Abdolaziz Abdollahi

Shiraz University

Non circularity of the numerical range of finite order elliptic automorphism composition operators

Abstract

In this talk we consider the following conjecture, posed in 2000 by P. Bourdon and J. Shapiro: "The numerical range of a finite order elliptic automorphism composition operator is not a disc", and we give a positive answer to this conjecture.

Talk time: 2016-07-21 17:30— 2016-07-21 17:50
Talk location: Cupples I Room 207

Session: Contributed talk

Afrah Abdou

king Abdulaziz University

Common fixed point results for multi-valued mappings with some examples

Abstract

In this work, we introduce the (CLR)-property for the hybrid pairs of single-valued and multi-valued mappings and give some coincidence and common fixed point theorems for the hybrid pairs of some contractive conditions. Also, we will give some examples to illustrate the main results in this paper. Our results extend and improve some results given by some authors

Talk time: 2016-07-18 17:00— 2016-07-18 17:20
Talk location: Cupples I Room 218

Session: Contributed talk

Akram Aldroubi

Vanderbilt

Dynamical Sampling and Systems of Iterative Action of Operators

Abstract

We consider frames and Bessel systems generated by iterations of the form $\{A^n g : g \in \mathcal{G}, 0 \leq n, < L(g)\}$, where A is a bounded linear operators on a separable complex Hilbert space $\mathcal{H}$ and $\mathcal{G}$ is a countable set of vectors in $\mathcal{H}$. The system of iterations mentioned above come from the so called *dynamical sampling problem*. In dynamical sampling, an unknown function f and its future states $A^n f$ are coarsely sampled at each time level n, $0 \leq n < L$, where A is an evolution operator that drives the system. The goal is to recover f from these space-time samples. The dynamical sampling problem has connections and applications to other areas of mathematics including, Banach algebras, C^*-algebras, spectral theory of normal operators, and frame theory.

Talk time: 2016-07-19 15:00— 2016-07-19 15:20
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

Il Ju An

Kyung Hee University

Remark on operator matrices and their Weyl type theorems

Abstract

In this talk, we study several spectral properties of operator matrices $\begin{pmatrix} A & C \\ Z & B \end{pmatrix}$ acting on an infinite dimensional separable Hilbert space, where the range of C is closed. In particular, we investigate the conditions for such operator matrices to satisfy Weyl's theorem and Weyl type theorems such as a-Weyl's theorem, a-Browder's theorem, and so on.

This talk is based on joint work with Eungil Ko and Ji Eun Lee.

Talk time: 2016-07-21 18:00— 2016-07-21 18:20
Talk location: Cupples I Room 218

Session: Contributed talk

Nicola Arcozzi

University of Bologna

The Dirichlet Space on the bi-disc

Abstract

We present some preliminary findings on properties of the Dirichlet space on the bi-disc, which is defined as the tensor product of two copies of the classical Dirichlet space on the unit disc. Work in collaboration with Pavel Mozolyako, Karl-Mikael Perfeckt, Giulia Sarfatti.

Talk time: 2016-07-21 15:00— 2016-07-21 15:20
Talk location: Cupples I Room 115

Session: Function spaces. Organized by J. McCarthy.

Wolfgang Arendt

Ulm University Germany

Weyl's Formula and Kernel Operators

Abstract

Weyl's famous formula determines the asymptotic behaviour of the eigenvalues of the Laplace Operator with Dirichlet or Neumann boundary conditions. It shows in particular that the volume is determined by the eigenvalues. In the talk we will show how the asymptotic behaviour in the spirit of Weyl is related to ultracontractivity and in particular to estimates for kernel operators. These estimates will allow us to develop a perturbation theory for Weyl asymptotics. The results are rewarding: We prove that also the Dirichlet-to-Neumann operator (in the Calderon setting with potential) has a Weyl asymptotics. This operator is defined on the L_2 space of the boundary of a smooth domain, and the main result shows that its eigenvalues determine the surface of the domain. This joint work with Tom ter Elst.

Talk time: 2016-07-18 14:30— 2016-07-18 15:20
Talk location: Cupples I Room 115

Session: Operator theory, singular integral equations, and PDEs. Organized by R. Duduchava, E. Shargorodsky, and J. Lang

Meric Augat

University of Florida

Free polynomial Biholomorphisms between free spectrahedra

Abstract

Linear Matrix Inequality (LMI) Domains are bounded free convex semialgebraic sets. Along with their commutative counterparts, they appear in a host of fields including convex optimization, semidefinite programming, convex real algebraic geometry and systems theory. We consider free polynomial mappings between LMI Domains, polynomial equivalence versus affine linear equivalence, and automorphisms for certain classes of domains. We produce a class of pairs of LMI domains that are polynomially, but not affine linearly, biholomorphic.

Talk time: 2016-07-18 18:30— 2016-07-18 18:50
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Joseph Ball

Virginia Tech

Beurling-Lax representation for weighted Bergman-shift invariant subspaces

Abstract

The Beurling-Lax-Halmos theorem tells us that any invariant subspace $\mathcal{M}$ for the shift operator $S\colon f(z) \mapsto zf(z)$ on the vectorial Hardy space over the unit disk $H^2_{\mathcal{Y}} = \{f(z) = \sum_{j=0}^{\infty} f_j z^j \colon \|f\|^2 = \sum_{j\ge 0} \|f_j\|^2 < \infty\}$ (the Reproducing Kernel Hilbert Space with reproducing kernel $K(z,w) = (1 - z\overline{w})^{-1} I_{\mathcal{Y}}$) can be represented as $\mathcal{M} = M_\Theta H^2_{\mathcal{U}}$ where $M_\Theta\colon H^2_{\mathcal{U}} \to H^2_{\mathcal{Y}}$ is an isometric multiplication operator $M_\Theta\colon u(z) \mapsto \Theta(z)u(z)$. We focus on three constructions of $\Theta(z)$:

(1) **the wandering subspace construction of Halmos**: $\mathcal{M} = \bigoplus_{j\ge 0} S^j(\mathcal{M} \ominus S\mathcal{M}) = M_\Theta H^2_{\mathcal{U}}$ where M_Θ is constructed so that $M_\Theta\colon H^2_{\mathcal{U}} \to \mathcal{M} \ominus S\mathcal{M}$ is unitary;

(2) as the **Sz.-Nagy–Foias characteristic function** $\Theta_T(z)$ of the $C_{\cdot 0}$ contraction operator $T = P_{\mathcal{M}^\perp} S|_{\mathcal{M}^\perp}$, and

(3) via the **functional-model realization formula** $\Theta(z) = D + zC(I - zA)^{-1}B$ where $\left[\begin{smallmatrix} A & B \\ C & D \end{smallmatrix}\right] = \begin{bmatrix} S^* & S^* M_\Theta \\ \mathbf{ev}_0 & \Theta(0) \end{bmatrix} : \begin{bmatrix} \mathcal{M}^\perp \\ \mathcal{U} \end{bmatrix} \to \begin{bmatrix} \mathcal{M}^\perp \\ \mathcal{Y} \end{bmatrix}$ with $\mathbf{ev}_0\colon f \mapsto f(0)$ is unitary.

We discuss analogues of these results for the weighted Bergman-shift operator $S_n\colon f(z) \mapsto zf(z)$ acting on the weighted Bergman space $\mathcal{A}_{n,\mathcal{Y}} = \{f(z) = \sum_{j\ge 0} f_j z^j : \|f\|^2 = \sum_{j\ge 0} \mu_{n,j} \|f_j\|^2_{\mathcal{Y}} < \infty\}$ (where $\mu_{n,j} = 1/\binom{j+n-1}{j}$ are reciprocal binomial coefficients), or $\mathcal{A}_{n,\mathcal{Y}}$ is the Reproducing Kernel Hilbert Space with reproducing kernel equal to $K_{n,\mathcal{Y}}(z,w) = (1 - z\overline{w})^{-n} I_{\mathcal{Y}}$, as well as for the freely noncommutative weighted Bergman shift-tuple $\mathbf{S}_n = (S_{n,1}, \dots, S_{n,d})$ where $S_{n,j}\colon f(z) \mapsto f(z) z_j$ $(j = 1, \dots, d)$ on the weighted Bergman-Fock space $\mathcal{A}_{n,\mathcal{Y}}(\mathbb{F}_d)$ consisting of formal power series $f(z) = \sum_{\mathfrak{a}\in\mathbb{F}_d} f_{\mathfrak{a}} z^{\mathfrak{a}}$ for which $\|f\|^2 = \sum_{\mathfrak{a}\in\mathbb{F}_d} \mu_{n,|\mathfrak{a}|} \|f_{\mathfrak{a}}\|^2 < \infty$ ($\mathbb{F}_d$ is the free semigroup (also called the monoid) on d generators $1, \dots, d$, $z = (z_1, \dots, z_d)$ is a d-tuple of freely noncommuting indeterminates, $z^{\mathfrak{a}}$ is the noncommutative monomial $z^{\mathfrak{a}} = z_{i_1} \cdots z_{i_N}$ if $\mathfrak{a} = i_1 \cdots i_N$, $|\mathfrak{a}|$ is the **length** of $\mathfrak{a}$ (equal to N if $\mathfrak{a} = i_1 \cdots i_N$). This talk reports on joint work with Vladimir Bolotnikov of the College of William and Mary.

