul-Emile Maingé (Paul-Emile.Mainge@martinique.univ-ag.fr) – University of Antilles-Guyane, Martinique (F.W.I.), France. Saturday 3:30pm BA110

Inertial and relaxed algorithms for monotone inclusions and fixed point problems

Abstract: This work is concerned with a general fixed point method which unifies relaxation factors and a two step inertial type extrapolation. These strategies are intended to improve the convergence of many existing algorithms for monotone inclusions as well as fixed point problems. The considered algorithm is mainly based upon an implicit discretization of a first order in time dynamical system. A convergence theorem established in this new setting improves known ones and numerical simulations are presented.

Bernard Mair (bamair@ufl.edu) – Department of Mathematics, University of Florida, Gainsville, FL 32611. Friday 4:30pm BA207

A Non-Monotone Algorithm for Tomographic Reconstruction

Abstract: We present a new interior point algorithm for penalized maximum likelihood reconstruction of tomographic images. Each iterate is based on a scaled cyclic Barzilai-Borwein (CBB) gradient so is not guaranteed to decrease the objective function. The algorithm is globally convergent and allows for upper and

lower bounds on the emission intensities. Preliminary numerical results on reconstructing positron emission tomography images indicate that it outperforms many of the existing algorithms. This is joint work with W. Hager and H. Zhang.

Mogens Melander (melander@smu.edu) – Department of Mathematics, Southern Methodist University, Dallas TX 75275-0156. Friday 2:30pm BA 212

Analysis of a Symmetry leading to an Inertial Range Similarity Theory for Isotropic Turbulence

Abstract: We present a theoretical attack on the classical problem of intermittency and anomalous scaling in turbulence. Our focus is on an ideal situation: high Reynolds number isotropic turbulence driven by steady large scale forcing. Moreover, the fluid is incompressible and no confining boundaries are present. We start from a good set of basis functions for the velocity field. These are real and divergence-free. To each wave-vector $\mathbf{k}$ in Fourier space there is one pair of basis functions with respectively left and right-handed polarity. Isotropy makes all k on the shell of constant $|\mathbf{k}|$ statistically equivalent. Consequently, the coefficients , χ^+ and χ^-, to the basis functions in that shell become two random variables whose joint pdf describes the statistics at scale $\ell = 2\pi/k$. Moreover, $(\chi^+)^2 + (\chi^-)^2$ becomes a random variable for the energy. Switching to polar coordinates, the joint pdf expands in azimuthal modes. We focus on the axisymmetric mode which is itself a pdf and characterized by it radial profile $P_0(r,\ell)$. Observations from both shell model and DNS data indicate that (1) the moments of $P_0(r,\ell)$ scale as power laws in ℓ, and (2) the profile obeys an affine symmetry $P_0(r,\ell) = C(\ell)f((\ln r - \mu(\ell))/\sigma(\ell))$ We raise the question: What statistics agree with both observation? The answer is pleasing. We find the functions f, μ, σ, and C analytically in terms of a few constants. Moreover, we obtain closed form expressions for both scaling exponents and coefficients in the power laws. A virtual origin also emerges as an intrinsic length scale ℓ_0 for the inertial range.

Peter Miller (millerpd@umich.edu) – Department of Mathematics, University of Michigan, East Hall, 530 Church St., Ann Arbor, MI 48109. Saturday 3:00pm BA126

On the Semiclassical Limit for the Sine-Gordon Equation

Abstract: I will discuss some aspects of recent work on the Cauchy problem in laboratory coordinates for the sine-Gordon equation, subject to a semiclassical scaling that introduces an essential separation of scales into the dynamics. This type of scaling naturally occurs in the modeling of superconducting Josephson tunneling junctions in which macroscopic (laboratory scale) excitations create a large number of quanta of magnetic flux whose nonlinear interactions can become complicated. This is joint work with Robert Buckingham.

C. Nahak and R. N. Mohapatra (ramm@mail.ucf.edu) – Department of Mathematics, University of Central Florida, Orlando, FL 32816, USA. Saturday 8:45am BA110

Some Inevxity Results in Multiokjective Optimization

Abstract: The notion of invexity was introduced by Hanson, who showed that for a nonlinear programming problem whose objective and constrained functions are invex, the Karush-Kuhn-Tucker necessary optimality conditions are also sufficient. The term invex (for invariant convex) was coined by Craven to signify the fact that the invexity property of a function is invariant under certain types of co-ordinate transformations. Many other extensions have been done and we consider the generalization due to Zalami in this paper. We consider the problem of multiobjective optimization where the functions involved are non-differentiable. We

obtain some weak, strong and converse dulity results and relate them to weak Pareto (efficient) solutions of the multiobjective programming problems. We also establish that the Karush-Kuhn-Tucker optimality conditions are sufficient.

Shari Moskow (moskow@math.drexel.edu) – Department of Mathematics, Drexel University, 3141 Chestnut Street, Philadelphia PA 19104. Friday 3:00pm BA207

Convergence and Stability of the Inverse Scattering Series for Diffuse Waves

Abstract: The application of the inverse Born series for the inverse scattering problem for diffuse light has been very promising, (Markel et. al J. Opt. Soc. Am. A, 2003) . The technique gives nonlinear corrections to the inverse Born approximation which do not require any further operator inversion, and formally the entire series yields the absorption coefficient. Here we examine the radius convergence of this functional series and the stability of the limit with respect to perturbations in the measured data. We find in particular that its stability is determined by the stability of the linearized inverse problem. The approach extends also to scalar waves in the near-field. This is joint work with J. Schotland.

Arunava Mukherjea (amukherjea@utpa.edu) – Department of Mathematics, University of Texas -Pan American, 1201 West University Drive, Edinburg, Texas 78539-2999. Saturday 2:30pm BA220

Skeletons, cyclicity, and products of i.i.d. stochastic matrices

Abstract: We shall talk about convergence in distribution of products of i.i.d. d by d random stochastic matrices, and discuss how skeletons of these matrices, and cyclicity in the support of their distribution can affect this convergence. These questions were originally posed by B.V.Rao.

