NEAM 1

Northeastern Analysis Meeting

Brockport
New York
October 14 - 16 2016

Organizers

Gabriel T. Prăjitură, College at Brockport, SUNY

Ruhan Zhao, College at Brockport, SUNY

Special Session Organizers

Anca Rădulescu, SUNY New Paltz

Kazuo Yamazaki, University of Rochester

NEAM 1

Friday October 14

After 8:00 Registration in **Edwards 106A**

Edwards 105

8:40 - 9:00 Dean Maliekal's Address
9:00 - 9:50 Brett D. Wick, Washington University in St. Louis
Commutators and BMO
10:00 - 10:30 Dan Geba, University of Rochester,
Regularity results for generalizations of the wave maps equation
10:30 - 11:00 Coffee Break
11:00 - 11:50 Jingbo Xia, University at Buffalo, SUNY
Hankel Operators On Weighted Bergman Spaces and Norm Ideals
12:00 - 12:50 Alex Iosevich, University of Rochester
Local smoothing for the wave equation and the Falconer conjecture

12:50 - 2:30 Lunch Break

Contributed Section 1
Edwards 103

2:30 - 2:50 Afrah Abdou, King Abdulaziz Unversity
Common fixed point results for multi - valued mappings with some examples
2:55 - 3:15 Qiyu Sun, University of Central Florida
Wiener's lemma and stability for infinite matrices
3:20 - 3:40 Wanqing Cheng, University of Arkansas (Fayetteville)
Spherical Π*-type Operators in Clifford Analysis and Applications*
3:45 - 4:05 Marius Beceanu, University at Albany, SUNY
New tools for the study of supercritical wave equations
4:05 - 4:30 Coffee Break
4:30 - 4:50 Chao Ding, University of Arkansas, Fayetteville
Construction of Arbitrary Order Conformally Invariant Operators in Higher Spin Spaces
4:55 - 5:15 Cheng Cheng, University of Central Florida
Spatially distributed sampling and reconstruction of signals on a graph
5:20 - 5:40 Jianhua Gong, United Arab Emirates University
Quasiconformal Groups

Contributed Section 2
Edwards 104

2:30 - 2:50 Joseph Cima, University of North Carolina at Chapel Hill
A Volterra operator on Hardy Spaces
2:55 - 3:15 Nathan Feldman, Washington & Lee University
Convex-Polynomial Interpolation, Approximation & Invariant Convex Sets
3:20 - 3:40 Zhijian Wu, University of Nevada, Las Vegas
Difference of weighted composition operators on Bergman spaces
3:45 - 4:05 Ruhan Zhao, College at Brockport, SUNY
Closures of Hardy and Hardy-Sobolev spaces in the Bloch type space on the unit ball
4:05 - 4:30 Coffee Break
4:30 - 4:50 Robert Rahm Jr, Washington University in St. Louis
Fractional Integral Operators Associated to Schrodinger Operators
4:55 - 5:15 Joshua Isralowitz, University at Albany, SUNY
A (very, very brief) introduction to matrically degenerate elliptic systems of PDEs
5:20 - 5:40 Miron Bekker, University of Pittsburgh at Johnstown
Parametrization of Scale-Invariant Self-Adjoint Extensions of symmetric Scale-Invariant Operators

Contributed Section 3
Edwards 106

2:30 - 2:50 Pablo Jimenez-Rodriguez Kent State University
Polynomial inequalities on circular sectors
2:55 - 3:15 Dorin Ghisa, York University
The Geometry of the Mappings by General Dirichlet Series
3:20 - 3:40 Sergii Myroshnychenko, Kent State University
On polytopes with congruent sections and projections
3:45 - 4:05 Grigore Sălăgean, The College at Brockport, SUNY
On the order of convolution consistence of certain classes of harmonic functions defined using a convolution operator
4:05 - 4:30 Coffee Break
4:30 - 4:50 Isaac DeFrain, Kent State University
Chebyshev polynomials on a continuum in the complex plane
4:55 - 5:15 Shan Tai Sandy Chan, Syracuse University
On holomorphic isometries of complex unit balls into irreducible bounded symmetric domains of rank ≥ 2

NEAM 1

Saturday October 15

After 8:00 Registration in **Edwards 106A**

Edwards 105

9:00 - 9:50 Aimo Hinkkanen, University of Illinois at Urbana-Champaign
Complex dilatation and the Cartan-Kähler theory
10:00 - 10:30 Dan Coman, Syracuse University
On the first order asymptotics of partial Bergman kernels
10:30 - 11:00 Coffee Break
11:00 - 11:50 Camil Muscalu, Cornell University
The helicoidal method

11:50 - 1:00 Lunch Break & Pannel Discussion How to get a tenure - track job

1:00 - 1:30 Anca Rădulescu, SUNY New Paltz
Extensions of the Mandelbrot for templates and networks of quadratic maps
1:35 - 2:05 Kazuo Yamazaki, University of Rochester
Global stability and uniform persistence of the reaction-convection-diffusion cholera epidemic model