Talk time: 2016-07-21 18:00— 2016-07-21 18:20
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Sergey Belyi

Troy University

A system coupling and Donoghue classes of Herglotz-Nevanlinna functions.

Abstract

We study the impedance functions of conservative L-systems with unbounded main operators. In addition to the generalized Donoghue class $\mathfrak{M}_\kappa$ of Herglotz-Nevanlinna functions considered earlier, we introduce "inverse" generalized Donoghue classes $\mathfrak{M}_\kappa^{-1}$ of functions satisfying a different normalization condition on the generating measure. We establish a connection between "geometrical" properties of two L-systems whose impedance functions belong to the classes $\mathfrak{M}_\kappa$ and $\mathfrak{M}_\kappa^{-1}$, respectively. After that we introduce a coupling of two L-system and show that if the impedance functions of two L-systems belong to the generalized Donoghue classes $\mathfrak{M}_{\kappa_1}(\mathfrak{M}_{\kappa_1}^{-1})$ and $\mathfrak{M}_{\kappa_2}(\mathfrak{M}_{\kappa_2}^{-1})$, then the impedance function of the coupling falls into the class $\mathfrak{M}_{\kappa_1\kappa_2}$. Consequently, we obtain that if an L-system whose impedance function belongs to the standard Donoghue class $\mathfrak{M} = \mathfrak{M}_0$ is coupled with any other L-system, the impedance function of the coupling belongs to $\mathfrak{M}$ (the absorbtion property). Observing the result of coupling of n L-systems as n goes to infinity, we put forward the concept of a limit coupling which leads to the notion of the system attractor, two models of which (in the position and momentum representations) are presented.

The talk is based on joint work with K. A. Makarov and E. Tsekanovskiĭ (see the reference below).

[1] S. Belyi, K. A. Makarov, and E. Tsekanovskiĭ: *A system coupling and Donoghue classes of Herglotz-Nevanlinna functions*, Complex Analysis and Operator Theory, (2016), 10 (4), pp. 835-880.

Talk time: 2016-07-21 16:00— 2016-07-21 16:20
Talk location: Cupples I Room 218

Session: Contributed talk

Philip Benge

Washington University in St. Louis

A Two-Weight Inequality for Essentially Well Localized Operators

Abstract

Nazarov, Treil and Volberg first introduced and characterized the two-weight boundedness of well localized operators. In this talk, we introduce a generalization of these operators, called essentially well localized operators, and obtain necessary and sufficient conditions to characterize their boundedness between $L^2(\mathbb{R}^n, u)$ and $L^2(\mathbb{R}^n, v)$ for general Radon measures u and v.

Talk time: 2016-07-22 17:00— 2016-07-22 17:20
Talk location: Crow 204

Session: Harmonic analysis. Organized by K. Bickel.

Roman Bessonov

St. Petersburg State University

Muckenhoupt Hamiltonians, triangular factorization, and Krein orthogonal entire functions

Abstract

According to classical results by M. G. Krein and L. de Branges, for every positive measure μ on the real line $\mathbb{R}$ such that $\int_{\mathbb{R}} \frac{d\mu(t)}{1+t^2} < \infty$ there exists a Hamiltonian H such that μ is the spectral measure for the corresponding canonical Hamiltonian system $JX' = zHX$. In the case where μ is an even measure from Steklov class on $\mathbb{R}$, we show that the Hamiltonian H normalized by $\det H = 1$ belongs to the classical Muckenhoupt class A_2. Applications of this result to triangular factorizations of Wiener-Hopf operators and Krein orthogonal entire functions will be also discussed.

Talk time: 2016-07-18 15:30— 2016-07-18 15:50
Talk location: Cupples I Room 115

Session: Operator theory, singular integral equations, and PDEs. Organized by R. Duduchava, E. Shargorodsky, and J. Lang

Tirthankar Bhattacharyya

Indian Institute of Science

Holomorphic functions on the symmetrized bidisk - realization, interpolation and extension

Abstract

There are three new things in this talk about the open symmetrized bidisk $\mathbb{G} = \{(z_1 + z_2, z_1 z_2) : |z_1|, |z_2| < 1\}$.

1. The Realization Theorem: A realization formula is demonstrated for every f in the norm unit ball of $H^\infty(\mathbb{G})$.
2. The Interpolation Theorem: Nevanlinna-Pick interpolation theorem is proved for data from the symmetrized bidisk and a specific formula is obtained for the interpolating function.
3. The Extension Theorem: A characterization is obtained of those subsets V of the open symmetrized bidisk $\mathbb{G}$ that have the property that every function f holomorphic in a neighbourhood of V and bounded on V has an H^∞-norm preserving extension to the whole of $\mathbb{G}$.

Talk time: 2016-07-19 17:30— 2016-07-19 17:50
Talk location: Cupples I Room 113

Session: State space methods in operator and function theory. Organized by J. Ball and S. ter Horst.

Bernhard Bodmann

University of Houston

Optimality beyond the Welch bound: orthoplectic Grassmannian frames as weighted complex projective 2-designs

Abstract

Despite being pursued with a lot of dedication in frame theory and quantum information theory, maximal equiangular tight frames have only been confirmed to exist for lowest dimensions. This is especially puzzling since maximal sets of mutually unbiased bases, which are also known to be optimal packings but have a slightly larger number of vectors, are known to exist in complex Hilbert spaces of any prime power dimension. This talk presents a method by which we can construct a set of M^2+1 vectors in M complex dimensions that form a tight complex orthoplectic Grassmannian frame that is in addition related to a weighted complex projective 2-design with optimality properties for quantum state tomography.

Talk time: 2016-07-18 15:00— 2016-07-18 15:20
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

Vladimir Bolotnikov

The College of William and Mary

Beurling-Lax type theorems in weighted Bergman-Fock spaces

Abstract

Since the shift operator $M_z : f(z) \to zf(z)$ is an isometry on the $\mathcal{Y}$-valued Hardy space $H^2_{\mathcal{Y}}$ of the open unit disk, any M_z-invariant closed subspace $\mathcal{M} \subset H^2_{\mathcal{Y}}$ is generated by the wandering subspace $\mathcal{E} = \mathcal{M} \ominus z\mathcal{M} = P_{\mathcal{M}} z\mathcal{M}^\perp$. Furthermore, $z^k\mathcal{E} \perp z^\ell\mathcal{E}$ for $k \neq \ell$, and any wandering subspace has the form $\mathcal{E} = \Theta\mathcal{U}$ for some $\mathcal{L}(\mathcal{U}, \mathcal{Y})$-valued inner function Θ and an appropriate coefficient space $\mathcal{U}$, which in turn leads to the representations

$$\mathcal{M} = \bigoplus_{k\geq 0}(z^k\mathcal{M} \ominus z^{k+1}\mathcal{M}) = \bigoplus_{k\geq 0} z^k\mathcal{E} = \bigoplus_{k\geq 0} z^k(P_{\mathcal{M}} z\mathcal{M}^\perp) = \bigoplus_{k\geq 0} z^k\Theta\mathcal{U} = \Theta H^2_{\mathcal{U}}$$

for an M_z-invariant subspace $\mathcal{M} \subset H^2_{\mathcal{Y}}$. These equivalent representations display the Beurling-Lax theorem and admit extensions to the noncommutative Fock space setting of formal power series in several non-commuting variables. We will discuss their possible extensions in the context of weighted Bergman-Fock spaces where they are produce several non-equivalent representations for closed subspaces invariant under multiplication by coordinate functions.

Talk time: 2016-07-19 15:30— 2016-07-19 15:50
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Alexander Borichev

Aix-Marseille University

Random and pseudo-random Taylor series

Abstract

We study entire functions represented by random and pseudo-random Taylor series. We prove that in many situations, their angular zero distribution is determined by certain autocorrelations of the coefficient multiplier sequence. This is a joint work with Alon Nishry and Mikhail Sodin.

Talk time: 2016-07-20 09:40— 2016-07-20 10:30
Talk location: Brown Hall 100

Session: Plenary Talk

Amin Boumenir

University of West Georgia

Sampling for multi-parameter spectral theory

Abstract

In this talk we extend the sampling method to deal with the multiparameter spectral theory of Sturm-Liouville systems. To do so, we use the 2-dimensional version of the Whittaker-Shannon-Kotelnikov sampling theorem to find a representation for the characteristic function which leads to the computation of the eigencurves of the system.

Talk time: 2016-07-19 17:30— 2016-07-19 17:50
Talk location: Cupples I Room 218

Session: Contributed talk

Marcin Bownik

University of Oregon

Improved bounds in Weaver and Feichtinger conjectures

Abstract

In this talk we present some results related to the recent solution of the Kadison-Singer problem by Marcus, Spielman, and Srivastava. We sharpen the constant in the KS_2 conjecture of Weaver that plays a key role in this solution. We then apply this result to prove optimal asymptotic bounds on the size of partitions in the Feichtinger conjecture.