M. Zuhair Nashed (znashed@mail.ucf.edu) – Department of Mathematics, University of Central Florida, Orlando, FL 32816, USA. Saturday 4:00pm BA110

Slant Newton-like Methods for Nonsmooth Optimization Problems

Abstract: We introduce a notion of strong slant differentiability of nonlinear operators on Banach spaces which is a strengthened version of the notion of slant differentiability introduced and studied in the paper [X. Chen, Z. Nashed and L. Qi, Smoothing methods and semismooth methods for nondifferentiabe operator equations, SIAM J. Numer. Anal. 38 (2000), 1200 - 1216. The new notion characterizes operators which satisfy a Lipschitz condition. Using this notion we consider Newton-like methods for nonsmooth optimization problems.

I. M. Navon (navon@scs.fsu.edu) – School of Computational Science and Department of Mathematics, Florida State University, Tallahassee, FL 32306-4120. Friday 4:00pm BA110

Application of Nonsmooth Optimization in Ensemble and Variational Data Assimilation Problems

Abstract: Cost functions formulated in four-dimensional variational data assimilation (4DVAR) are non-smooth in the presence of discontinuous physical processes (i.e., the presence of on-off switches in NWP models). The adjoint model integration produces values of subgradients, instead of gradients, of these cost functions with respect to the models control variables at discontinuous points. Minimization of these cost functions using conventional optimization algorithms may encounter difficulties. Nondifferentiable optimization algorithms were able to find the true minima in cases where the differentiable minimization failed. Optimal control of the 1-D Riemann problem of Euler equations was studied, with the initial values for pressure and density as control parameters. The cost functional employs either distributed observations in time or observations calculated at the end of the assimilation window. Smooth and nonsmooth optimization methods employ the numerical gradient (respectively, a subgradient) of the cost functional, obtained from adjoint of the discrete forward model. The numerical flow obtained with the optimal initial conditions obtained from application of nonsmooth minimization matches very well with the observations. The Maximum Likelihood Ensemble Filter (MLEF) equations are derived without the differentiability requirement for the prediction model and for the observation operators. Derivation reveals that a new non-differentiable minimization method can be defined as a generalization of the gradient-based unconstrained methods, such as the preconditioned conjugate-gradient and quasi-Newton methods. In the new minimization algorithm the vector of first order increments of the cost function is defined as a generalized gradient, while the symmetric matrix of second order increments of the cost function is defined as a generalized Hessian matrix. For differentiable observation operators, the minimization algorithm reduces to the standard gradient-based form. The non-differentiable aspect of the MLEF algorithm is illustrated with one-dimensional Burgers model. The MLEF algorithm has a robust performance, producing satisfactory results for tested non-differentiable observation operators

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Hoa Nguyen (nguyen@scs.fsu.edu, student speaker) – School of Computational Science, Florida State University, Tallahassee, FL 32306-4510. Saturday 9:45am BA209

Adaptive Anisotropic Meshes for Steady-State Convection Dominated Problems

Abstract: Obtaining accurate solutions for the convection-diffusion equation is challenging due to the presence of layers when convection dominates diffusion. To solve this problem we have designed an adaptive algorithm which optimizes the alignment of anisotropic meshes with a numerical solution. Three main ingredients are used. First, a streamline upwind Petrov Galerkin method is used to produce a stabilized solution. Second, an adapted metric tensor is computed from the approximate solution. Third, optimized anisotropic meshes are generated from the computed metric tensor. Our algorithm has been tested on a variety of 2-dimensional examples. The results show better accuracy and convergence rates at lower computational cost when compared with those of methods using isotropic meshes.

Liang Peng (peng@math.gatech.edu) – School of Mathematics, Georgia Institute of Technology, Atlanta, GA 30332-0160. Saturday 9:45am BA121

Conditional Variance Estimation in Heteroscedastic Regression Models

Abstract: First, we propose a new method for estimating the conditional variance in heteroscedasticity regression models. For heavy tailed innovations, this method is in general more efficient than either of the local linear and local likelihood estimators. Secondly, we apply a variance reduction technique to improve the inference for the conditional variance. Thirdly, we applied empirical likelihood methods to construct interval estimation.

Sonja Petrovic (petrovic@ms.uky.edu, student speaker) – Department of Statistics, University of Kentucky, 805A Patterson Office Tower, Lexington, KY 40506-0027. Friday 3:30pm BA146

Properties of cut ideals of certain graphs

Abstract: Given a graph G, any partition of its vertex set induces a coloring on its edges by recording whether the ends of an edge have been separated by the partition. The set of edges whose ends have been separated in this way is called a cut of the graph. These edge colorings induced by vertex set partitions parametrize a toric variety. Its defining ideal, the cut ideal of G, records algebraic relations among the cuts.

These toric ideals have been introduced by Sturmfels and Sullivant who also posed the problem of relating their properties to the combinatorial structure of the graph. We will describe a certain class of graphs whose cut ideals admit squarefree lexicographic Groebner bases. Thus the associated semigroup algebras are Cohen-Macaulay. In addition, the cut ideals of an important subclass of these graphs have a quadratic Groebner basis.

Dzung Phan* and William Hager (dungphan@math.ufl.edu, student speaker) – Department of Mathematics, University of Florida, Gainesville, FL 32611-8105. Saturday 2:30pm BA110

A Branch and Bound Approach to Solving Quadratic Programs

Abstract: In this talk, we present a branch and bound algorithm for globally minimizing a general quadratic function subject to a constraint defined as the intersection of ifinitely many ellipsoids. We consider an ellipsoidal bisection in branching and use a convex ellipsoidal constrained quadratic program obtained by under estimating the objective function to compute the lower bound. It is shown that the under estimator is tight which guarantees global convergence as the diameter of the ellipsoids in the refinement process tends to zero. An effcient method for solving the convex quadratic programs is also introduced. Numerical comparisons with other algorithms are given using randomly generated larger-scale problems.

Gabriel Picioroaga (gabriel@math.binghamton.edu) – Department of Mathematical Sciences, Binghamton University, Binghamton, New York 13902-6000. Saturday 4:00pm BA218

Orthonormal Dilations of Parseval Wavelets

Abstract: This is a report on our joint work with D.Dutkay, D.Han and Q.Sun. We prove that any Parseval wavelet frame is the projection of an orthonormal wavelet basis for a representation of the Baumslag-Solitar group BS(1,2). We give a precise description of this representation in some special cases and show that for wavelet sets the representation is related to symbolic dynamics. The structure of the representation is revealed by the analysis of certain finite orbits for the associated symbolic dynamics. We give concrete examples of Parseval wavelets for which we compute the orthonormal dilations in detail; we construct Parseval wavelet sets which have infinitely many non-isomorphic orthonormal dilations.