Special Session on Fluid Dynamics
Edwards 103

2:15 - 2:35 Manil Thankamani Mohan, Air Force Institute of Technology
Some Recent Progress in Quasilinear Hyperbolic Systems: New Local Solvability Methods and Stochastic Analysis
2:40 - 3:00 Vincent Martinez, Tulane University
Analytical studies for a Data Assimilation Algorithm: Surface data, Higher-order synchronization, and Time-averaged measurements
3:05 - 3:25 Zachary Bradshaw, University of Virginia
Scaling invariant solutions to 3D NSE
3:30 - 3:50 Andrei Ţarfulea, University of Chicago
Front propagation and symmetrization for the fractional Fisher-KPP equation
3:50 - 4:20 Coffee Break
4:20 - 4:40 Jiahong Wu, Oklahoma State University
The 2D Magnetohydrodynamic (MHD) Equation WIth Partial Dissipation
4:45 - 5:05 Bradley McCaskill, University of Wyoming
Continuous Data Assimilation for Miscible Displacement in Porous Media
5:10 - 5:30 Chenyun Luo, Johns Hopkins University

On the motion of the free surface of a compressible liquid
5:35 - 5:55 Lizheng Tao, University of California, Riverside
Inviscid limit problem with fractional Laplacian

Special Session on Dynamical Systems
Edwards 104

2:15 - 2:35 Natalie Frank, Vassar College
Towards spectral analysis of self-similar tilings via a renormalization approach
2:40 - 3:00 Edmond Rusjan, SUNY IT
Fractal Trees and Poisson - A Model of the Blood Flow in the Retina of the Eye
3:05 - 3:25 Wael Al-Sawai, University of South Florida
Perturbation of Gaudin Integrable Dynamical Systems
3:30 - 3:50 Armenak Petrosyan, Vanderbilt University
Iterative actions of operators on a system of vectors
3:50 - 4:20 Coffee Break
4:20 - 4:40 Roza Aceska, Ball State University
Tight and scalable frames in dynamical sampling
4:45 - 5:05 Flavia Colonna, George Mason University
Hypercyclicity of composition operators on Banach spaces of analytic functions
5:10 - 5:30 Mai Tran, University at Albany, SUNY
An Exploration on the Resolvent Set with Geometry
5:35 - 5:55 Gabriel Prăjitură, College at Brockport, SUNY
Operators with simple orbits

Contributed Section 4
Edwards 106

2:15 - 2:35 Oleksandr Vlasiuk
Point Configurations via Hypersingular Riesz Energy With an External Field
2:40 - 3:00 Pritha Chakraborty, Texas A&M University Corpus-Christi
A Different Approach to Korenblum's Conjecture in Bergman Spaces
3:05 - 3:25 Cezar Lupu, University of Pittsburgh
The Riemann zeta function for integer values and evaluation of some multiple zeta values
3:30 - 3:50 Mihai Stoiciu, Williams College
Transition in the Eigenvalue Distribution of Random and Deterministic Unitary Operators
3:50 - 4:20 Coffee Break
4:20 - 4:40 Mihai Băileşteanu, Central Connecticut State University
Geometric methods to study non-linear parabolic equation
4:45 - 5:05 Jan Lang, The Ohio State University
Spectral theory on Banach spaces
5:10 - 5:30 Yunyun Yang, West Virginia University Institute of Technology
Distributions in Spaces with Thick Points

7:00 Dinner

NEAM 1

Sunday October 16

Edwards 105

9:00 - 9:50 Dechao Zheng, Vanderbilt University
Multiplication operators on the Bergman spaces of polygons
10:00 - 10:30 Javad Mashreghi, Laval University
Numerical range versus spectrum
10:30 - 11:00 Coffee refueling
11:00 - 11:50 Kelly Bickel, Bucknell University
Compressions of the shift on two-variable model spaces
12:00 - 12:50 Vladimir Peller, Michigan State University
M.G. Krein's problem and the Lifshits-Krein trace formula

Abstracts

Afrah Abdou
King Abdulaziz Unversity
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Title: Common fixed point results for multi - valued mappings with some examples

Abstract: In this paper, we define the concepts of the (CLR)-property and the (owc)-property for two single-valued mappings and two multi-valued mappings in metric spaces and give some new common fixed point results for these mappings. Also, we give some examples to illustrate the main results in this paper. Our main results extend and improve some results given by some authors

Roza Aceska
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Joint work with Yeon Hyang Kim

Title: Tight and scalable frames in dynamical sampling

Abstract: We study the iterative actions of an operator A on a finite dimensional Hilbert space H. Under certain conditions on the operator A, a fixed finite set of vectors $G \subset H$, and the number of iterations $L(g)$, the set of iterations $F_G(A) = \{A^j g \mid g \in G,\ 0 \leq j \leq L(g)\}$ is a frame for H. We show that the canonical dual frame of $F_G(A)$ has an iterative set structure, and we state the conditions which ensure that the system $F_G(A)$ is a tight or a scalable frame. We provide special results for the case when the operator A is Hermitian.

Wael Al-Sawai
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Joint work with Razvan Teodorescu

Title Perturbation of Gaudin Integrable Dynamical Systems

Abstract: The Gaudin integrable system is known to be solvable by Sklyanin algebra. We investigate perturbation around the classical solution for n-variables.

