

Dhanapati Adhikari - Oklahoma State University

Title: On the global well-posedness of the 2D Boussinesq system with partial viscous dissipation.

Abstract: The Boussinesq equation is a system of non linear partial differential equations which is widely used in the modeling of oceanic and atmospheric motions. In this talk we consider 2D Boussinesq system with vertical viscosity and vertical diffusivity. For such a system, we prove global regularity by imposing condition on the vertical component of velocity field.

M. B. Bekker - University of Missouri-Kansas City

Title: Tangential Interpolation Problems for a Class of Automorphic Matrix-Functions.

Abstract: Tangential interpolation problems are studied for matrix-valued functions of class (R) analytic in the upper half-plane with non-negative imaginary part, which are invariant under a linear fractional transformation of finite order.

Joint work with A. A. Nudel'man, Odessa, Ukraine

Mukta Bhandari - Kansas State University

Title: Good-lambda inequalities and potentials for non-doubling measures in \mathbb{R}^n .

Abstract: We establish a good-lambda inequality relating the distribution functions of a Riesz potential and a fractional maximal function on \mathbb{R}^n , $d\mu$, where μ does not necessarily satisfy a doubling condition. This is extended to weights w in $A_\infty(\mu)$ associated to the measure μ . We also derive potential inequalities as an application.

Weidong Chen - University of Texas-Pan American

Title: Some Aspects of Band-limited Extrapolations

Abstract: In this talk some problems in band-limited extrapolations are discussed. These aspects include the computation of the inverse Fourier transform, the accuracy of the extrapolation, the ill-posedness and regularization method.

Emmanuele DiBenedetto - Vanderbilt University

Title: Measure Theoretical Methods in Degenerate and/or Singular Parabolic Partial Differential Equations

Abstract: Degenerate and/or singular parabolic equations arise in a number of physical models, including porous media, non-newtonian fluids, phase transition etc. Their mathematical interest is in that their solutions exhibit a behavior considerably different than solutions of the heat equation and/or its quasi-linear counterparts. Harnack and local Hölder estimates are a suitable tool to explore the local behavior of their solutions as opposed to that of non-degenerate and/or non-singular equations. The theory, begun in the 80's, has recently experienced a considerable growth due to the discovery of some novel measure theoretical methods, of independent interest on their own right. We present a spectrum of these new techniques and apply them to establish Harnack estimates in the intrinsic geometry generated by both the PDEs and their solutions. Degenerate equations and singular equations afford different forms of Harnack estimates. We discuss their differences, their significance and their implications and point to some open problems for sub-critically singular equations.

Kyle Fey - University of Nebraska, Lincoln

Title: Young measures generated by sequences in Morrey spaces

Abstract: Given a weakly convergent sequence of functions, its weak limit describes the limiting behavior of the averages of those functions. Young measures are parameterized probability measures that provide a way to capture the oscillatory behavior of weakly convergent sequences of functions as well as their average behavior. We will present results that characterize those Young measures that are generated by sequences bounded in Morrey (or Sobolev-Morrey) spaces. An application of this result to variational problems allows one to use information about a minimizing Young measure to determine how much Morrey (or Sobolev-Morrey) regularity one can expect a minimizing sequence to possess.

Mikil Foss - University of Nebraska, Lincoln

Title: Global Lipschitz Regularity Results for Asymptotically Convex Variational Problems

Abstract: I will present some global Lipschitz regularity results for minimizers of functionals with the general form

$$\mathbf{u} \mapsto \int_{\Omega} g(\mathbf{x}, \mathbf{u}(\mathbf{x}), \nabla \mathbf{u}(\mathbf{x})) \, d\mathbf{x},$$

with $\Omega \subset \mathbb{R}^n$ an open and bounded set and $g : \Omega \times \mathbb{R}^N \times \mathbb{R}^{N \times n} \rightarrow \mathbb{R}$. In addition to hypotheses on its growth and smoothness, the function $\mathbf{F} \mapsto g(\mathbf{x}, \mathbf{u}, \mathbf{F})$ is assumed to be asymptotically convex in the sense that it behaves like a rotationally symmetric convex function whenever the magnitude of \mathbf{F} is sufficiently large. The regularity results to be presented are valid up to the boundary provided that the boundary data is sufficiently smooth. This work was done in collaboration with A. Passarelli di Napoli and A. Verde from Università di Napoli “Fredico II”.