Virgil U. Pierce (vpierce@math.ohio-state.edu) – Department of Mathematics, The Ohio State University , 100 Math Tower, 231 West 18th Avenue , Columbus, OH 43210-1174. Friday 4:30pm BA126

The Whitham equations for the higher order KdV and the defocusing complex mKdV equations

Abstract: The Whitham equations are quasilinear hyperbolic equations which describe the averaged dynamics of the rapid oscillations which appear in the higher order KdV equations and defocusing complex mKdV equations when the dispersion parameter is small. The oscillations in this situation are called dispersive shocks. For these PDEs the Whitham equations are neither strictly hyperbolic nor genuinely nonlinear. In contrast, the Whitham equations for the KdV and NLS equations are strictly hyperbolic and genuinely nonlinear. We have computed self similar solutions to these equations. We show that the non-strict hyperbolicity is responsible for an additional structure in the dispersive shocks of these higher order PDEs which is not present in the KdV and NLS equations. This is joint work with Y. Kodama and F.-R. Tian.

Michael D. Plummer (michael.d.plummer@vanderbilt.edu) – Department of Mathematics, Vanderbilt University, Nashville, TN37240, USA. Saturday 9:15am BA107

Vertex criticality for connected domination

Abstract: A dominating set of vertices S of a graph G is connected if the subgraph $G[S]$ is connected. Let $\gamma_c(G)$ denote the size of any smallest connected dominating set in G. Graph G is k-connected-vertex-critical (abbreviated kcvc) if $\gamma_c(G) = k$, but if any vertex v is deleted from G, then $\gamma_c(G - v) \leq k - 1$.

It is well-known that the only $1cvc$ graph is K_1 and the $2cvc$ graphs are obtained from the even complete graphs K_{2n}, with $n \geq 2$, by deleting a perfect matching. For higher values of γ_c, little is known. In this paper we concentrate on the case when $\gamma_c = 3$ and study some basic properties of $3cvc$ graphs, especially with respect to connectivity, and then present three new infinite families of $3cvc$ graphs.

A set of vertices S of a graph G is said to be a total dominating set if every vertex in $V(G)$ is adjacent to a vertex of S. Connections to total domination will also be mentioned.

This is joint work with Watcharaphong Ananchuen and Nawarat Ananchuen.

Florin A. Potra (potra@math.umbc.edu) – Department of Mathematics & Statistics. University of Maryland, Baltimore County, 1000 Hilltop Circle Baltimore, MD 21250. Friday 2:30pm BA110

On the numerical solution of complementarity problems

Abstract: A new class of infeasible interior point methods for solving sufficient linear complementarity problems requiring one matrix factorization and m backsolves at each iteration is proposed and analyzed. The algorithms from this class use a large ($\mathcal{N}_{\infty}^{-}$) neighborhood of an infeasible central path associated with the complementarity problem and an initial positive, but not necessarily feasible, starting point. The Q-order of convergence of the complementarity gap, the residual, and the iteration sequence is $m+1$ for problems that admit a strict complementarity solution and $(m+1)/2$ for general sufficient linear complementarity problems. The methods do not depend on the handicap κ of the sufficient LCP. If the starting point is feasible (or "almost" feasible) the proposed algorithms have $\mathcal{O}((1+\kappa)(1+\log \sqrt[m]{1+\kappa}\,)\sqrt{n}\,L)$ iteration complexity, while if the starting point is "large enough" the iteration complexity is $\mathcal{O}((1+\kappa)^{2+1/m}(1+\log \sqrt[m]{1+\kappa}\,)n\,L)$.

Alexander Powell (alexander.m.powell@vanderbilt.edu) – Department of Mathematics, Vanderbilt University, Nashville, TN 37240. Saturday 4:30pm BA218

MSE bounds for the RG-algorithm

Abstract: The RG-algorithm addresses the problem of estimating a signal from a set of noisy frame coefficients. We prove new MSE error bounds for the performance of this algorithm in the settings of deterministic and random measurements.

Lianfen Qian (lqian@fau.edu) – Department of Mathematical Sciences, Florida Atlantic University, Boca Raton, FL 33431. Friday 4:00pm BA 121

Efficient Empirical Likelihood Methods for Longitudinal Data

Abstract: Efficient estimation of parameters of interest is a major objective in analyzing longitudinal data. In this work, we propose two empirical likelihood based methods that take into consideration of within subject correlations. A nonparametric version of the Wilks theorem for the limiting distributions of the empirical likelihood ratios is derived. A simulation study is carried out to compare the proposed methods with the block empirical likelihood method by You et al. (2006) and normal approximation with working independence correlation. The results suggest that our proposed methods are more efficient than the existing methods. This is joint work with Suojin Wang and Raymond Carroll.

Jian-Jian Ren (jren@mail.ucf.edu) – Department of Mathematics, University of Central Florida, Orlando, FL 32816. Saturday 9:15am BA121

Weighted Empirical Likelihood in Some Two-Sample Semiparametric Models

Abstract: For In this article, the weighted empirical likelihood is applied to a general setting of two-sample

semiparametric models, which includes biased sampling models and case-control logistic regression models as special cases. For various types of censored data, such as right censored data, doubly censored data, interval censored data, and partly interval-censored data, the weighted empirical likelihood-based semiparametric maximum likelihood estimator $(\tilde{\theta}_n, \tilde{F}_n)$ for the underlying parameter θ_0 and distribution F_0 is derived, and the strong consistency of $(\tilde{\theta}_n, \tilde{F}_n)$ and the asymptotic normality of $\tilde{\theta}_n$ are established. Under biased sampling models, the weighted empirical log-likelihood ratio is shown to have an asymptotic scaled chi-square distribution for censored data aforementioned. For right censored data, doubly censored data and partly interval-censored data, it is shown that $\sqrt{n}(\tilde{F}_n - F_0)$ weakly converges to a centered Gaussian process, which leads to a consistent goodness of fit test for the case-control logistic regression models.