Mihai Băileşteanu
Central Connecticut State University
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Title: Geometric methods to study non-linear parabolic equation

Abstract: We use Harnack inequalities techniques developed from geometric analysis to study solutions of various parabolic equations, like Allen-Cahn, curve shortening flow etc.

Marius Beceanu
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Joint work with: Avy Soffer

Title: New tools for the study of supercritical wave equations

Abstract: I shall present two new methods for the study of supercritical semilinear wave equations. One is the decomposition of solutions into incoming and outgoing parts. The other is a comparison principle based on the positivity of solutions.

Miron Bekker
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Title: Parametrization of Scale-Invariant Self-Adjoint Extensions of symmetric Scale-Invariant Operators

Abstract: On a Hilbert space $\mathcal{H}$ wee consider a symmetric scale-invariant operator with equal defect numbers. It is assumed that the operator has at least one scale-invariant self-adjoint extension in $\mathcal{H}$. We prove that there is one-to-one correspondence between (generalized) resolvents of scale-invariant extensions and the solutions of some functional equation. Two examples of Dirac type operators are considered.

Kelly Bickel
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Joint work with: Constanze Liaw and Pam Gorkin.

Title: Compressions of the shift on two-variable model spaces

Abstract: There are many classical results about operator-theoretic properties of the compressed shift on one-variable model spaces, especially spaces associated to finite Blaschke products. In this talk, we will discuss generalizations of such results to the setting of two-variable model spaces associated to rational inner functions on the bidisk. Among other things, we will discuss characterizations and properties of the numerical range and radius of compressed shifts on two variable model spaces as well as when the commutator of a compressed shift with its adjoint has finite rank.

Zachary Bradshaw
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Title: Scaling invariant solutions to 3D NSE

Abstract: We discuss several recent results on the existence of solutions to 3D NSE for large, rough self-similar or discretely self-similar data in the critical weak Lebesgue space. Several generalizations are also considered. In particular, existence can be shown for data in certain critical Besov spaces, for the problem on the half-space, and for a new class of rotated self-similar/discretely self-similar data.

Pritha Chakraborty
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Joint work with Alexander Solynin

Title: A Different Approach to Korenblum's Conjecture in Bergman Spaces

Abstract: B. Korenblum conjectured in 1991 and W. Hayman proved in 1992 that for $f,\ g \in \mathcal{A}^2(\mathbb{D})$, there is a constant c, $0 < c < 1$, such that if $|f(z)| \leq |g(z)|$ for all z in $c \leq |z| < 1$, then $\|f\|_2 \leq \|g\|_2$, where $\mathcal{A}^2(\mathbb{D})$ is the set of square integrable analytic functions in the unit disc $\mathbb{D}$. The largest possible value of such c is called the Korenblum's constant. The exact value of this constant, which is denoted by κ, remains unknown. I shall discuss two non-linear extremal problems in Bergman spaces and prove some results which will shed some light on Korenblum's conjecture.

Shan Tai Sandy Chan
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Joint work with N. Mok
Title: On holomorphic isometries of complex unit balls into irreducible bounded symmetric domains of rank ≥ 2
Abstract: Recently, Mok constructed holomorphic isometries of the complex unit balls $\mathbb{B}^{p+1}$ into irreducible bounded symmetric domains Ω of rank ≥ 2 which are not totally geodesic, where p is some positive integer depending on Ω. It is natural to look for general properties of images of holomorphic isometries of complex unit balls into irreducible bounded symmetric domains Ω of rank ≥ 2. In this talk, we discuss a new property of such holomorphic isometries with the minimal normalizing constant. After that, we will discuss some classification results for such holomorphic isometries in the case of bounded symmetric domains of type IV.

Cheng Cheng
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Joint work with Yingchun Jiang and Qiyu Sun
Title: Spatially distributed sampling and reconstruction of signals on a graph
Abstract: A spatially distributed system contains a large amount of agents with limited sensing, data processing, and communication capabilities. Recent technological advances have opened up possibilities to deploy spatially distributed systems for signal sampling and reconstruction. In this talk, I will discuss a graph structure for a distributed sampling and reconstruction system, distributed-verifiable criterion for system stability and distributed algorithms for signal reconstruction.

Wanqing Cheng
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Joint work with: John Ryan and Uwe Kahler
Title: Spherical Π-type Operators in Clifford Analysis and Applications
Abstract: The Π-operator (Ahlfors-Beurling transform) plays an important role in solving the Beltrami equation. With the help of the spectrum of the spherical Dirac operator, the spherical operator is constructed as an isometric L^2 operator over the sphere. Some analogous properties for the spherical Π-operator are also developed. We also study the applications of spherical operator to the solution of the spherical Beltrami equations.

Joseph Cima
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Title: A Volterra operator on Hardy Spaces

Abstract: An integral operator similar to the Volterra operator is introduced. It is shown that the operator maps the Hardy space H^1 into the space of Cauchy Transforms.

Flavia Colonna
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Joint work with: Ruben Martinez Avendano

Title: Hypercyclicity of composition operators on Banach spaces of analytic functions

Abstract: It is well known that there exist hypercyclic composition operators on the Hardy spaces H^p for $0 < p < \infty$ and a host of other Banach spaces of analytic functions. In this talk, we give a classification of a large class of separable Banach spaces X of analytic functions on the open unit disk according to whether or not hypercyclic composition operators on X exist. We highlight how the use of the Hypercyclicity Comparison Principle and information on the relationship among such spaces, paired with known results in the literature, allow us to extend them to many other spaces.