Ugo Gianazza - University of Pavia

Title: Continuity of the Saturation in the Flow of Two Immiscible Fluids in a Porous Medium

Abstract: The weakly coupled system

$$\begin{aligned} v_t &= \operatorname{div}[A(v)\operatorname{grad} v + B(v)] = V \cdot \operatorname{grad}(C(v)) \\ \operatorname{div} V &= 0 \end{aligned}$$

in E_T where $V = K(v)[\operatorname{grad} u + e(v)]$ consists of an elliptic equation, and a degenerate parabolic equation, and it arises in the theory of flows of immiscible fluids in a porous medium. The unknown functions u and v and the equations they satisfy, represent the pressure and the saturation respectively, subject to Darcy’s law and the Buckley-Leverett coupling. Due to the empirical nature of these laws no determination is possible on the structure of the degeneracy exhibited by the system. It is established that the saturation is a locally continuous function in its space-time domain of definition, irrespective of the nature of the degeneracy of the principal part of the system.

Nguyen Hoang - Kansas State University

Title: Dynamical Systems Gradient Method for Solving Ill-Conditioned Linear Algebraic Systems.

Abstract: A version of the Dynamical Systems Method (DSM) for solving ill-conditioned linear algebraic systems is studied in this paper. An a priori and a posteriori stopping rules are justified. An algorithm for computing the solution using a spectral decomposition of the left-hand side matrix is proposed. Numerical results show that when a spectral decomposition of the left-hand side matrix is available or not computationally expensive to obtain the new method can be considered as an alternative to the Variational Regularization.

The talk is based on joint work with Prof. A. G. Ramm.

Young-Heon Kim - University of British Columbia

Title: Non-negatively cross-curved transportation costs

Abstract: Theory of optimal transport is concerned with phenomena arising when one matches two mass distributions in a most economic way, minimizing transportation cost of moving mass from one location to another. We consider optimal transportation problem with costs satisfying certain type of degenerate curvature condition. This condition is a slightly stronger but still degenerate version of the Ma-Trudinger-Wang condition for regularity of optimal transport maps. We explain a continuity result of optimal maps with rough data on local and global domains. If time permits, we will also explain a connection to Principal-Agent problem in microeconomics. These reflect joint work in progress with Alessio Figalli and Robert McCann.

Joe Lakey - New Mexico State University

Title: On eigenvalues and eigenfunctions for time and bandlimiting

Abstract: No signal can be simultaneously timelimited and bandlimited. The prolate spheroidal wave functions are, in a sense, the most nearly so. Their basic theory was investigated in the 1960s, the so-called Bell Labs theory. After briefly reviewing some basic properties, this talk will discuss several issues surrounding their burgeoning use in communications, specifically, their numerical computation, their sampling theory, and their extension to multiband signals.

Kabe Moen - Washington University

Title: Weighted multilinear Poincaré inequalities for vector fields of Hörmander type

Abstract: In this joint work with D. Maldonado and V. Naibo we introduce a weighted Poincaré inequality for products of functions. As the classical Poincaré inequality fails for $0 < p < 1$, the multilinear Poincaré inequality is a natural substitute in this situation. We prove such weighted multilinear Poincaré inequalities in the subelliptic context associated to vector fields of Hörmander type. We do so by establishing multilinear representation formulas and weighted estimates for multilinear potential operators in spaces of homogeneous type.

Katharine Ott - University of Kentucky

Title: The mixed problem for the Laplacian in Lipschitz domains

Abstract: In this talk I will discuss recent progress on the mixed boundary value problem for the Laplacian in Lipschitz domains. We prove that given Dirichlet boundary data in the Sobolev space $W^{1,p}$ and Neumann boundary data in L^p , the mixed problem has a unique solution and the non-tangential maximal function of the gradient lies in L^p of the entire boundary. This is joint work with Russell Brown.

Nguyen Cong Phuc - Louisiana State University,

Title: Capacitary inequalities and quasilinear Riccati type equations with super-critical growth

Abstract: We establish explicit criteria of solvability for the quasilinear Riccati type equation $-\Delta_p u = |\nabla u|^q + \omega$ in a bounded C^1 domain $\Omega \subset \mathbb{R}^n$, $n \geq 2$. Here Δ_p , $p > 1$, is the p -Laplacian, q is in the super critical range $q > p$, and the datum ω is a measure. Our existence criteria are given in the form of potential theoretic or geometric (capacitary) estimates that are sharp when ω is compactly supported in the ground domain Ω . A key in our approach to this problem is capacitary inequalities for certain nonlinear singular operators arising from the p -Laplacian.