The talk is based on a joint work with Casazza, Marcus, and Speegle.

Talk time: 2016-07-19 14:30— 2016-07-19 14:50
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

David Brown

Newcastle University

A criterion for the solvability of a μ-synthesis problem

Abstract

We give a solvability criterion for the following μ-synthesis problem. Let μ be the structured singular value for the diagonal matrices with entries in $\mathbb{C}$.

Problem. Given distinct points $\lambda_1, \ldots, \lambda_n$ in the open unit disc $\mathbb{D}$ and target 2×2 complex matrices $W_1, \ldots, W_n$ such that $\mu(W_j) \leq 1$ for all $j = 1, \ldots, n$, find a holomorphic 2×2 matrix function F on $\mathbb{D}$ such that $F(\lambda_j) = W_j$ for each j, and $\mu(F(\lambda)) \leq 1$ for all $\lambda \in \mathbb{D}$.

By [1, Theorem 9.2], this problem is equivalent to the following interpolation problem: does there exist a holomorphic function x from the disc to the tetrablock $\overline{\mathbb{E}}$ such that $x(\lambda_j) = (w_{11}^j, w_{22}^j, \det W_j)$ for each j? The tetrablock is the domain in $\mathbb{C}^3$ defined by

$$\overline{\mathbb{E}} := \{(x_1, x_2, x_3) \in \mathbb{C}^3 : 1 - x_1 z - x_2 w + x_3 z w \neq 0 \text{ for all } z, w \in \mathbb{D}\}.$$

In this talk we show such an x exists if and only if, for distinct $z_1, z_2, z_3 \in \mathbb{D}$, there are positive $3n$-square matrices $[N_{il,jk}]$, of rank 1, and $[M_{il,jk}]$ such that

$$\left[1 - \frac{\overline{z_l x_{3i} - x_{1i}}}{x_{2i} z_l - 1} \frac{z_k x_{3j} - x_{1j}}{x_{2j} z_k - 1}\right] \geq [(1 - \overline{z_l} z_k) N_{il,jk}] + [(1 - \overline{\lambda_i} \lambda_j) M_{il,jk}],$$

where $(x_{1j}, x_{2j}, x_{3j}) = (w_{11}^j, w_{22}^j, \det W_j)$ for each j.

The talk is based on a joint work with Z. A. Lykova and N. J. Young.

[1] A. A. Abouhajar, M. C. White and N. J. Young, A Schwarz lemma for a domain related to μ-synthesis, *J. Geom. Anal. 17*, (2007), pp. 717-750

Talk time: 2016-07-18 15:00— 2016-07-18 15:20

Talk location: Cupples I Room 207

Session: Contributed talk

Branimir Ćaćić

University of New Brunswick

Spectral triples for discrete groups

Abstract

The Pontrjagin dual of an Abelian discrete group is a compact topological group, but if the Abelian discrete group is finitely generated, then its dual is actually a Lie group. The reduced group $C*$-algebra of a non-Abelian discrete group is certainly a compact quantum group, but under what conditions can we endow it with the structure of a noncommutative manifold? In this talk, I'll recall Connes's construction of spectral triples for discrete groups endowed with a proper length function, and then I'll discuss how to refine this construction for discrete groups endowed with a proper array, e.g., groups with the Haagerup property together with a witnessing proper 1-cocycle, at the price of working with unbounded KK-cycles. This is joint work in progress with Steve Avsec.

Talk time: 2016-07-22 18:00— 2016-07-22 18:20
Talk location: Cupples I Room 115

Session: Non-commutative geometry. Organized by X. Tang.

Peter Casazza

University of Missouri

The distance between frames and between subspaces of a Hilbert space

Abstract

We make a deep study of the distance between frames and between subspaces of a Hilbert space. There are many surprises here. First, of the six standard ways of measuring distance between subspaces, 5 of them are equal and the sixth, chordal distance, is within a factor of 2 of the others. We also show that the vectors giving chordal distance are biorthogonal - which the definition does not indicate. There are many more surprising results here.

Talk time: 2016-07-18 14:30— 2016-07-18 14:50
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

Isabelle Chalendar

University Lyon 1

Semiflow of analytic functions and semigroups of composition operators

Abstract

The study of analytic semiflows on the open unit disc and the particular form of its infinitesimal generator G makes possible the study of semigroups of composition operators $(T(t))_{t\geq 0}$ on various well-known spaces of holomorphic functions such as Hardy, Dirichlet and Bergman spaces. We will provide compactness, analyticity and invertibility complete characterization of $(T(t))_{t\geq 0}$ in terms of G.

Talk time: 2016-07-18 11:00— 2016-07-18 11:30
Talk location: Brown Hall 100

Session: Plenary Talk

Yeong Chyuan Chung

Texas A&M University

Quantitative K-theory for SQ_p-algebras

Abstract

Quantitative (or controlled) K-theory for C^*-algebras was introduced by Guoliang Yu in his work on the Novikov conjecture for groups with finite asymptotic dimension, and was later expanded into a general theory, with further applications, by Yu together with Hervé Oyono-Oyono. Motivated by investigations of the L_p Baum-Connes conjecture, we will describe an analogous framework of quantitative K-theory that applies to algebras of bounded linear operators on subquotients of L_p spaces.

Talk time: 2016-07-22 16:00— 2016-07-22 16:20
Talk location: Cupples I Room 115

Session: Non-commutative geometry. Organized by X. Tang.

Raphael Clouatre

University of Manitoba

Representations of multiplier algebras of complete Pick spaces on the ball

Abstract

We study multiplier algebras of certain complete Pick spaces on the unit ball. Rather than focusing on function theory, we adopt a dilation theoretic point of view. Based on work of Agler and Ambrozie-Engliš-Müller, we show that every completely contractive representation can be co-extended to a $*$-homomorphism of the associated Toeplitz-type algebra, and describe when these representations have the unique extension property. In the special case where we represent the multiplier algebra on another Hilbert function space, we reformulate results on functional models from Douglas-Misra-Sarkar and establish the equivalence of dilation, co-extension, and a simple positivity condition relating the two kernels. This is joint work with Michael Hartz.

Talk time: 2016-07-19 17:30— 2016-07-19 17:50
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Raul Curto

University of Iowa

An algorithmic approach to the sextic moment problem

Abstract

We describe an approach to solving the sextic moment problem based on a thorough analysis of the extremal case, and algorithmic solutions for the non-extremal cases.

For a degree $2n$ complex sequence $\gamma \equiv \gamma^{(2n)} = \{\gamma_{ij}\}_{i,j\in Z_+, i+j\leq 2n}$ to have a representing measure μ, it is necessary for the associated moment matrix $M(n)$ to be positive semidefinite, and for the algebraic variety associated to γ, $\mathcal{V}_\gamma \equiv \mathcal{V}(M(n))$, to satisfy rank $M(n) \leq$ card $\mathcal{V}_\gamma$ as well as the following consistency condition: if a polynomial $p(z,\bar{z}) \equiv \sum_{ij} a_{ij}\bar{z}^i z^j$ of degree at most $2n$ vanishes on $\mathcal{V}_\gamma$, then the *Riesz functional* $\Lambda(p) \equiv p(\gamma) := \sum_{ij} a_{ij}\gamma_{ij} = 0$.

Positive semidefiniteness, recursiveness, and the variety condition of a moment matrix are necessary and sufficient conditions to solve the quadratic ($n = 1$) and quartic ($n = 2$) moment problems. Also, positive semidefiniteness, combined with the above mentioned consistency condition, is a sufficient condition in the case of *extremal* moment problems, i.e., when the rank of the moment matrix (denoted by r) and the cardinality of the associated algebraic variety (denoted by v) are equal. However, these conditions are not sufficient for *non*-extremal (i.e., $r < v$) sextic ($n = 3$) or higher-order truncated moment problems.
DTLpar For extremal sextic moment problems, verifying consistency amounts to having good representation theorems for sextic polynomials in two variables vanishing on the algebraic variety of the moment sequence. We obtain such representation theorems using the Division Algorithm from algebraic geometry. As a consequence, we are able to complete the analysis of extremal sextic moment problems.

Assume now that $M(3) \geq 0$, and that it satisfies the variety condition $r \leq v$ as well as consistency. Also assume that $M(3)$ admits at least one *cubic* column relation. We prove the existence of a related matrix $\widetilde{M(3)}$ with rank $\widetilde{M(3)} <$ rank $M(3)$ and such that each representing measure for $\widetilde{M(3)}$ gives rise to a representing measure for $M(3)$. As a concrete application, we discuss the case when rank $M(3) = 8$ and card $\mathcal{V}(M(3)) \leq 9$.

Along the way, we settle three key instances of the non-extremal sextic moment problem, as follows: when $r = 7$, positive semidefiniteness, consistency and the variety condition guarantee the existence of a 7-atomic representing measure; when $r = 8$ we construct two determining algorithms, corresponding to the cases $v = 9$ and $v = +\infty$. To accomplish this, we generalize the above mentioned rank-reduction technique, which was used in previous work to find an explicit solution of the nonsingular quartic moment problem.