Dan Coman
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Joint work with George Marinescu

Title: On the first order asymptotics of partial Bergman kernels

Abstract: Let L be a holomorphic line bundle over a compact complex manifold X, and h be a singular Hermitian metric on L. We discuss the asymptotics of the partial Bergman kernel function of the space of holomorphic sections of $L^{\otimes p}$ vanishing to high order along an analytic hypersurface Σ of X. We show that under very general assumptions it has exponential decay in a neighborhood of Σ. We also show that when (L, h) is positive, the partial Bergman kernel has the same asymptotics as the full Bergman kernel on compact sets away from Σ.

Isaac DeFrain
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Joint work with: Vladimir Andrievskii and Fedor Nazarov

Title: Chebyshev polynomials on a continuum in the complex plane

Abstract: The relationship between the supremum norm of the n^{th} Chebyshev polynomial and the n^{th} power of the logarithmic capacity of a continuum K is very complicated. In general, it is not known if the ratio of these two quantities is bounded. We obtain an upper estimate for this ratio on an arbitrary continuum by discretizing the equilibrium measure on level curves of the Riemann conformal mapping of $\Omega := \hat{\mathbb{C}} \setminus K$ onto the exterior $\mathbb{D}^*$ of the closed unit disc. In particular,

we show that our bound is finite for a continuum K with piecewise quasiconformal boundary such that the complement Ω is a John domain.

Chao Ding
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Joint work with: Raymond Walter and John Ryan
Title of the Talk: Construction of Arbitrary Order Conformally Invariant Operators in Higher Spin Spaces
Abstract: In this talk, we will complete the work of constructing arbitrary order conformally invariant differential operators in higher spin spaces. Jan Slovak has classified all conformally invariant differential operators on locally conformally flat manifolds. Here we complete his results in higher spin theory by giving explicit expressions for arbitrary order conformally invariant differential operators. Fundamental solutions and intertwining operators are also revealed during our construction.

Nathan Feldman
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Joint work with: Paul McGuire
Title: Convex-Polynomial Interpolation, Approximation & Invariant Convex Sets
Abstract: We define a convex-polynomial to be one that is a convex-combination of the monomials $\{x^n\}_{n=0}^{\infty}$ or $\{z^n\}_{n=0}^{\infty}$. We shall discuss some interpolation and approximation problems for these polynomials, which are also related to questions about the closed invariant convex sets for matrices and multiplication operators.

Natalie Frank
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Title: Towards spectral analysis of self-similar tilings via a renormalization approach
Abstract: We examine the example of a tiling of the line given by the non-Pisot substitution rule $a \to abbb$, $b \to a$. We describe how, when natural tile lengths are used, the pair correlation functions that determine the diffraction spectrum satisfy easily computable renormalization equations. These equations carry through to the autocorrelation and diffraction measures and therefore can be useful for computing the spectral type of these measures. In our example, the spectral type is known to contain a continuous part and the renormalization approach provides clues to whether this part can be absolutely or singularly continuous with respect to Lebesgue measure.

Dan Geba
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Title: Regularity results for generalizations of the wave maps equation

Abstract: In this talk, we will present an overview of recent results for semilinear and quasilinear generalizations of the wave maps equation, which have a strong physical motivation and present many challenges from a mathematical point of view. The emphasis will be on local and global regularity theories for these problems and the new analytic tools developed in connection to these theories.

Dorin Ghisa
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Title: The Geometry of the Mappings by General Dirichlet Series

Abstract: We are studying general Dirichlet series which can be continued analytically to the whole complex plane, except for a possible simple pole at $s = 1$. By taking the preimage of the real axis with respect to such a function we distinguish some components partitioning the complex plane into an infinite number of strips which are mapped by the function (not necessarily one to one) onto the complex plane with a slit alongside the interval $[1, \infty)$ of the real axis. Then a technique is used to partition every such strip into fundamental domains of the function, i. e. domains which are mapped conformally by the function onto the whole complex plane with some slits. The distribution of the zeros of the function as well as of its derivative is also studied.

Jianhua Gong
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Title of the Talk: Quasiconformal Groups

Abstract: I will present some recent results about quasiconformal groups such as compactness properties and Hilbert-Smith conjecture.

Quasiconformal mappings in higher dimensional spaces are transformations of subdomains of the extended Euclidean space, which have uniformly bounded distortion. They provide a class of mappings that lie between homeomorphisms and conformal mappings. There are a number of interesting relevant results in the plane. On the other hand, very little is known about the higher dimensional (greater than 3) situation.

Aimo Hinkkanen
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Title:Complex dilatation and the Cartan-Kähler theory

Abstract: We show how the measurable Riemann mapping theorem can also be proved by using the Cartan-Kähler theory together with standard approximation results for quasiconformal mappings in the plane.