Neil Robertson (robertso@math.ohio-state.edu) – Department of Mathematics, The Ohio State University, 100 Math Tower, 231 West 18th Avenue , Columbus, OH 43210-1174. Friday 1:10pm BA107

An outlook on graph minor structure theory

Abstract: This talk will survey past, present and future directions in graph minor structure theory. For context the basic structure theorem used in proving that finite graphs are a well quasi-order under minor (deletion-contraction) inclusion will be described. Two main current threads of research involve the Hadwiger conjecture and matroid minor well-quasi-order (for matrices over a finite field). Besides these, some apparently very difficult open problems, often related to better-quasi-order and finer graph structure and which may motivate future research will be discussed.

John C. Schotland (schotland@seas.upenn.edu) – Department of Bioengineering, University of Pennsylvania, Philadelphia, PA 19104. Friday 2:30pm BA207

Image Reconstruction in Optical Tomography

Abstract: The inverse problem of optical tomography is to reconstruct the optical properties of a highly-scattering medium from boundary measurements. I will review recent work on associated inverse scattering problems for the radiative transport equation. Our results will be illustrated by numerical simulations and experiments in model systems.

Chang Eon Shin (shinc@sogang.ac.kr) – Department of Mathematics, Sogang University, Seoul 121-742, South Korea. Saturday 9:15am BA218

Nonuniform sampling of bandlimited functions

Abstract: We show that a bandlimited signal with bandwidth π which is square integrable on the real line can be reconstructed in the Lagrange interpolation form with sampling points $\{t_n\}$ satisfying $|t_n - n| \leq d$ and L additional points, where d is a nonnegative real number which is not necessarily less than 1/4, and $L = [4d]$. Here, $[a]$ denotes the integer part of a. We also provide sampling expansions for functions in B^p_π, $1 \leq p \leq \infty$.

Bhimsen Shivamoggi (bhimsens@pegasus.cc.ucf.edu) – Department of Mathematics, University of Central Florida, Orlando, FL 32816. Saturday 8:45am BA212

Vortex Stretching in a Compressible Fluid and Applications to Turbulence

Abstract: Stretching of axisymmetric vortices in a compressible fluid is considered. The flow associated with the vortex is perpendicular to the plane of the uniform straining flows. Compressibility effects are considered to be weak to facilitate an analytic solution. Applications to compressible turbulence are briefly considered.

Palle Jorgensen and Myung-Sin Song* (msong@siue.edu) – Department of Mathematics and Statistics, Southern Illinois University Edwardsville, Edwardsville, IL 62026-1653, USA. Saturday 5:00pm BA218

Analysis of Fractals, Image Compression, Entropy Encoding and Karhunen-Loe've Transforms

Abstract: The algorithms in a diverse set of applications may be cast in the context of relations on a finite set of operators in Hilbert space will be shown. The Cuntz relations form a finite set of isometries form a prototype of these relations. Such applications as entropy encoding, analysis of correlation matrices (Karhunen-Lo'eve), fractional Brownian motion, and fractals more generally, admit multi-scales. In signal/image processing, this may be implemented with recursive algorithms using subdivisions of frequency bands; and in fractals with scale similarity. In Karhunen-Lo'eve analysis, we introduce a diagionalization procedure; and we show how the Hilbert space formulation offers a unifying approach.

Chris Stephens (cstephen@mtsu.edu) – Department of Mathematical Sciences, Middle Tennessee State University, MTSU BOX 34 Murfreesboro, Tennessee 37132. Saturday 3:30pm BA107

Spanning disks in toroidal embeddings

Abstract: Let Φ be an embedding of a graph G in a surface S. If there exists a subset K of S bounded by a subgraph of G such that K contains all vertices of G, then K is called a spanning subset of Φ.

Examples of spanning subsets include spanning disks and spanning annuli with some number of holes (the latter are called planarizing sets in some papers). A spanning subset may provide a simpler structure, yet still contain enough information to approach certain problems about graphs embedded on surfaces. We prove that any embedding of a 4-connected graph in the torus with representativity at least three has a "spanning disk"—i.e., a (contractible) disk which contains all vertices of the graph and which is bounded by a cycle of the graph. Some potential applications will be discussed. This is joint work with Xiaoya Zha.

Seth Sullivant (seths@math.harvard.edu) – Department of Mathematics, Harvard University, One Oxford Street, Cambridge, MA 02138. Saturday 9:15am BA146

Algebraic Factor Analysis

Abstract: Factor analysis is a statistical model where observed covariates are conditional independent given

a small number of hidden factors, and all random variables are jointly Gaussian. The resulting algebraic parameter spaces are higher secant varieties of the toric variety associated to the second hypersimplex, inside the cone of positive semidefinite matrices. I will describe some recent work on determining a Grobner basis for the 2-factor model, using combinatorial techniques and prolongations.

Shuyu Sun (shuyu@clemson.edu) – Department of Mathematical Sciences, Clemson University, Clemson, SC 29634-0975. Friday 4:00pm BA209

Conservative and Adaptive Galerkin Methods for Coupling Flow and Transport in Porous Media

Abstract: Numerical modeling of flow and transport in porous media has important applications in many fields including hydrology, environmental protection and petroleum industry. Computational challenges of this coupled system include long simulation time periods, multiple nonlinearly coupled components, multi-scale variation of parameters, concentrated plumes, and sharp fronts. For example, numerical schemes need to be locally conservative for accurately treating this system; in particular, violation of local conservation in Darcy velocity could cause spurious sources and sinks to transport simulations, leading to substantial numerical overshoots and undershoots of transport solutions. In addition, many localized phenomena such as dynamically evolved concentration fronts demand intensive spatial and temporal adaptivity. To address these challenges, we propose a locally conservative numerical approach based on Galerkin formulation with space enrichment, and equip it with effective mesh adaptation guided by a posteriori error estimators. In this talk, we discuss theoretical analysis of this method including the consistency of the scheme, the inf-sup condition of the discrete problem, and the optimal convergence of numerical solutions. Moreover, various numerical experiments on coupled flow and transport in porous media are provided to illustrate the advantages of this proposed method.

Jason Swanson (jswanson@math.ucf.edu) – Department of Mathematics, University of Central Florida, 4000 Central Florida Blvd P.O. Box 161364, Orlando, FL 32816-1364. Saturday 3:00pm BA220

The median of independent Brownian motions and other colliding particle models

Abstract: In 1965, T. E. Harris considered a model of particles interacting through elastic collisions. The particles are initially distributed along the real line as a Poisson point process. Their subsequent motion is Brownian, with the collisions modeled by a relabeling of their trajectories. Harris showed that the motion of a tagged particle in this system is asymptotically that of a fractional Brownian motion. This result was generalized in 1985 by Dürr, Goldstein, and Lebowitz to particle systems whose underlying motion may be non-Brownian.