The talk is based on joint work with Seonguk Yoo.

Talk time: 2016-07-21 14:30— 2016-07-21 14:50
Talk location: Cupples I Room 113

Session: Finite and infinite dimensional moment problems. Organized by M. Infusino, S. Kuhlmann, and T. Kuna.

Raul Curto

University of Iowa, USA

A New Necessary Condition for the Hyponormality of Toeplitz Operators on the Bergman Space

Abstract

It is a well known result of C. Cowen that, for a symbol $\varphi \in L^\infty$, $\varphi = \bar{f} + g \ \ (f, g \in H^2)$, the Toeplitz operator T_φ acting on the Hardy space of the unit circle is hyponormal if and only if $f = c + T_{\bar{h}} g$, for some $c \in \mathbb{C}$, $h \in H^\infty$, $\|h\|_\infty \leq 1$. In this talk we will consider possible versions of this result in the it Bergman space case.

Concretely, we consider Toeplitz operators on the Bergman space of the unit disk, with symbols of the form

$$\varphi \equiv \alpha z^n + \beta z^m + \gamma \bar{z}^p + \delta \bar{z}^q,$$

where $\alpha, \beta, \gamma, \delta \in \mathbb{C}$ and $m, n, p, q \in \mathbb{Z}_+$, $m < n$ and $p < q$. By letting T_φ act on vectors of the form

$$z^k + cz^\ell + dz^r \ \ (k < \ell < r),$$

we study the asymptotic behavior of a suitable matrix of inner products, as $k \to \infty$. As a consequence, we obtain a rather sharp inequality involving the above mentioned data:

$$|\alpha|^2 n^2 + |\beta|^2 m^2 - |\gamma|^2 p^2 - |\delta|^2 q^2 \geq 2 \left| \bar{\alpha}\beta mn - \bar{\gamma}\delta pq \right|.$$

This result is intended to be a precursor of basic necessary conditions for joint hyponormality of commuting tuples of Toeplitz operators acting on Bergman spaces in several complex variables.

The talk is based on joint work with Željko Čučković (University of Toledo, USA).

Talk time: 2016-07-19 15:00— 2016-07-19 15:20
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Gopal Datt

University of Delhi

Operator equations and Spectral Problems

Abstract

The multiplication operators are the linear operators induced by multiplication by some fixed function. One of the important fact which motivates the study of multiplication operators is that every normal operator is similar to a multiplication operator. The another motivational fact that makes the study of multiplication operators interesting as well as demanding is its close association with various classes of operators, particularly, Toeplitz operators, Hankel operators and Composition operators. Multiplication operators have been a matter of study in operators theory over the years and these operators on different function spaces have been studied by several mathematicians. We talk about some operator equations involving these operators and discuss some spectral problems.

Talk time: 2016-07-21 14:30— 2016-07-21 14:50
Talk location: Cupples I Room 215

Session: Operator theory, singular integral equations, and PDEs. Organized by R. Duduchava, E. Shargorodsky, and J. Lang

Kenneth Davidson

University of Waterloo

The functional calculus for commuting row contractions

Abstract

A commuting row contraction is a d-tuple of commuting operators $T_1, \ldots, T_d$ such that $\sum_{i=1}^d T_i T_i^* \leq I$. Such operators have a polynomial functional calculus which extends to a norm closed algebra of multipliers $\mathcal{A}_d$ on Drury-Arveson space. We characterize those row contractions which admit an extension of this map to a weak-$*$ continuous functional calculus on the full multiplier algebra. In particular, we show that completely non-unitary row contractions are always absolutely continuous, in direct parallel with the case of a single contraction. This is based on the detailed structure of the dual space of $\mathcal{A}_d$. Finally, we consider refinements of this question for row contractions that are annihilated by a given ideal.

This is joint work with Raphaël Clouâtre.

Talk time: 2016-07-22 09:40— 2016-07-22 10:30
Talk location: Brown Hall 100

Session: Plenary Talk

Matthew Dawson

CIMAT

Radial Toeplitz operators on the weighted Bergman spaces of the Cartan domain $SU(n,n)/S(U(n)\times U(n))$

Abstract

We consider Toeplitz operators on Bergman spaces over the bounded symmetric domain $SU(n,n)/S(U(n)\times U(n))$. As a special case of a previous result, it was shown that Toeplitz operators with radial symbols (that is, symbols that are invariant under the action of $S(U(n)\times U(n))$) generate a commutative C^*-algebra. As a consequence, it is possible to simultaneously diagonalize all Toeplitz operators with radial symbols. We explicitly determine the simultaneous eigenspaces using the representation theory of U(n) and provide an integral formula for computing the eigenvalues of a Toeplitz operator with a given radial symbol. This is joint work with Raúl Quiroga.

Talk time: 2016-07-19 15:00— 2016-07-19 15:20
Talk location: Cupples I Room 215

Session: Toeplitz operators and related topics. Organized by S. Grudsky and N. Vasilevski.

Santanu Dey

Indian Institute of Technology Bombay

$\mathfrak{K}$-families and CPD-H-extendable families

Abstract

We introduce, for any set S, the concept of $\mathfrak{K}$-family between two Hilbert C^*-modules over two C^*-algebras, for a given completely positive definite (CPD-) kernel $\mathfrak{K}$ over S between those C^*-algebras and obtain a factorization theorem for such $\mathfrak{K}$-families. If $\mathfrak{K}$ is a CPD-kernel and E is a full Hilbert C^*-module, then any $\mathfrak{K}$-family which is covariant with respect to a dynamical system (G, η, E) on E, extends to a $\tilde{\mathfrak{K}}$-family on the crossed product $E \times_\eta G$, where $\tilde{\mathfrak{K}}$ is a CPD-kernel. Several characterisations of $\mathfrak{K}$-families, under the assumption that E is full, are obtained and covariant versions of these results are also given. One of these characterizations says that such $\mathfrak{K}$-families extend as CPD-kernels, between associated (extended) linking algebras, whose $(2, 2)$-corner is a homomorphism and vice versa. We discuss a dilation theory of CPD-kernels in relation to $\mathfrak{K}$-families.

Talk time: 2016-07-19 17:00— 2016-07-19 17:20
Talk location: Cupples I Room 113

Session: State space methods in operator and function theory. Organized by J. Ball and S. ter Horst.

Adam Dor-On

University of Waterloo

Matrix convex sets: Inclusions, completely positive interpolation and minimality

Abstract

This talk is complementary to the plenary talk to be given by Orr Shalit in IWOTA 2016, and is a part of a joint work with Kenneth R. Davidson, Orr Moshe Shalit and Baruch Solel.

A matrix convex set is a stratified set of the form $\mathcal{S} = \cup_{n\geq 1}\mathcal{S}_n$, where each $\mathcal{S}_n$ is comprised of d-tuples of $n \times n$ matrices, and is closed under direct sums and application of unital completely positive maps from M_n to M_k. To each d-tuple A, we associate a matrix convex set $\mathcal{W}(A)$ called the *matrix range* of A.

For two d-tuples $A = (A_1, ..., A_d)$ and $B = (B_1, ..., B_d)$, we show that there exists a UCP map sending A_i to B_i if and only if $\mathcal{W}(B) \subseteq \mathcal{W}(A)$. From this we recover results of Helton, Klep and McCullough in the case of real symmetric matrices and of Li and Poon in the case of Hermitian commuting matrices.

We say that a d-tuple A of operators on a Hilbert space H is *minimal* if there is no subspace $\{0\} \neq H' \subsetneq H$ that reduces A and $\mathcal{W}(A|_{H'}) = \mathcal{W}(A)$. Generalizing work of Helton, Klep and McCullough in the case of real symmetric matrices, we show for two minimal compact d-tuples of operators A and B, that $\mathcal{W}(A) = \mathcal{W}(B)$ if and only if A and B are simultaneously unitarily conjugate. We give an example of a d-tuple of non-compact operators where the situation is more complicated, and provide a reasonable alternative to the above theorem in cases where the C*-algebras generated by each d-tuple contains no compact operator.

Talk time: 2016-07-19 18:00— 2016-07-19 18:20
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Michael Dritschel

Newcastle University

TBA

Abstract

TBA

Talk time: 2016-07-21 17:00— 2016-07-21 17:20
Talk location: Cupples I Room 115

Session: Function spaces. Organized by J. McCarthy.

Michael Dritschel

Newcastle University

Factorization of non-negative operator valued trigonometric polynomials in two variables

Abstract

Schur complements provide a convenient tool for proving the operator valued version of the classical (single variable) Fejér-Riesz problem. It also enables the factorization of multivariable trigonometric polynomials which are strictly positive. A result of Scheiderer implies that in two variables, nonnegative scalar valued trigonometric polynomials have sums of squares decompositions, Using a generalization of the notion of the Schur complement, we show how to extend this to operator valued trigonometric polynomials in two variables. We also indicate some other problems which may be tackled in a similar manner, including an operator version of Marshall's Positivstellensatz on the strip.