The existence part of the measurable Riemann mapping theorem states that if D is a domain in the complex plane and μ is a complex–valued L^∞-function in D with $||\mu||_\infty < 1$, then there exists a quasiconformal homeomorphism f defined in D such that at almost every point $z \in D$, the Beltrami equation

$$\frac{\partial f}{\partial \overline{z}}(z) = \mu(z)\frac{\partial f}{\partial z}(z)$$

is satisfied. Several proofs are known for this result. It is well known that one possible way to prove it, is to first solve the Beltrami equation locally when μ is real analytic, and then use approximation theorems (to move from real analytic μ to measurable μ) together with the uniformization theorem for Riemann surfaces (to move from a local result to a global result).

The Cartan-Kähler theory is a general method for solving systems of partial differential equations with real analytic data locally, and for finding integrability conditions in those cases where such restrictions are required.

We show how one can solve the Beltrami equation locally when μ is real analytic using the Cartan-Kähler theory. Together with the above remarks, this then provides yet another way of proving the measurable Riemann mapping theorem.

Alex Iosevich
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Title: Local smoothing for the wave equation and the Falconer conjecture

Abstract: We are going to use develop and explicit connection between the local smoothing estimates for the wave equation and the Falconer conjecture in geometric measure theory.

Joshua Isralowitz
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Joint work with: Kabe Moen

Title: A (very, very brief) introduction to matrically degenerate elliptic systems of PDEs

Abstract: In this talk we will discuss how the matrix Muckenhoupt A2 condition for matrix weights appears very naturally in the context of degenerate elliptic systems of PDEs and Poincare inequalities. Furthermore, we will discuss the existence, uniqueness, and time permitting, the higher integrability of weak solutions to these elliptic systems.

Pablo Jimenez-Rodriguez
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Joint work with: Gustavo Araujo, Gustavo Adolfo Munoz-Fernandez and Juan Benigno Seoane-Seplveda

Title: Polynomial inequalities on circular sectors

Abstract: A number of sharp inequalities are proved for the space $\mathcal{P}(^2D(\beta))$ of 2-homogeneous polynomials on $\mathbb{R}^2$ endowed with the supremum norm on the sector $D(\beta) := \{e^{i\theta} : \theta \in [0, \beta]$, for the values $\beta = \frac{\pi}{4}, \frac{\pi}{2}$. Among the main results, we find sharp Markov and Bernstein inequalities, as well as the polarization and unconditional constants of the canonical basis of the space $\mathcal{P}(^2D(\beta))$ for such values of β.

Jan Lang
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Joint work with: David E. Edmunds

Title: Spectral theory on Banach spaces

Abstract: We consider a compact linear map T acting between Banach spaces both of which are uniformly convex and uniformly smooth. We will introduce a new concept of eigenfunctions (called j-eigenfaunctions) and with their help we obtained conditions under which the action of T is given by a series. This provides a Banach-space version of the well-known Hilbert-space result of E. Schmidt.

Chenyun Luo
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Joint work with: Hans Lindblad

Title: On the motion of the free surface of a compressible liquid

Abstract: I would like to go over some recent results on the compressible Euler equations with free boundary. We first provide a new apriori energy estimates which are uniform in the sound speed, which leads to the convergence of solution for the compressible Euler equations to solution for the incompressible equations, for which we know the long time existence.

Cezar Lupu
University of Pittsburgh
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Titlu: The Riemann zeta function for integer values and evaluation of some multiple zeta values.

Joint work with: Derek Orr

Abstract: In this talk, we derive some new series representations involving odd values of the Riemann zeta function and Euler numbers. Using a well-known series representation for the Clausen function, we also provide some new representations of Apery's constant. In particular cases, we recover some well-known series representations of π. Moreover, we use analytic methods to evaluate multiple zeta values and multiple t-values of Zagier type. Our formulas are related to the ones proved by Hoffman and Zagier back in the early days of the MZV.

Vincent Martinez
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Joint work with: Animikh Biswas, Michael Jolly, Eric Olson, Edriss Titi

Title: Analytical studies for a Data Assimilation Algorithm: Surface data, Higher-order synchronization, and Time-averaged measurements

Abstract: This talk will discuss recent studies in a data assimilation algorithm proposed by Azouani, Olson, and Titi. The algorithm exploits the finite-dimensionality of the dynamics of certain dissipative equations for which "determining quantities" exist, e.g. knowledge of sufficiently many Fourier modes of the solution for all time, determines all higher modes asymptotically in time. By collecting finitely many of such quantities, one can then construct an algorithm to produce an approximating solution that converges to the reference solution corresponding to the collected data asymptotically in time and at an exponential rate.

In this talk, we will discuss several joint works with A. Biswas, M.S. Jolly, E.J. Olson, and E.S. Titi in which we investigate the topologies that the synchronization takes place, its ability to accommodate the more physical case of time-averaged observables, and studies that support the idea that for vertically-constrained flows, one need only assimilate data collected at the boundary to synchronize the approximating flow with the reference flow in the domain's interior. In these works, we use the 2D Navier-Stokes and 2D subcritical surface quasi-geostrophic equations as our main examples.

Javad Mashreghi
Laval University
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Title: Numerical range versus spectrum

Abstract: The spectral mapping theorem is one of the most important results in operator theory. However, the same statement fails for the numerical range. In this talk, we provide several examples to reveal the relation between spectrum and numerical range. Then we discuss a weak version of the spectral mapping theorem that can be extended for the numerical range. This point of view leads us to Halmos conjecture and theorems of Berger-Stampfli and Drury.