Sarah Raynor - Wake Forest University

Title: A system of ODEs for a Perturbation of a Minimal Mass Soliton.

Abstract: In this work we study soliton solutions to the nonlinear Schrödinger equation with a saturated nonlinearity. It is known that these nonlinearities have minimal-mass soliton solutions. We consider a small perturbation of the minimal mass soliton, and provide analysis to find a system of ODEs which model the behavior of the perturbation for short times. We then provide numerical evidence that under this system of ODEs a generic initial perturbation tends to the stable side of the soliton curve. This provides some initial evidence that even though the minimal mass soliton itself is known to be unstable due to the work of Comech and Pelinovsky, small initial perturbations of the minimal mass soliton do tend to approach a stable soliton over time. This is joint work with Jeremy Marzuola and Gideon Simpson.

Monica Torres - Purdue University

Title: On the distributional divergence of vector fields vanishing at infinity

Abstract: In this talk we show that the equation $\operatorname{div} v = F$ has a solution v in the space of continuous vector fields vanishing at infinity if and only if F acts linearly on $\operatorname{BV}_{\frac{m}{m-1}}(\mathbb{R}^m)$ (the space of functions in $L^{\frac{m}{m-1}}(\mathbb{R}^m)$ whose distributional gradient is a vector valued measure) and satisfies the following continuity condition: $F(u_j)$ converges to zero for each sequence $\{u_j\}$ such that the measure norms of ∇u_j are uniformly bounded and $u_j \rightarrow 0$ weakly in $L^{\frac{m}{m-1}}(\mathbb{R}^m)$

Daniel Toundykov - University of Nebraska, Lincoln

Title: Well-posedness and trace regularity of a plate equation with non-dissipative boundary conditions

Abstract: This work addresses well-posedness of a Kirchhoff (Euler-Bernoulli) plate equation subject to non-dissipative boundary conditions, such as, for instance, the bending moment velocity feedback. Boundary dynamics of this type destroys the natural dissipativity of the evolution generator, rendering the standard semigroup methods inapplicable. In order to establish well-posedness of this model one requires at least some a priori bounds on the energy of the system. The energy estimates are obtained by microlocally decomposing the trace terms into a "monotone" part, plus a certain perturbation, which is partially smoothed out by the parabolic factor (on the microlocal scale) of the interior dynamics. Challenges arise from the complexity of the symbols corresponding to the boundary operators, and lack of control on the tangential components of the traces. The latter issue is handled by introducing a suitably constructed "correcting" control.

Ray Treinen - Kansas State University

Title: On the symmetry and existence of solutions of some floating drop problems

Abstract: Floating drops are configurations of three fluids in equilibrium. Presumably one fluid has significantly less volume, and is the drop. Floating drops may arise in bounded containers, or in unbounded regions, and the drop may be either more or less dense than the supporting fluid. These cases are called heavy or light drops. Presented here is a general existence theorem for symmetric configurations. A theorem is presented on the symmetry of the configurations which form a partition of R^3 .

Vincenzo Vespri - University of Florence

Title: A new regularity approach for weak solutions of degenerate parabolic equations

Abstract: In order to prove the Hölder regularity of weak solutions to quasilinear degenerate (singular) parabolic equations we use the same approach originally introduced in recent papers by DiBenedetto-Gianazza-V to obtain Harnack inequalities for nonnegative solutions to these equations. The new approach gives a more geometric and intuitive proof to the regularity and avoids covering and alternative arguments.

Lianwen Wang - University of Central Missouri

Title: Approximate Controllability for a Class of Stochastic Differential Equations

Abstract: This talk is devoted to the study of approximate controllability for a class of control systems described by semilinear stochastic differential equations in infinite-dimensional spaces. First, we establish the solvability for a system constructed from the stochastic control systems. Then, we derive approximate controllability for the original control systems with the help of the solvability result. Finally, an example is provided to illustrate the application of the approximate controllability result.

Peiyong Wang - Wayne State University

Title: Infinity Laplace Equation with General Sign-Changing Right-Hand-Side

Abstract: I will cover a recent joint work with Guozhen Lu on the inhomogeneous infinity Laplace equation. The set of continuous viscosity solutions of the infinity Laplace equation $-\Delta_{\infty}^N w(x) = f(x)$ with generally sign-changing right-hand-side f in a bounded domain is analyzed. The existence of a least and a greatest continuous viscosity solutions up to the boundary is proved through a Perron's construction by means of a strict comparison principle. These extremal solutions are proved to be absolutely extremal solutions.