Talk time: 2016-07-18 14:30— 2016-07-18 14:50
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Geir Dullerud

University of Illinois

Operators and Feedback Control Theory: Linear Switched Systems

Abstract

Switching is a common feature in models for systems comprised of interacting software and physical processes, and in this talk we will focus on a special type of hybrid model called a linear switched system. In discrete time, these systems are represented by difference equations in which the defining system matrices are functions of a parameter taking values in a finite set; further, this discrete parameter evolves, or indeed switches, according to a transition system which in the simplest case is an automaton. The talk will focus on such linear switched systems in a feedback control context-both centralized and decentralized-and how they can be systematically analyzed using a combination of state space methods, operator theory and semidefinite programming. As a start, we will investigate the property of stability, and also the more involved attribute stabilizability-whether a feedback policy exists to stabilize an inherently unstable system. In each case we show that the property can be checked exactly from a nested chain of semidefinite programs: feasibility of any program in the chain provides a mathematical certificate that the property holds; using the concept of a multi-norm, we further show that infeasibility provides information about the degree to which the property may be attainable. More generally, we consider performance metrics for switched systems, and present results on performance verification, and automated synthesis of feedback policies. We will also discuss connections to the joint spectral radius of a set of matrices, and Markovian jump linear systems.

Talk time: 2016-07-21 09:00— 2016-07-21 09:30
Talk location: Brown Hall 100

Session: Plenary Talk

Ken Dykema
Texas A&M University

TBA

Abstract

TBA

Talk time: 2016-07-22 17:30— 2016-07-22 17:50
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Piotr Dymek

University of Agriculture in Krakow

Analytic structure of weighted shifts on directed trees

Abstract

The class of weighted shifts on directed trees generalizes classical weighted shifts. It was introduced a few years ago and provided a lot of examples of operators with interesting properties. In the talk I will concentrate on analytic properties of these operators. In particular, I will prove that a weighted shift on a directed tree is related to a multiplier algebra of coefficients of analytic functions. This result leads to a kind of functional calculus for functions from multiplier algebras. Furthermore, I will present some properties of the spectrum and bounded point evaluations of these operators.

The talk is based on a joint work with P. Budzyński and M. Ptak

Talk time: 2016-07-18 15:30— 2016-07-18 15:50
Talk location: Cupples I Room 207

Session: Contributed talk

Martin Ehler

University of Vienna

Kernel-based function approximation on Grassmannians

Abstract

Function approximation on compact Riemannian manifolds based on eigenfunctions of the Laplace-Beltrami operator has been widely studied in the recent literature. In this talk, we present numerical experiments associated to the approximation schemes for the Grassmann manifold. Our numerical computations illustrate and match the theoretical findings in the literature.

Talk time: 2016-07-19 17:00— 2016-07-19 17:20
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

Rachid El Harti

University Hassan I

The slice property and equalizers of diagrams of C^*-algebras.

Abstract

Let A and B be two C*-algebras. For any C*-subalgebra D of B which is equalizer defined by *-homomorphism $\phi_1, \phi_2 : B \to C$ where C is an other C*-algebra. $(A, D.B)$ has the slice property if and only if the tensor product spatial $A \otimes D$ is an equalizer defined by the canonical *-homomorphism $id :_A \otimes \phi_1$ and $id_A \otimes \phi_2$.

Talk time: 2016-07-22 17:30— 2016-07-22 17:50
Talk location: Cupples I Room 115

Session: Non-commutative geometry. Organized by X. Tang.

Mahmoud El-Borai

Professor of Mathematics Faculty of Science Alexandria University

On some stochastic singular integro-partial differential equations and the parabolic transform

Abstract

Some stochastic singular integro-partial differential equations are studied without any restrictions on the characteristic forms of the partial differential operators. Linear and nonlinear cases are studied. Using the parabolic transform, existence and stability results are obtained. The Cauchy problem of fractional stochastic partial differential equations can be considered as a special case from the obtained results. Key words: Singular integral equations, Stochastic partial differential equations, Existence and stability of solutions, Fractional stochastic partial differential equations.

Talk time: 2016-07-19 15:30— 2016-07-19 15:50
Talk location: Cupples I Room 218

Session: Contributed talk

Khairia El-Nadi

Professor of Mathematics Faculty of Science Alexandria University

On some fractional nonlocal integrated semi groups

Abstract

Some classes of fractional abstract differential equations with α-integrated semi groups are studied in Banach space. The existence of a unique solution of the nonlocal Cauchy problem is studied. Some properties are given.

Talk time: 2016-07-19 15:00— 2016-07-19 15:20
Talk location: Cupples I Room 218

Session: Contributed talk

Eric Evert

University of California, San Diego

Circular Free Spectrahedra

Abstract

This talk considers matrix convex sets invariant under several types of rotations. It is known that matrix convex sets that are free semialgebraic are solution sets of Linear Matrix Inequalities (LMIs); they are called free spectrahedra. The talk will classify all free spectrahedra that are circular, that is, closed under multiplication by e^{it}: up to unitary equivalence, the coefficients of a minimal LMI defining a circular free spectrahedron have a common block decomposition in which the only nonzero blocks are on the superdiagonal.

This talk also gives a classification of those noncommutative polynomials invariant under conjugating each coordinate by a different unitary matrix. Up to unitary equivalence such a polynomial must be a direct sum of univariate polynomials. This talk is based on joint work with Bill Helton, Igor Klep, and Scott McCullough.

Talk time: 2016-07-22 15:30— 2016-07-22 15:50
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Quanlei Fang

Bronx Community College

Multiplier characterization for the Drury-Arveson space

Abstract

Let H_n^2 be the Drury-Arveson space on the unit ball $\mathbf{B}$ in $\mathbf{C}^n$, and suppose that $n \geq 2$. Let k_z, $z \in \mathbf{B}$, be the normalized reproducing kernel for H_n^2. In this talk we will discuss the following rather basic question in the theory of the Drury-Arveson space: For $f \in H_n^2$, does the condition $\sup_{|z|<1} \|fk_z\| < \infty$ imply that f is a multiplier of H_n^2? We show that the answer is negative and the analogue of the familiar norm inequality $\|H_\varphi\| \leq C\|\varphi\|_{\mathrm{BMO}}$ for Hankel operators fails in the Drury-Arveson space. This is joint work with Jingbo Xia.

Talk time: 2016-07-18 15:30— 2016-07-18 15:50
Talk location: Cupples I Room 113

Session: State space methods in operator and function theory. Organized by J. Ball and S. ter Horst.

Douglas Farenick

University of Regina

Non-commutative Jensen and Chebyshev inequalities for measurable matrix-valued functions and measures

Abstract

The idea of noncommutative averaging (that is, of a matrix-convex combination of matrix-valued functions) extends quite naturally to the integral of matrix-valued measurable functions with respect to positive matrix-valued measures. In this lecture I will report on collaborative work with F. Zhou, S. Plosker, and M. Kozdron on formulations of some classical integral inequalities (Jensen, Chebyshev) in the context of noncommutative integration. The Schwarz inequality will also be considered, leading to the notions of noncommutative expectation and variance.

Talk time: 2016-07-21 14:30— 2016-07-21 14:50
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Tim Ferguson

University of Alabama

Mean Holder Continuity, Area Integral Means and Extremal Problems

Abstract

I will discuss mean Hölder continuity conditions for functions in Bergman spaces and the relation of these conditions with the growth of area integral means of derivatives of analytic functions. I will also discuss a result about mean Holder continuity of solutions of certain linear extremal problems in Bergman spaces that is similar to a result of Khavinson, McCarthy, and Shapiro (but with improved Holder exponent for $1 < p < 2$). I will indicated some applications of this result.

Talk time: 2016-07-21 15:00— 2016-07-21 15:20
Talk location: Crow 204

Session: Harmonic analysis. Organized by K. Bickel.

Lawrence Fialkow

SUNY New Paltz

Positivity and representing measures in the truncated moment problem

Abstract

Let K denote a nonempty closed subset of $\mathbb{R}^n$ and let $\beta \equiv \beta^{(m)} = \{\beta_i\}_{i \in \mathbb{Z}_+^n, |i| \leq m}$, $\beta_0 > 0$, denote a real n-dimensional multisequence of finite degree m. *The Truncated K-Moment Problem (TKMP)* concerns the existence of a positive Borel measure μ, supported in K, such that

$$\beta_i = \int_{\mathbb{R}^n} x^i d\mu \qquad (i \in \mathbb{Z}_+^n, \ \ |i| \leq m).$$

We describe a number of interrelated techniques for establishing the existence of such *K-representing measures*. We discuss K-representing measures arising from *K-positivity* or *strict K-positivity* of the Riesz functional L_β associated with β; representing measures arising from extensions of moment matrices; Tchakaloff's Theorem and its generalizations and applications to TKMP; representing measures arising from a nonempty *core variety*.

Talk time: 2016-07-22 14:30— 2016-07-22 14:50
Talk location: Cupples I Room 113

Session: Finite and infinite dimensional moment problems. Organized by M. Infusino, S. Kuhlmann, and T. Kuna.