Bradley McCaskill
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Joint work with: Hakima Bessaih and Victor Ginting

Title: Continuous Data Assimilation for Miscible Displacement in Porous Media

Abstract: In this talk we propose the use of a continuous data assimilation algorithm for miscible flow models in porous media. In the absence of initial conditions for the model, observed sparse measurements are used to generate an approximation to the true solution. Under certain assumptions of the sparse measurements and their incorporation into the algorithm it can be shown that the resulting solution converges to the true solution at an exponential rate. Various numerical examples are considered in order to validate the convergence of the algorithm. Computational results related to these examples are shown.

Manil Thankamani Mohan
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Joint work with: Sivaguru S. Sritharan

Title: Some Recent Progress in Quasilinear Hyperbolic Systems: New Local Solvability Methods and Stochastic Analysis

Abstract: Quasilinear symmetric and symmetrizable hyperbolic system has a wide range of applications in engineering and physics including unsteady Euler and potential equations of gas dynamics, inviscid magnetohydrodynamic (MHD) equations, shallow water equations, non-Newtonian fluid dynamics, and Einstein field equations of general relativity. In the past, the Cauchy problem of smooth solutions for these systems has been studied by several mathematicians using semigroup approach and fixed point arguments. In a recent work of M. T. Mohan and

S. S. Sritharan, the local solvability of symmetric hyperbolic system is established using two different methods, viz. local monotonicity method and a frequency truncation method. The local existence and uniqueness of solutions of symmetrizable hyperbolic system is also proved by them using a frequency truncation method. Later they established the local solvability of the stochastic quasilinear symmetric hyperbolic system perturbed by Levy noise using a stochastic generalization of the localized Minty-Browder technique. Under a smallness assumption on the initial data, a global solvability for the multiplicative noise case is also proved. The essence of this talk is to give an overview of these new local solvability methods and their applications.

Camil Muscalu
Cornell University
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Joint work with Cristina Benea
Title: The helicoidal method
Abstract: The plan of the talk is to describe a new method of proving (multiple) vector valued inequalities in harmonic analysis. This method allows one not only to reprove most of the well known previous results, but also to answer some open questions that circulated in the field for some time.

Sergii Myroshnychenko
Kent State University
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Joint work with: Dmitry Ryabogin
Title: On polytopes with congruent sections and projections
Abstract: Let $2 \leq k \leq d-1$ and let P and Q be two convex polytopes in $\mathbb{E}^d$. Assume that their projections, $P|H$, $Q|H$, onto every k-dimensional subspace H, are congruent. We show that P and Q or P and $-Q$ are translates of each other. We also prove an analogous result for sections by showing that $P = Q$ or $P = -Q$, provided the polytopes contain the origin in their interior and their sections, $P \cap H$, $Q \cap H$, by every k-dimensional subspace H, are congruent.

Vladimir Peller
Michigan State University
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Title: M.G. Krein's problem and the Lifshits-Krein trace formula
Abstract: I am going to speak about a solution to a longstanding problem posed by M.G. Krein. The main result of the talk is that the maximal class of functions, for which the Lifshits–Krein trace formula holds, coincides with the class of operator Lipschitz functions.

Armenak Petrosyan
Vanderbilt University
arm.petros@gmail.com I Title: Iterative actions of operators on a system of vectors

Abstract: We consider systems of vectors of the form

$$\{A^n g : \ g \in \mathcal{G}, n = 0, 1, 2, \dots\}$$

where A is a bounded operator on a Hilbert space $\mathcal{H}$ and $\mathcal{G}$ is a countable set of vectors in $\mathcal{H}$, and try to find conditions that allow the system to be a frame, basis, complete Bessel system etc. Some of the recent results and open questions will be presented. The problem was originally considered in the context of a sampling theory, called dynamical sampling problem, where the unknown signal is recovered from its spatio-temporal samples.

Gabriel Prăjiturǎ
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Title: Operators with simple orbits
Abstract: We will discuss two classes of operators on a Hilbert space: operators with all orbits going to 0 and operators with all non zero orbits going to ∞ (in norm). We will caracterize, in terms of spectral properties, operators in the closure and in the interior of these classes.

Anca Rădulescu
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Title: Extensions of the Mandelbrot for templates and networks of quadratic maps
Abstract: Behavior under iterations of quadratic maps has been one of the earliest and most popular topics in discrete dynamics, in both the real and complex case. However, while iterations of a single map have been exhaustively studied, less effort has been directed towards addressing what happens (1) when the map itself evolves in time according to a symbolic template and (2) when the maps are organized as nodes in a network, and interact in a time-dependent fashion. We define extensions of the Julia and Mandelbrot sets for template iterations and for net- works of coupled maps. We illustrate how the hardwired structure (e.g., symbolic template, or respectively adjacency graph) can affect the topology of these asymptotic sets. We investigate whether traditional results (such as the Fatou-Julia theorem) still hold in the new frameworks. This is of potential interest to a variety of applications (including genetic and neural cod- ing), since (1) investigates how an occasional or a reoccurring error in a replication or learning algorithm may affect the outcome and (2) relates to algorithms of synaptic restructuring and neural dynamics in brain networks.