In these models, the analysis of the tagged particle relies heavily on the initial Poisson distribution, which ensures that the entire system is stationary. In 2007, we considered a similar model in which n independent Brownian motions, all starting at the origin, interact through the same elastic collisions. Our tagged particle in this system is simply the median particle. We showed that the rescaled median process converges to a process with the same local behavior as fractional Brownian motion. Our proof, however, does not rely on the special nature of the initial particle distribution. These methods, therefore, may prove to be more robust in analyzing a variety of different colliding particle models.

I will discuss this 2007 result, as well as directions for future research in this area.

Alexandru Tamasan (tamasan@math.ucf.edu) – Department of Mathematics, University of Central Florida, Orlando, FL 32816. Saturday 10:15am BA207

On the inversion of the Attenuated Doppler transform for planar vector fields

Abstract: I will present the problem of determination of a planar vector field when its Doppler data is modified by the presence of an unknown scalar field. Using Bukhgeim's approach to tomography based on A-analyticity, we show that the curl of the vector field can be stably recovered. In absorbing media the integrals are weighted to account for the attenuation along the path. When the boundary values of the field are known, its solenoidal part is determined from its curl.

Fei-Ran Tian (tian@math.ohio-state.edu) – Department of Mathematics, Ohio State University, 231 W. 18th Avenue, Columbus, OH 43210. Friday 3:30pm BA126

Non-Strictly Hyperbolic Whitham Equations

Abstract: We will discuss the Whitham equations whose real eigenspeeds coincide. These equations occur as the modulation equations for the higher order KdV, higher order defocusing NLS and the regular Camassa-Holm.

Li Tian (tianl@math.sc.edu, student speaker) – Department of Mathematics, University of South Carolina. Saturday 9:15am BA209

Analysis of a Mixed Finite Volume Discretization of Fourth Order Equations on General Surfaces

Abstract: Classical finite volume methods do mesh generation and solve equations on a 2D plane, while numerical solutions of PDEs on arbitrary surfaces are needed in diverse applications such as fluid dynamics, weather forecast and climate modeling, cell membrane and image processing. In this paper, we discuss how to solve fourth-order elliptic equations on arbitrary surface with mixed finite volume discretization, analysis and convergence rate, and numerical experiment is given after the theoritical part.

Alexandre Timonov (atimonov@uscupstate.edu) – Division of Mathematics and Computer Science, University of South Carolina Upstate, Charlotte, NC 28223-0001. Friday 3:30pm BA207

On a new approach to constructing globally convergent algorithms for quantitative imaging

Abstract: Quantitative imaging is usually reduced to a non-convex optimization problem, so that the globally convergent algorithms are needed for a nonlinear identification of coefficients. The global convergence is understood in the sense that an initial approximation is arbitrarily chosen in a correctness set, not necessarily close to the desired solution. A new approach reduces an original inverse problem to the Cauchy problems for the Riccati equation and then to the Cauchy problem for a first order differential equation for

the sequence valued maps. The latter equation does not contain an unknown coefficient. The numerical results demonstrate the computational feasibility of the approach.

Alexander Tovbis (atovbis@pegasus.cc.ucf.edu) – University of Central Florida, Department of Mathematics, 4000 Central Florida Blvd., P.O. Box 161364, Orlando, FL 32816-1364. Saturday 4:00pm BA126

Direct and Inverse Scattering transforms for the semiclassical focusing Nonlinear Schroedinger Equation

Abstract: We consider the semiclassical limit for the focusing Nonlinear (cubic) Schroedinger Equation (NLS) in the pure radiational case. We present a method of reconstructing the leading order terms of the solitonless initial data and of its evolution for a wide class of the corresponding reflection coefficients. Conversely, we present a method of constructing leading order terms of the scattering data through the initial potential.

Sergey Belov, Alexander Tovbis, Stephanos Venakides* and Xin Zhou (ven@math.duke.edu) – Mathematics Department, Duke University, Box 90320, Durham, NC 27708-0320. Friday 2:30pm BA126

Long-time focusing NLS asymptotitcs and their connection to a catastrophic collision

Abstract: We analyze the persistence of modulated 2-phase NLS waves developed after the first break (first nonlinear causticline in space-time). In previous work, we have shown the global time-persistence of these waves and the absence of further breaking within an initial solitonless wave structure. For initial data containing solitons, a certain catastrophic collision in the complex plane, could initiate a new kind of breaking. We show that this collisison does not occur over a large region of space-time.

Ram Verma (verma99@msn.com) – International Publications, 12085 Lake Cypress Circle, Suite I 109, Orlando, Florida 32828, USA. Saturday 8:15am BA110

Generalized Proximal Point Algorithm and η-Maximal Monotonicity Framework with Application to Minimization

Abstract: First, based on $\eta-$maximal monotonicity framework, a generalization to Rockafellar's theorem (1976) in the context of approximating a solution to a general inclusion problem involving a multivalued $\eta-$maximal monotone mapping using the proximal point algorithm in a Hilbert space setting is considered. The convergence rate turns out to be linear. Then an application to a minimization problem of a functional on a Hilbert space is examined. The general framework for $\eta-$maximal monotonicity generalizes the general theory of multivalued maximal monotone mappings.

Rafael H. Villarreal (vila@esfm.ipn.mx) – Departamento de Matematicas, Centro de Investigacion y de Estudios Avanzados del IPN, 07000 Mexico City, D.F., Mexico. Friday 4:00pm BA146

Algebraic and combinatorial properties of ideals and algebras of uniform clutters of TDI systems

Abstract: Let C be a uniform clutter, i.e., all the edges of C have the same size, and let A be the incidence matrix of C. We denote the column vectors of A by $v1, ..., vq$. Let P be the toric ideal of the monomial subring $K[x^{v1}, ..., x^{vq}]$, where K is a field. If A is a balanced matrix we prove that any regular triangulation of the cone generated by $v1, ..., vq$ is unimodular, i.e., all initial ideal of P are generated by square-free monomials. If C satisfies the max-flow min-cut property, we prove that A diagonalizes over the integers to an identity matrix and that $v1, ..., vq$ is a Hilbert basis.