Lawrence Fialkow

SUNY New Paltz

The core variety of a multisequence in the truncated moment problem

Abstract

Let K denote a nonempty closed subset of $\mathbb{R}^n$, let $m = 2d$, and let $\beta \equiv \beta^{(m)} = \{\beta_i\}_{i \in \mathbb{Z}_+^n, |i| \leq m}$, $\beta_0 > 0$, denote a real n-dimensional multisequence of finite degree m. *The Truncated K-Moment Problem* concerns the existence of a positive Borel measure μ, supported in K, such that

$$\beta_i = \int_{\mathbb{R}^n} x^i d\mu \qquad (i \in \mathbb{Z}_+^n, \quad |i| \leq m).$$

The *core variety* of β, $\mathcal{V} \equiv \mathcal{V}(\beta)$, is an algebraic variety in $\mathbb{R}^n$ that contains the support of any such *K-representing measure*. In previous work we showed, conversely, that if $\mathcal{V}$ is a nonempty compact set, or $\mathcal{V}$ is nonempty and is a determining set for polynomials of degree at most m (in particular, if $\mathcal{V} = \mathbb{R}^n$), then β admits a $\mathcal{V}$-representing measure. We describe some additional cases where a nonempty core variety implies the existence of a representing measure.

Talk time: 2016-07-19 14:30— 2016-07-19 14:50
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Matthew Fickus

Air Force Institute of Technology

Polyphase equiangular tight frames

Abstract

An equiangular tight frame (ETF) is a type of optimal packing of lines in a finite-dimensional Hilbert space. ETFs arise in various applications, such as waveform design for wireless communication, compressed sensing, quantum information theory and algebraic coding theory. In a recent paper, signature matrices of ETFs were constructed from abelian distance regular covers of complete graphs. We extend this work, constructing a new infinite family of complex ETFs. Our approach involves designing matrices whose entries are polynomials over a finite abelian group, namely polyphase matrices of finite filter banks.

Talk time: 2016-07-18 15:30— 2016-07-18 15:50
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

Art Frazho

Purdue University

A band formula for a Toeplitz commutant lifting problem

Abstract

The band method plays a fundamental role in solving a Toeplitz and Nehari interpolation problem; see [2]. The solution to the Nehari problem involves the inverses of $I - HH^*$ and $I - H^*H$ where H is the corresponding Hankel matrix. Here we will derive a similar result for a certain commutant lifing problem.

Let Θ be an inner function in $H^\infty(\mathcal{E}, \mathcal{Y})$ and $\mathcal{H}(\Theta)$ the subspace of $\ell^2_+(\mathcal{Y})$ defined by

$$\mathcal{H}(\Theta) = \ell^2_+(\mathcal{Y}) \ominus T_\Theta \ell^2_+(\mathcal{E})$$

where T_Θ is the Toeplitz operator determined by Θ. Clearly, $\mathcal{H}(\Theta)$ is an invariant subspace for the backward shift $S^*_{\mathcal{Y}}$. Consider the *data set* $\{A, T', S_{\mathcal{Y}}\}$ where A is a strict contraction mapping $\ell^2_+(\mathcal{U})$ into $\mathcal{H}(\Theta)$, the operator T' on $\mathcal{H}(\Theta)$ is the compression of $S_{\mathcal{Y}}$ to $\mathcal{H}(\Theta)$, that is,

$$T' = \Pi_{\mathcal{H}(\Theta)} S_{\mathcal{Y}} | \mathcal{H}(\Theta) \text{ on } \mathcal{H}(\Theta).$$

Here $\Pi_{\mathcal{H}(\Theta)}$ is the orthogonal projection from $\ell^2_+(\mathcal{Y})$ onto $\mathcal{H}(\Theta)$. Moreover, A intertwines $S_{\mathcal{U}}$ with T', that is, $T'A = AS_{\mathcal{U}}$. Given this data set the commutant lifting problem is to find all contractive Toeplitz operators T_Ψ such that

$$\Pi_{\mathcal{H}(\Theta)} T_\Psi = A. \tag{1}$$

This lifting problem includes the Nevanlinna-Pick and Leech interpolation problems. Using two different methods we will show that the set of all solutions are given by

$$\Psi = \big(\Upsilon_{12} + \Upsilon_{11} g\big)\big(\Upsilon_{22} + \Upsilon_{21} g\big)^{-1}.$$

Here g is a contactive analytic function acting between the appropriate spaces. Analogous to the band formulas in the Nehari interpolation problem, Υ_{jk} are determined by the inverses of $I - AA^*$ and $I - A^*A$. The proofs relay on different techniques. Finally, this is joint work with S. ter Horst and M.A. Kaashoek.

References

[1] C. Foias, A.E. Frazho, I. Gohberg, and M. A. Kaashoek, *Metric Constrained Interpolation, Commutant Lifting and Systems,* Operator Theory: Advances and Applications, **100**, Birkhäuser-Verlag, 1998.

[2] I. Gohberg, S. Goldberg, and M.A. Kaashoek, *Classes of Linear Operators*, Vol. II, Operator Theory: Advances and Applications, **63**, Birkhäuser-Verlag, Basel, 1993.

Talk time: 2016-07-18 15:00— 2016-07-18 15:20
Talk location: Cupples I Room 113

Session: State space methods in operator and function theory. Organized by J. Ball and S. ter Horst.

Daniel Freeman

St Louis University

The Discretization Problem for continuous frames.

Abstract

There is a long history of creating frames by sampling continuous frames. For instance, Gabor frames are formed by sampling the short time Fourier transform at a lattice. Continuous frames often arise naturally in mathematics and physics, but the sampled frames are usually more useful in application. Using the results of Marcus-Spielman-Srivastava in their solution of the Kadison-Singer problem, we prove that every bounded continuous frame may be sampled to obtain a frame.

This is joint work with Darrin Speegle.

Talk time: 2016-07-18 16:00— 2016-07-18 16:20
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

EVA GALLARDO-GUTIERREZ

UNIVERSIDAD COMPLUTENSE DE MADRID E ICMAT

A CONTINUOUS MODEL FOR QUAINILPOTENT OPERATORS AND TRANSLATION INVARIANT SUBSPACES IN WEIGHTED L^2 OF R_+

Abstract

In this talk we will show a continuous version of the model due to Foias and Pearcy for quasinilpotent operators defined on a separable, infinite-dimensional complex Hilbert space, providing an approach for studying their invariant subspaces connected to translation invariant subspaces in weighted L^2 of R_+.

Talk time: 2016-07-20 09:00— 2016-07-20 09:30
Talk location: Brown Hall 100

Session: Plenary Talk

Jadav Ganesh

IIT Hyderabad, India

A Characterization of Absolutely Minimum Attaining operators

Abstract

We study the spectral properties of positive absolutely minimum attaining operators defined on infinite dimensional complex Hilbert spaces and using that derive a characterization theorem for such type of operators. We construct several examples and discuss some of the properties of this class. Also, we extend this characterization theorem for general absolutely minimum attaining operators by means of the polar decomposition theorem.

Talk time: 2016-07-21 15:00— 2016-07-21 15:20
Talk location: Cupples I Room 207

Session: Contributed talk

Stephan Garcia

Pomona College

Three Remarks on Similarity

Abstract

We consider three questions concerning similarity of matrices. Which matrices are similar to partial isometries? If A and B are normal, is AB similar to BA? Which matrices are unitarily similar to their transposes (and what does this have to do with Lie algebras)? Along the way, we hope to highlight some interesting matrix theory results that deserve to be more widely known.

Talk time: 2016-07-18 09:00— 2016-07-18 09:30
Talk location: Brown Hall 100

Session: Plenary Talk

Tryphon Georgiou

University of California, Irvine

Entropic and Displacement interpolation of probability distributions: geometric and computational aspects

Abstract

We will discuss two problems with a long history and a timely presence. Optimal mass transport (OMT) was posed as a problem in 1781 by Gaspar Monge. It provides a natural geometry for interpolating distributions (displacement interpolation) and for modeling flows. As such it has been the cornerstone of many recent developments in physics, probability theory, and image processing. The Schrödinger bridge problem (SBP) was posed by Erwin Schrödinger in 1931, in an attempt to provide a classical interpretation of quantum mechanics. It is rooted in statistical mechanics and large deviations theory, and provides an alternative model for flows of the distribution of particles (entropic interpolation -Schrödinger bridge). We will explain the relation between the two problems, their practical relevance in the control of particles, ensembles, thermal noise, time-series analysis, images interpolation, etc., and we will present a computational approach based on the Hilbert metric.

The talk is based on joint work with Yongxin Chen (Mechanical Engineering, University of Minnesota) and Michele Pavon (Department of Mathematics, University of Padova).

Talk time: 2016-07-21 09:40— 2016-07-21 10:30
Talk location: Brown Hall 100

Session: Plenary Talk

Ramesh Golla

Indian Institute of Technology Hyderabad

ABSOLUTELY MINIMUM ATTAINING CLOSED OPERATORS

Abstract

We define and discuss properties of the class of unbounded operators which attain minimum modulus. We establish a relationship between this class and the class of norm attaining bounded operators and compare the properties of both. Also we define absolutely minimum attaining operators (possibly unbounded) and characterize injective absolutely minimum attaining operators as those with compact inverse. We give several consequence, one of them is that every such operator has a non trivial hyper invariant subspace.