Robert Rahm Jr
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Joint work with Brett Wick and Ji Li
Title: Fractional Integral Operators Associated to Schrodinger Operators
Abstract: Consider the Schroedinger operator $Lf(x) = -Laplace f(x) + V(x)f(x)$. We investigate weighted inequalities for the fractional integral operator $I_a = (L)^- a/2$. More precisely, let $0 < a < n$ and $1/p - 1/q = a/n$, we would like to estimate the

operator norm of I_a as an operator from $L^p(w^p)$ to $L^q(w^q)$ in terms of a fractional Muckenhoupt condition adapted to L. I_a has better decay properties than the classical fractional integral operator but is highly "non-local"; this is one of the obstructions to establishing the weighted estimate.

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Joint work with: Andrea Dziubek, Giovanna Guidoboni, Anil Hirani, and William Thistleton

Title: Fractal Trees and Poisson - A Model of the Blood Flow in the Retina of the Eye

Abstract: We describe a mathematical model of the blood flow in the retina of the eye. The model couples a fractal vascular tree with a porous medium described by a Poisson-like equation. We solve the model numerically with a structure preserving discrete exterior calculus method. Preliminary results have implications in the study of the pathologies of the eye. In particular, they indicate that the disruptions of the blood flow in the retina of the eye induced by the changes in the ocular shape may play a significant role in the dynamics of the open eye glaucoma.

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Title: On the order of convolution consistence of certain classes of harmonic functions defined using a convolution operator

Abstract: Making use of a modified Hadamard product or convolution of harmonic functions with varying arguments (denoted by $\circledast$), combined with an integral operator, we study when these functions belong to a given class. Following an idea of U. Bednarz and J. Sokol [Stud. Univ. Babes-Bolyai Math. 55 (2010), no. 3, 41-50] we consider the order of convolution consistence of three classes of functions and determine it for certain classes of harmonic functions with varying arguments defined using a convolution operator.

Mihai Stoiciu
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Title: Transition in the Eigenvalue Distribution of Random and Deterministic Unitary Operators

Abstract: We investigate the microscopic distribution of the eigenvalues for various classes of random and deterministic unitary operators (in particular, CMV operators). We show that random CMV matrices exhibit a transition in the microscopic eigenvalue distribution from Poisson to the equidistant "clock" distribution, via the circular beta ensemble of the random matrix theory. Deterministic CMV operators corresponding to Patterson-Sullivan measures associated to hyperbolic reflection groups exhibit a similar transition towards the clock eigenvalue distribution.

Qiyu Sun

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Title: Wiener's lemma and stability for infinite matrices

Abstract: Given a Banach algebra $\mathcal{B}$, a subalgebra $\mathcal{A}$ of $\mathcal{B}$ is said to be inverse-closed if $A \in \mathcal{A}$ and its inverse $A^{-1} \in \mathcal{B}$ implies that $A^{-1} \in \mathcal{A}$. The inverse-closedness for the subalgebra of absolutely convergent Fourier series in the algebra of bounded periodic functions was first established by N. Wiener. The inverse-closed property (=Wiener's lemma) has been established for infinite matrices satisfying various off-diagonal decay conditions in last thirty years. In this talk, I will discuss Wiener's lemma for infinite matrices and its application to signal sampling and reconstruction on spatially distributed networks.

The invertibility is one of the basic assumptions for matrices arising in the study of spline approximation, Gabor time-frequency analysis, nonuniform sampling. In this talk, I will also discuss invertibility verification of matrices of large sizes in a distributed manner.

Lizheng Tao
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Title: Inviscid limit problem with fractional Laplacian

Abstract: In this talk, we present some preliminary result for inviscid limit problem between Navier Stokes Equations and the Euler Equations in a bounded domain in R^2. The dissipation operator is presented by fractional Laplacian. We show that the nonlinear term remains as the dominating factor in determining the condition for inviscid limit when compared to the original Navier Stokes Equations.

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Joint work with: Jean-Michel Roquejoffre

Title: Front propagation and symmetrization for the fractional Fisher-KPP equation

Abstract: We prove strong gradient decay estimates for solutions to the multi-dimensional Fisher-KPP equation with fractional diffusion. It is known that this equation exhibits exponentially advancing level sets with strong qualitative upper and lower bounds on the solution. However, little has been shown concerning the gradient of the solution. We prove that, under mild conditions on the initial data, the first and second derivatives of the solution obey a comparative exponential decay in time. We then use this estimate to prove a symmetrization result, which shows that the reaction front flattens and quantifiably circularizes, losing its initial structure.

Mai Tran
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Title: An Exploration on the Resolvent Set with Geometry

Abstract: In a recent paper by Ronald Douglas and Rongwei Yang, Hermitian metrics were defined on resolvent set of operators. In this talk, we will look at

two particular examples, namely nilpotent operator and unilateral shift operator. Through the metrics we will explore some of the basic and natural properties using geometry, such as arc length and geodesics.