Shiyi Chen, Gregory L. Eyink, Minping Wan*, **Zuoli Xiao** (mpwan@jhu.edu, student speaker) – Department of Applied Mathematics & Statistics, The Johns Hopkins University, Baltimore, Maryland 21218-2682. Friday 3:30pm BA212

Physical mechanism of the inverse energy cascade of 2D turbulence: a numerical investigation

Abstract: We report an investigation of inverse energy cascade in steady-state 2D turbulence by direct numerical simulation of the 2D N-S equation, with small-scale forcing and large-scale damping. We employed several types of damping and dissipation mechanisms in simulations up to 20482 resolution. For all these simulations we obtained a wavenumber range for which the mean spectral energy flux is a negative constant and the energy spectrum scales as $k^{-5/3}$, consistent with the predictions of Kraichnan (1967). To gain further insight, we investigated the energy cascade in physical space, employing a local energy flux defined by smooth filtering. We found that the inverse energy cascade is scale-local, but that the strongly local contribution vanishes identically. The mean flux across a length scale l was shown to be due mainly to interactions with modes 2-8 times smaller. A major part of our investigation was devoted to identifying the physical mechanism of the 2D inverse energy cascade. We made a quantitative study employing a precise topological criterion of merger events. Our statistical analysis showed that vortex mergers play a negligible direct role in producing mean inverse energy flux. Instead, we obtained considerable evidence in favor of a vortex-thinning mechanism, according to which the large-scale strains do negative work against turbulent stress as they stretch out the isolines of small-scale vorticity. In particular, we studied a Multi-Scale Gradient (MSG) expansion for the turbulent stress, whose contributions to inverse cascade can all be explained by thinning. The MSG expansion up to second-order in space gradients was found to predict very well the magnitude, spatial structure and scale distribution of the local energy flux. The majority of mean flux was found to be due to the relative rotation of strain matrices at different length-scales, a first-order effect of thinning. The remainder arose from two second-order effects, differential strain-rotation and vorticity-gradient stretching. Our findings give strong support to vortex-thinning as the fundamental mechanism of 2D inverse energy cascade.

Kening Wang (kening.wang@unf.edu) – Department of Mathematics and Statistics, University of North Florida, Jacksonville, FL 32224. Friday 2:30pm BA209

An Iterative Substructuring Algorithm for C_0 Interior Penalty Methods

Abstract: We study the Bramble-Pasciak-Schatz (BPS) preconditioner that can be used in the iterative solution of the discrete problems resulting from C0 interior penalty methods for fourth order elliptic boundary value problems. We prove that the condition number of the preconditioned system for the BPS preconditioner is of order $O((1+\ln(H/h))^2)$, where H and h represent the coarse mesh size and the fine mesh size respectively.

Qiuhui Chen, Yanbo Wang and Yi Wang* (ywang2@mail.aum.edu) – Department of Mathematics, Auburn University at Montgomery, Montgomery, AL 36124-4023. Saturday 9:45am BA218

A Sampling Theorem for Non-bandlimited Signals Using Generalized Sinc Functions

Abstract: A ladder shape filter of two real parameters $a_1, a_2 \in (-1, 1)$ is introduced in this note. The impulse response of the corresponding LTI system is a generalized Sinc function of two parameters. Consequently a generalized Shannon type sampling theorem is established for a class of non-bandlimited signals with special spectrum properties associated with a ladder shaper filter of two parameters. Finally, a mathematical characterization for the class of non-bandlimited signals holding the generalized sampling theorem is offered. These signals are restrictions to the real line of certain analytic functions in stripped domains symmetric about the real axis in the complex plane. For these signals, their spectra in high frequency bands are measured by the spectra of the base band.

Mingxin Xu (atimonov@uscupstate.edu) – Department of Mathematics, UNC Charlotte, 9201 University City Blvd. Charlotte, NC 28223-0001. Saturday 3:30pm BA220

Infinite Horizon Optimal Search Problem with Hiring and Firing Options

Abstract: This is one extension of the 'Secretary Problem' in probability study. The candidates arrive one after another with independent exponentially distributed random times. Their value processes are driven by Brownian motions with i.i.d. initial values. The time horizon is infinite. We find the sequence of optimal hiring and firing stopping times to maximize the expected value of the integral of discounted value process where linear penalties of hiring and firing are incorporated.

Liqing Yan (yan@math.ufl.edu) – Department of Mathematics, University of Florida, 358 Little Hall, PO Box 118105, Gainesville, FL 32611–8105. Saturday 4:00pm BA220

Asymptotic optimal tradeoff in Monte Carlo simulation of security prices

Abstract: This paper presents an efficient algorithm for the allocation of computing resources to the problem of Monte Carlo simulation of continuous-time security prices. The asymptotic optimal tradeoff $m = cn^2$ between increasing n, the number of time intervals and, increasing m, the number of simulations, given a limited budget of computer time, is found for the discrete-time Euler scheme. The constant c is estimated by $\hat{c}$ from the first round simulations. An efficient algorithm, based on the second round simulations according to the optimal tradeoff $m = \hat{c}n^2$, is provided for the desired security price.

Xiaofeng Yang (xfyang@email.unc.edu) – Department of Mathematics, the University of North Carolina at Chapel Hill, Phillips Hall Chapel Hill, NC 27599. Friday 3:00pm BA218

An energetic variational phase field model for two incompressible flows: Newtonian fluids and complex fluids

Abstract: An energectic variational phase field model is propsed to describe the motions of mixture of two incompressible flows. It is used to study the retraction and pinch-off of a liquid filament in the newtonian case. For the viscoelastic case, two phase complex fluids motion under shear flow are studied.

Carl Yerger (cyerger@math.gatech.edu, student speaker) – School of Mathematics, Georgia Institute of Technology, Atlanta, GA 30318, USA. Saturday 4:00pm BA107

Six-Critical Graphs on the Klein Bottle

Abstract: We exhibit an explicit list of nine graphs such that a graph drawn in the Klein bottle is 5-colorable if and only if it has no subgraph isomorphic to a member of the list. This answers a question of Thomassen [J. Comb. Theory Ser. B 70 (1997), 67–100] and implies an earlier result of Král', Mohar, Nakamoto, Pangrác and Suzuki that an Eulerian triangulation of the Klein bottle is 5-colorable if and only if it has no complete subgraph on six vertices.