Talk time: 2016-07-21 17:30— 2016-07-21 17:50
Talk location: Cupples I Room 218

Session: Contributed talk

Sandrine Grellier

université ORLEANS, FRANCE

Multiple singular values of Hankel operators and weak turbulence in the cubic Szegő equation

Abstract

We establish an inverse spectral result on compact Hankel operators on the unit sphere. Namely, we describe the set of symbols of compact Hankel operators having a prescribed sequence of singular values. It is done by constructing a one-to-one correspondence between a symbol of a compact Hankel operator and its sequence of singular values as well as some additional spectral parameters.

This one-to-one correspondence plays the role of a non linear Fourier transform for some hamiltonian equation: the cubic Szegő equation. It allows to obtain explicit formulae of the solutions and to prove a wave turbulence phenomenon: for a dense G_δ of initial data, solutions develop large oscillations on small space scales. It is from joint works with Patrick Gérard.

Talk time: 2016-07-20 11:40— 2016-07-20 12:30
Talk location: Brown Hall 100

Session: Plenary Talk

Anatolii Grinshpan

Drexel University

Nested Subclasses of the Schur Class

Abstract

We will discuss a family of intermediate subclasses “joining" the Schur-Agler class and the Schur class. The talk is based on a joint project with Dmitry Kaliuzhnyi-Verbovetskyi and Hugo J. Woerdeman.

Talk time: 2016-07-19 17:00— 2016-07-19 17:20
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Sergei Grudsky

CINVESTAV del IPN, Mexico

Uniform individual asymptotics for the eigenvalues and eigenvectors of large Toeplitz matrices

Abstract

The asymptotic behavior of the spectrum of large Toeplitz matrices has been studied for almost one century now. Among this huge work, we can nd the Szegő theorems on the eigenvalue distribution and the asymptotics for the determinants, as well as other theorems about the individual asymptotics for the smallest and largest eigenvalues. Results about uniform individual asymptotics for all the eigenvalues and eigenvectors appeared only ve years ago. The goal of the present lecture is to review this area, to talk about the obtained results. This review is based on joint works with Manuel Bogoya, Albrecht Böttcher, and Egor Maximenko.

Talk time: 2016-07-19 15:30— 2016-07-19 15:50
Talk location: Cupples I Room 215

Session: Toeplitz operators and related topics. Organized by S. Grudsky and N. Vasilevski.

Caixing Gu

California Polytechnic State University

Toral m-isometric tuples of commuting operators on a Hilbert space

Abstract

We initiate the study of toral m-isometric tuples of commuting operators on a Hilbert space. This class of operator naturally generalize the m-isometry of a single operator in Agler and Stankus's work. The word "toral" is in contrast to the "spherical" m-isometric tuple of several commuting operators studied in by Gleason and Richter. We derive some basic reproducing formulas and give some alternative characterizations for this class of operators. Spectral and decomposition properties are obtained. In particular, we construct numerous examples of toral m-isometric tuples by using sums of operators, product of operators, functions of operators. Concrete examples of tuples of weighted shifts and multiplication operators on holomorphic spaces of several variables are displayed.

Talk time: 2016-07-19 16:00— 2016-07-19 16:20
Talk location: Cupples I Room 207

Session: Contributed talk

Anuradha Gupta

University of Delhi

WEYL TYPE THEOREMS FOR NON-NORMAL OPERATORS

Abstract

The theory of operators is a branch of mathematics that focuses on bounded linear operators but which includes closed operators and unbounded operators. The subject of operator theory and its most important part, *the spectral theory*, came into focus rapidly after 1900. A major event was the appearance of *Fredholm's theory of integral equations*, which arose as a new approach to the Dirichlet problem.

In 1909, H. Weyl (*Über beschränkte quadatische Formen, deren Differenz Vollstetig ist*) examined the spectra of all compact perturbations of a self adjoint operator on a Hilbert space and found that their intersection consisted precisely of those points of the spectrum which were not isolated eigenvalues of finite multiplicity. A bounded linear operator satisfying this property is said to satisfy **Weyl's theorem**.

Further, in 2002, M. Berkani (*Index of B-Fredholm operators and generalization of a Weyl's theorem*) proved that if T is a bounded normal operator acting on a Hilbert space H, then $\sigma_{BW}(\mathrm{T}) = \sigma(\mathrm{T}) \setminus \mathrm{E}(\mathrm{T})$, where E(T) is the set of all isolated eigenvalues of T, which gives the generalization of the Weyl's theorem. He also proved this generalized version of classical Weyl's theorem for bounded hyponormal operators (*Generalized Weyl's theorem and hyponormal operators*).

Following Weyl and Berkani, various variants of Weyl's theorem, generally known as the Weyl-type theorems, have been introduced with much attention to an approximate point version called a-Weyl's theorem. Study of other generalizations began in 2003 that resulted in the Browder's theorem, a-Browder's theorem, generalized a-Weyl's theorem, property (w), property(ab), etc. This study, however, was limited to the classes of bounded operators.

Most applications of linear operators use unbounded linear operators which are closed or atleast have closed linear extensions. Our objective was to define and study non-normal classes of unbounded operators on a Hilbert space and study various Weyl-type theorems for those classes of operators. Some of the classes studied include the class of hyponormal operators and class-$\mathcal{A}$ operators. We have proved the following results:

"If T is an unbounded hyponormal operator or an unbounded class-$\mathcal{A}$ operator, then

(i) $\mathrm{p}(\mathrm{T} - \lambda\mathrm{I}) \leqslant 1$ for every $\lambda \in \mathbb{C}$,

(ii) λ is an isolated point of $\sigma(T)$ iff λ is a simple pole of the resolvent of T.

(iii) $\sigma(\mathrm{T}) = \sigma_w(\mathrm{T}) \cup \mathrm{iso}\sigma_o(\mathrm{T}) = \sigma_w(\mathrm{T}) \cup \pi_o(\mathrm{T})$, where $\mathrm{iso}\sigma_o(\mathrm{T})$ is the set of all isolated spectral points of finite multiplicity and $\pi_o(\mathrm{T})$ is the set of poles of finite multiplicity.

(iv) $\sigma(\mathrm{T}) = \sigma_{BW}(\mathrm{T}) \cup \mathrm{iso}\sigma(\mathrm{T}) = \sigma_{BW}(\mathrm{T}) \cup \pi(\mathrm{T})$.""

As a consequence of the results proved, the following equivalences, between several variants, were established:

"If T is an unbounded hyponormal operator or an unbounded class-$\mathcal{A}$ operator, then

(i) property (w) is equivalent to Weyl's Theorem,

(ii) property (b) is equivalent to Browder's Theorem,

(iii) Weyl's Theorem is equivalent to Browder's Theorem

(iv) generalized Weyl's Theorem is equivalent to generalized Browder's Theorem

(v) property (aw) is equivalent to a-Weyl's Theorem,

(vi) property (ab) is equivalent to a-Browder's Theorem.

Talk time: 2016-07-21 17:00— 2016-07-21 17:20
Talk location: Cupples I Room 218

Session: Contributed talk

Christoph Hanselka
University of Auckland

TBA

Abstract

TBA

Talk time: 2016-07-22 18:00— 2016-07-22 18:20
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Michael Hartz

University of Waterloo

von Neumann's inequality for commuting weighted shifts

Abstract

The failure of von Neumann's inequality for three commuting contractions has been known since the seventies, thanks to examples of Kaijser-Varopoulos and Crabb-Davie. Nevertheless, this phenomenon is still not well understood.

I will talk about a result which shows that von Neumann's inequality holds for a particularly tractable class of commuting contractions, namely multivariable weighted shifts. This provides a positive answer to a question of Lubin and Shields from 1974. As an application, we see that there is no "nice" Hilbert function space which is to commuting contractions as the Drury-Arveson space is to commuting row contractions.

Talk time: 2016-07-18 15:30— 2016-07-18 15:50
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Christopher Heil

Georgia Tech

Duals of Gabor systems and weighted exponentials at the critical density

Abstract

A Gabor system can only be a Riesz basis when the Beurling density of its index set is exactly 1. There exist Gabor systems that are Schauder bases but not Riesz basis, but it is not known whether every Gabor Schauder basis must have density 1. For lattice Gabor systems there is a complete characterization in terms of the Zak transform of the generating atom. We investigate the properties of subsets of lattice Gabor systems and systems of weighted exponentials at the critical density, which can still be complete and even minimal. Can these systems be bases? We will show that many properties of the dual system are tied to the behavior of the zeros of the atom and the number of lattice elements that are missing from the lattice.

Talk time: 2016-07-18 17:00— 2016-07-18 17:20
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

J. William Helton

UCSD

Changing noncommuting variables with free analytic functions

Abstract

The talk concerns inequalities for functions having matrix variables. The functions are typically (noncommutative) polynomials or rational functions. A focus of much attention are the inequalities corresponding to convexity.