Oleksandr Vlasiuk
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Joint work with: Douglas Hardin and Edward Saff
Title: Point Configurations via Hypersingular Riesz Energy With an External Field
Abstract: For a compact d-dimensional rectifiable subset of $\mathbb{R}^p$ we study asymptotic properties as $N \to \infty$ of N-point configurations minimizing the energy arising from a Riesz s-potential $1/r^s$ and an external field in the hypersingular case $s \geq d$. Formulas for the weak* limit of normalized counting measures of such optimal point sets and the first-order asymptotic values of minimal energy are obtained. As an application, we derive a method for generating configurations whose normalized counting measures converge to a given absolutely continuous measure supported on a rectifiable subset of $\mathbb{R}^p$. Results on separation and covering properties of discrete minimizers, as well as numerical illustrations are given.

Brett Wick
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Title: Commutators and BMO
Abstract: In this talk we will discuss the connection between functions with bounded mean oscillation (BMO) and commutators of Calderon-Zygmund operators. In particular, we will discuss how to characterize certain BMO spaces related to second order differential operators in terms of Riesz transforms adapted to the operator and how to characterize commutators when acting on weighted Lebesgue spaces.

Jiahong Wu
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Title: The 2D magnetohydrodynamic (MHD) equations with partial dissipation
Abstract: The magnetohydrodynamic (MHD) equations model electrically conducting fluids in the presence of a magnetic field such as plasmas and liquid metals. They are a combination of the Navier-Stokes equations (with Lorentz force) and the electromagnetic equations. The global (in time) regularity problem concerning the MHD equations have garnered considerable interest recently. This talk focuses on recent developments on the 2D MHD equations with partial dissipation. When there is only partial dissipation, the global regularity problem can be extremely difficult. We report very recent global regularity results for two partial dissipation cases: the MHD equations with no magnetic diffusion and the MHD equations with no velocity dissipation.

Zhijian Wu
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Title: Difference of weighted composition operators on Bergman spaces

Abstract: In the setting of Bergman spaces, Choe, Hosokawa and Koo characterized the Hilbert-Schmidt differences of two composition operators via an integrability condition. In this talk, we discuss a necessary and sufficient integrability condition for a difference of two weighted composition operators acting on Bergman spaces to be Hilbert-Schmidt. The boundedness and compactness conditions are also investigated.

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Joint work with: Xueying Wang

Title: Global stability and uniform persistence of the reaction-convection-diffusion cholera epidemic model

Abstract: Cholera is an infectious disease caused by the bacterium Vibrio cholerae. Its spread and consequence in countries of Africa, Southeast Asia, Haiti and central Mexico are well-known and indicates the need for an efficient mathematical model to control the spread of such a disease. In dynamics of population biology, an important disease threshold is called the basic reproduction number ρ, which measures the expected number of secondary infections caused by one infectious individual during its infectious period in an otherwise susceptible population.

In this talk, we discuss our recent result which showed that ρ serves as a parameter that predicts whether cholera will persist or become globally extinct. Specifically, when ρ is beneath one, the disease-free-equilibrium is globally attractive while if it exceeds one, then in the case the infectious hosts or the concentration of bacteria in the contaminated water are not initially identically zero, the uniform persistence can be proven as well as the existence of an endemic equilibrium.

We also make remarks on previous results on similar models and discuss remaining difficult open problems.

Jingbo Xia
University at Buffalo, SUNY

Joint work with: Quanlei Fang

Title: Hankel Operators On Weighted Bergman Spaces and Norm Ideals

Abstract We consider Hankel operators H_f on the weighted Bergman space $L^a_2(\mathbf{B}$ $dv)$. In this talk we give a characterization of the membership of $(H_f H_f)^{s/2} = H^s_f$ in the norm ideal $C\Phi$, where $0 < s \leq 1$ and the symmetric gauge function Φ is allowed to be arbitrary.

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Joint work with: Ricardo Estrada

Title: Distributions in Spaces with Thick Points

Abstract: The Theory of distributions were introduced by Sergei Sobolev and Laurent Schwartz independently in the early 20th century. It is useful in many areas in mathematics, ranging from PDE to number theory. Modern mathematics

and physics research suggest a need to consider singularities in the test function space. The theory of thick distributions in dimension one was initially introduced to deal with the occurrence of a distributional singularity on the bounday of a domain of integration. We introduced a similar theory in higher dimensions [**?**], yet the approach was quite different: we considered asymptotic expansions of test functions. I will explain the motivations of our work. I will present the construction of the new spaces, I will present several important examples of thick distributions, including the "thick delta functions". Asymptotic expansions of thick distributions will also be mentioned. In the end I will briefly discuss future research directions and how the space of thick distributions could shed light on different research areas.

Ruhan Zhao
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Joint work with: Jasbir Singh Manhas
Title: Closures of Hardy and Hardy-Sobolev spaces in the Bloch type space on the unit ball
Abstract: For $0 < \alpha < \infty$, $0 < p < \infty$ and $0 < s < \infty$, we characterize the closures in the α-Bloch norm of α-Bloch functions that are in a Hardy space H^p and in a Hardy-Sobolev space H^p_s on the unit ball of $\mathbb{C}^n$.

Dechao Zheng
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Joint work with: Hansong Huang
Title: Multiplication operators on the Bergman spaces of polygons
Abstract: I will show that multiplication operators on the Bergman space of a polygon and some von Neumann algebras induced by these operators has deep connections with the geometry of the polygon.