This is joint work with Nathan Chenette, Luke Postle, Noah Streib and Robin Thomas.

Jeong-Rock Yoon (jryoon@clemson.edu) – Department of Mathematical Sciences, Clemson University, Clemson, SC 29634-0975. Friday 4:00pm BA207

Magnetic resonance elastography and its detectability

Abstract: In this talk, an MR technique, incorporated with a time-harmonic mechanical excitation, to reconstruct the elasticity of tissue is introduced. One of the advertising merits of this technique is the possibility of detecting early stage small cancerous tissue, which is believed to be of 3 5 mm diameter stiffer inclusion. However, the detection of this small inclusion is challenging, because the inclusion is quite small relative to the typical wavelength (10 30 mm) of time harmonic wave in a healthy background medium (3 m/sec shear wave speed) for 100 300 Hz excitation. Additionally, in a noisy environment the amplitude drop, which reflects the existence of the stiffer inclusion, should be above noise level in order to be detected. This talk provides a theoretical bound of the smallest possible size of the detectable inclusion as a function of noise level, contrast ratio of the stiffness, and the excitation frequency.

Ruriko Yoshida (ruriko@ms.uky.edu) – Department of Statistics, University of Kentucky, 805A Patterson Office Tower, Lexington, KY 40506-0027. Saturday 9:45am BA 146

Markov bases for two-way subtable sum problems

Abstract: It has been well-known that for two-way contingency tables with fixed row sums and column

sums the set of square-free moves of degree two forms a Markov basis. However when we impose an additional constraint that the sum of a subtable is also fixed, then these moves do not necessarily form a Markov basis. In this talk, we show a necessary and sufficient condition on a subtable so that the set of square-free moves of degree two forms a Markov basis. (joint work with Hisayuki Hara and Akimichi Takemura)

Gexin Yu (gexin.yu@Vanderbilt.Edu) – Department of Mathematics, 1326 Stevenson Center, Vanderbilt University, Nashville, Tennessee 37240. Saturday 2:30pm BA107

Ore-type Packing Problems

Abstract: Two graphs pack if there is an embedding of the graphs on the same vertex set such that there are no conflicting edges. The extremal problems on packing involving maximum degrees are well-studied, while the ones involving Ore-type degree conditions are just started recently. In this talk, we will talk about the Ore-type pacing problems, especially we will give an Ore-type degree conditions ensuring the existence of all possible 2-factors. This is a joint work with A.Kostochka.

Qiqing Yu (qyu@math.binghamton.edu) – Department of Mathematical Sciences, Binghamton University, Binghamton, NY 13902-6000 USA. Saturday 2:30pm BA121

Identifiability and Consistency in Masking Models for Competing Risks Data

Abstract: We consider the estimation problem with competing risks data and masked failure cause (called MCR data). We study the identifiability of the parameters of interests. It suffices to study the same problem of the marginal distribution of the failure cause. In particular, we investigate the identifiability issue for two popular models in the literature on the MCR data. A finding of the paper is that the parameters in the model proposed by Flehinger *et al.* (2001) is not identifiable unless additional constraints such as the stage-2 model are imposed on the parameters. We also show that the marginal MLE of the failure cause under the other model is consistent and efficient under certain regularity assumptions. We apply our procedure to analyze a medical research data set.

Xingxing Yu (yu@math.gatech.edu) – Department of Mathematics, Georgia Institute of Technology, Atlanta, GA 30318, USA Friday 2:30pm BA107

Approximating the chromatic index of multigraphs

Abstract: It is well known that if G is a multigraph then $\chi'(G) \geq \chi'^*(G) := \max\{\Delta(G), \Gamma(G)\}$, where $\chi'(G)$ is the chromatic index of G, $\chi'^*(G)$ is the fractional chromatic index of G, $\Delta(G)$ is the maximum degree of G, and $\Gamma(G) = \max\{2|E(G[U])|/(|U|-1) : U \subseteq V(G), |U| \geq 3, |U| \text{ is odd}\}$. The conjecture that $\chi'(G) \leq \max\{\Delta(G)+1, \lceil\Gamma(G)\rceil\}$ was made independently by Goldberg (1973), Anderson (1977), and Seymour (1979). We prove this conjecture for multigraphs G with $\chi'(G) > \lfloor \Delta(G) + \sqrt{\Delta(G)/2} \rfloor$.

This is joint work with Guantao Chen and Wenan Zang.

Alexander Zamyatin (azamyatin@tmriusa.com) – Toshiba Medical Research Institute USA, Inc. Saturday 9:15am BA207

An exact reconstruction algorithm for computed tomography utilizing circle and line trajectory with optional gantry tilt.

Abstract: We investigate image reconstruction with circle and line trajectory with tilted gantry. We derive new equations for reconstruction from line data, such as equations of filtering lines, range of filtering lines, range of the line scan and backprojection from the filtering lines. The proposed algorithm allows arbitrary tilt angles. We analyze detector requirements of the proposed algorithm. We discuss full scan and short scan versions of the algorithm. For evaluation we use simulated and real 256-slice data. This is joint work with A. Katsevich.

Wenan Zang (wzang@maths.hku.hk) – Department of Mathematics, University of Hong Kong, Pokfulam, Hong Kong. Saturday 10:15am BA107

The Circumference of a Graph with no $K_{3,t}$-minor

Abstract: The class of graphs with no $K_{3,t}$-minors, $t \geq 3$, contains all planar graphs and plays an important role in graph minor theory. In 1992, Seymour and Thomas conjectured the existence of a function $\alpha(t) > 0$ and a constant $\beta > 0$, such that every 3-connected n-vertex graph with no $K_{3,t}$-minors, $t \geq 3$, contains a cycle of length at least $\alpha(t)n^{\beta}$. The purpose of this talk is to present a proof of this conjecture with $\alpha(t) = (\frac{1}{2})^{t(t-1)}$ and $\beta = \log_{1729} 2$. (Joint work with Guantao Chen and Xingxing Yu)

Ahmed I. Zayed (azayed@condor.depaul.edu) – Department of Mathematical Sciences, DePaul University, 2320 North Kenmore Avenue Chicago, IL 60614. Saturday 10:15am BA218

A Generalization of the Paley-Wiener Space

Abstract: In this talk we introduce an analogue of the Paley-Wiener space of bandlimited functions, PW_{ω}, in Hilbert spaces. This space is defined in terms of a self-adjoint operator D. We show that the space $PW_{\omega}(D)$ has similar properties to those of the space PW_{ω}, including an analogue of the Bernstein inequality and the Riesz interpolation formula.

Xiaoya Zha (xzha@mtsu.edu) – Department of Mathematical Science, Middle Tennessee State University, USA. Friday 4:30pm BA107

Representativity of Cayley Maps

Abstract: A Cayley map is an embedded Cayley graph with the property that the clockwise rotation of generators is the same at each vertex. This project is driven by the following question: given a finite group and a generating set, what are the minimum and maximum representativities that can be achieved by a corresponding Cayley map? In particular, we are interested in whether we can achieve representativity

at least two. In this talk we will (i) provide some sufficient conditions for certain Cayley Maps having representativity at least two, and (ii) discuss the cases in which the generating set has size two or three. This is joint work with Chris Stephens.

Hongchao Zhang (hozhang@ima.umn.edu) – The Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN 55455, USA. Saturday 9:15am BA110

A Derivative-free Approach for the Least-Squares Minimization

Abstract: In this talk, we discuss an approach for solving the least square minimization $\min \Phi(x) = \sum_{i=1}^{m} f_i(x)^2$, where $x \in R^n$ and $f_i : R^n \to R, i = 1, ..., m$, are nonlinear functions, but their derivatives are not available. This problem arises frequently and becomes more important in computational science and engineering. We apply Powell's least Frobenius norm updating strategy to asymptotically build at least fully-linear models for each f_i. With the help of these approximation models, a generalized Levenberg-Marquardt approach is applied for minimizing the least squares residue of the problem. Numerical results indicating this approach is very promising compared with using NEWUOA (Powell, 2004) for the least squares minimization directly and performs more efficient and stable than LMDIF (More' etc., 1980). Performances of the algorithm for system of nonlinear equations with noise will also be discussed.

Lei Zhang (zhang_l@math.psu.edu) – Department of Mathematics, Pennsylvania State University, University Park, PA 16802. Friday 4:30pm BA218

Phase field modeling and simulation of 2D/3D critical nuclei morphology in solid state phase transitions

Abstract: A phase field model combined with the minimax technique is implemented to simulate the 2D/3D critical nucleus in solid state phase transformations. It takes into account the anisotropic interfacial energy and anisotropic long-range elastic interactions. We demonstrate that the morphology of critical nuclei in elastically anisotropic solids can be efficiently predicted by the numerical algorithm without a priori assumptions. Numerical examples provide to show that strong elastic energy interactions may lead to critical nuclei whose point group symmetry is below the crystalline symmetries of both the new and the parent phases.

Tianyu Zhang (zhang@math.fsu.edu) – Department of Mathematics, Florida State University Tallahassee, FL, 32306-4510. Friday 3:30pm BA218

Phase-Field Models for Biofilm Growth, Expansion, and Biofilm-Flow Interaction

Abstract: We derive a set of phase field models for biofilms using the one-fluid two-component formulation in which the combination of extracellular polymeric substances (EPS) and the bacteria are effectively modeled as one fluid component while the collective ensemble of nutrient and the solvent are modeled as the other. The biofilm is assumed an incompressible continuum. Two growth modes are identified in linearized analysis. Numerical simulations are carried out in one and two space dimension using a velocity-corrected projection method for incompressible flows. Biofilm growth, expansion, streaming, rippling, and detachment are simulated in shear cells numerically. Viscoelastic properties of the biofilm is investigated as well.

Yanzhi Zhang (yzhang@scs.fsu.edu) – School of Computational Science, Florida State University, Tallahassee, FL 32306-4120. Saturday 8:45am BA209

Efficient and Stable Spectral Methods for Dynamics of Bose-Einstein Condensation

Abstract: In this talk, an efficient and accurate spectral method will be presented to simulate the dynamics of non-rotating Bose-Einstein condensates (BECs). This method has higher order accuracy in both space and time. Then this method is also extended to study the dynamics of rotating BECs based on the Gross-Pitaevskii equation (GPE) with an angular momentum rotation term. Finally, some numerical results are presented to show the efficiency of these methods.

Yichuan Zhao (matyiz@langate.gsu.edu) – Department of Mathematics and Statistics, Georgia State University, Atlanta, Georgia 30303-3083. Friday 3:30pm BA121

Empirical likelihood Based Inference for the Calibration Regression Model with Lifetime Medical Cost

Abstract: In recent years, medical cost has received increasing interest in Biostatistics and public health. Statistical analysis and inference of lifetime medical cost have been challenging by the fact that the survival times are censored on some study subjects and their subsequent cost are unknown. Recently, the calibration regression model has been proposed to study the medical cost associated with covariates. However, the accuracy of the inference procedure may be low when the sample size is small due to highly skewed nature of the medical cost and non-uniform rate of cost accumulation over time. In this paper, we develop an empirical likelihood ratio method for the calibration regression model. The adjusted empirical likelihood confidence regions are constructed for the regression parameters accordingly. Furthermore, we compare the proposed empirical likelihood method with normal approximation based method. Simulation results show that the proposed method outperforms the existing method in terms of coverage probability. In particular, the proposed adjusted empirical likelihood method overcomes the under coverage problem.

Mai Zhou (mai@ms.uky.edu) – Department of Statistics, University of Kentucky, 849 Patterson Office Tower, Lexington, KY 40506-0027. Friday 2:30pm BA121

Censored Data Parametric/Nonparametric Hybrid Two Sample Problems by Empirical Likelihood

Abstract: Zhou & Liang (2005, Biometrika) investigated the use of Empirical Likelihood (EL) in testing with right censored data in a parametric/nonparametric two sample hybrid model. However, they used a pseduo EL in the study. Here, we use the hazard formulation of the censored data EL to study the two sample parametric/nonparametric hybrid model. We demonstrate that a proper EL definitions leads to an EL ratio test with a proper chi-square limiting distribution under null hypothesis. We illustrate the use of the proposed test by testing the ROC curve with censored data, among others. Results are compared to Zhou & Liang (2005). This is joint work with Hua Liang.