Since systems problems seldom produce an LMI directly it is important to have a theory for changing variables to produce an LMI or a theory of convex hulls. While this is hopeless for classical polynomials in commuting variables, there is some chance of an informative theory for matrix variables. For noncommuting variables this produces a wide range of subsidiary problems which need to be solved. The talk will describe some of these and what is known about them.

Most of the work is done jointly with Meric Augat, Igor Klep and Scott A. McCullough who also will be speaking at IWOTA so our talks will be somewhat coordinated.

Talk time: 2016-07-19 14:30— 2016-07-19 14:50
Talk location: Cupples I Room 113

Session: State space methods in operator and function theory. Organized by J. Ball and S. ter Horst.

Irina Holmes

WUSTL

Two-Weight Inequalities for Commutators

Abstract

In this talk we discuss commutators with Calderon-Zygmund operators in the two-weight setting. In particular, we extend a one-dimensional result of S. Bloom for the Hilbert transform to n-dimensional Calderon-Zygmund operators, and discuss some natural extensions to iterated commutators and commutators with Riesz potentials.

Talk time: 2016-07-22 15:00— 2016-07-22 15:20
Talk location: Crow 204

Session: Harmonic analysis. Organized by K. Bickel.

Maria Infusino

University of Konstanz

The full infinite dimensional moment problem on symmetric algebras of locally convex real spaces

Abstract

This talk aims to introduce an infinite dimensional version of the classical full moment problem and explore certain instances which actually arise in several applied fields. The general theoretical question addressed is whether a linear functional L on the symmetric algebra $S(V)$ of a locally convex topological real vector space V can be represented as an integral w.r.t. a non-negative Radon measure supported on a fixed subset of the algebraic dual V^* of V. I present a recent joint work with M. Ghasemi, S. Kuhlmann and M. Marshall where we get representations of continuous positive semidefinite linear functionals $L : S(V) \to \mathbb{R}$ as integrals w.r.t. uniquely determined Radon measures supported in special sorts of closed balls in the topological dual space V' of V. A better characterization of the support is obtained when L is positive on a $2d-$power module of $S(V)$. I compare these results with the corresponding ones for the full moment problem on locally convex nuclear spaces, pointing out the crucial roles played by the continuity and the quasi-analyticity assumptions on L in determining the support of the representing measure. In particular, I focus on a joint work with T. Kuna and A. Rota where we derive an analogous result for functionals on the symmetric algebra of the space of test functions on $\mathbb{R}^d$ which are positive on quadratic modules but not necessarily continuous. This setting is indeed general enough to encompass many spaces which occur in concrete applications, e.g. the space of point configurations.

Talk time: 2016-07-21 16:00— 2016-07-22 16:20
Talk location: Cupples I Room 113

Session: Finite and infinite dimensional moment problems. Organized by M. Infusino, S. Kuhlmann, and T. Kuna.

Joshua Isralowitz

University at Albany

Boundedness of commutators and H1-BMO duality in the two matrix weighted setting

Abstract

In this talk we discuss the two matrix weighted boundedness of commutators with any of the Riesz transforms in terms of a natural two matrix weighted BMO space. Furthermore, we identify this BMO space when $p = 2$ as the dual of a natural two matrix weighted H^1 space and discuss some consequences.

Talk time: 2016-07-22 15:30— 2016-07-22 15:50
Talk location: Crow 204

Session: Harmonic analysis. Organized by K. Bickel.

Michael Jury

University of Florida

Extremal multipliers of the Drury-Arveson space

Abstract

(This is joint work with Robert T. W. Martin.) We introduce a family of multipliers on the Drury-Arveson space H^2_d which we call *quasi-extreme*. To each contractive multiplier b is associated a de Branges-Rovnyak space $\mathcal{H}(b)$ with kernel

$$k^b(z,w) = \frac{1 - b(z)b(w)^*}{1 - zw^*}$$

In one variable, the theory of $\mathcal{H}(b)$ spaces splits into two streams, one for b which are extreme points of the unit ball of $H^\infty(\mathbb{D})$, and the other for non-extreme points. We show that there is an analogous splitting in the Drury-Arveson case, between the quasi-extreme and non-quasi-extreme cases. (In one variable the notions of extreme and quasi-extreme coincide.) We give a number of equivalent characterizations of quasi-extremity, and prove that if b is quasi-extreme then b is an extreme point of the unit ball of the multiplier algebra of H^2_d, and conjecture that the converse holds. A key tool is the analysis of contractive d-tuples of operators which solve the Gleason problem in $\mathcal{H}(b)$.

Talk time: 2016-07-18 15:00— 2016-07-18 15:20
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Marinus Kaashoek

Vrije Universiteit Amsterdam

The Ellis-Gohberg inverse problem for matrix-valued Wiener functions on the line

Abstract

This talk deals with the Ellis-Gohberg inverse problem for matrix-valued Wiener functions on the line, instead of on the circle, as was done in [1] for scalar functions and in [2] for matrix-valued functions. Using elements of mathematical system theory, the problem is reduced to a linear finite matrix equation of which the right hand side is described explicitly in terms of one of the given functions. Necessary and sufficient conditions will be given in order that the problem is solvable and the solution is unique. The results obtained parallel and extend those derived in [2] for Wiener functions on the circle. Special attention is paid to the scalar case and to the case when the given functions are Fourier transforms of functions of finite support. The talk is based on joint work with Freek van Schagen.

References

[1] R. L. Ellis and I. Gohberg, Orthogonal systems related to infinite Hankel matrices, *J. Functional Analysis* **109** (1992), 155–198.

[2] M.A. Kaashoek and F. van Schagen, The inverse problem for Ellis-Gohberg orthogonal matrix functions, *Integral Equ. Oper. Theory* **80** (2014), 527-555.

Talk time: 2016-07-18 14:30— 2016-07-18 14:50
Talk location: Cupples I Room 113

Session: State space methods in operator and function theory. Organized by J. Ball and S. ter Horst.

Dmitry Kaliuzhnyi-Verbovetskyi

Drexel University

Rational inner functions on a square-matrix polyball

Abstract

We establish the existence of a finite-dimensional unitary realization for every matrix-valued rational (bi-)inner function from the Schur–Agler class on a unit square-matrix polyball, a generalization of Knese's result for the unit polydisk. In the scalar-valued case, we characterize the denominators of these functions. We also show that every polynomial with no zeros in the closed domain is such a denominator. One of our tools is the Korányi–Vagi theorem generalizing Rudin's description of rational inner functions to the case of bounded symmetric domains; we provide a short elementary proof of this theorem suitable in our setting. This is a joint work with A. Grinshpan, V. Vinnikov, and H. J. Woerdeman.

Talk time: 2016-07-18 17:00— 2016-07-18 17:20
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Oleksandr Karelin

Hidalgo State University

On singular integral operators with linear-fractional involutions

Abstract

We denote the Cauchy singular integral operator along a contour $\mathcal{L}$ by $(S_{\mathcal{L}}\varphi)(t) = \frac{1}{\pi i}\int\limits_{\mathcal{L}} \frac{\varphi(\tau)}{\tau - t}d\tau$ and the identity operator by $(I_{\mathcal{L}}\varphi)(t) = \varphi(t)$.

In the paper [1,2] we constructed a similarity transformation $F^{-1}AF = D$, between the singular integral operators A with the rotation operator $W_{\mathbb{T}}$ through the angle $2\pi/m$ on the unit circle $\mathbb{T}$, acting on the space $L_2(\mathbb{T})$, and a certain matrix characteristic singular integral operator without shifts acting on the space $L_2^m(\mathbb{T})$. For $m = 2$, we have $(W_{\mathbb{T}}\varphi)(t) = \varphi(-t)$,

$$A = a_0 I_{\mathbb{T}} + b_0 S_{\mathbb{T}} + a_1 W_{\mathbb{T}} + b_1 S_{\mathbb{T}} W_{\mathbb{T}}, \quad A \in [L_2(\mathbb{T})], D = uI_{\mathbb{T}} + vS_{\mathbb{T}}, \quad D \in [L_2^2(\mathbb{T})].$$

the right hand and left-hand side we reduced

$$B_{\mathbb{R}} = aI_{\mathbb{R}} + bQ_{\mathbb{R}} + cS_{\mathbb{R}} + dQ_{\mathbb{R}}S_{\mathbb{R}}, \ B_{\mathbb{R}} \in [L_2(\mathbb{R})], \ \mathbb{R} = (+\infty, -\infty),$$

where involution $(Q_{\mathbb{R}}\varphi)(x) = \frac{\sqrt{\delta^2+\beta}}{x-\delta}\varphi[\alpha(x)], \ \alpha(x) = \frac{\delta x+\beta}{x-\delta}, \ \delta^2 + \beta > 0,$
to a matrix characteristic singular integral operator without shift:

$$\mathcal{H}B\mathcal{F} = D_{\mathbb{R}_+}, \quad D_{\mathbb{R}_+} = u\mathbb{R}_+ I_{\mathbb{R}_+} + v\mathbb{R}_+ S_{\mathbb{R}_+},$$

acting on the space $L_2^2(\mathbb{R}_+, x^{-\frac{1}{4}}), \ \mathbb{R}_+ = (0, +\infty)$. We will refer to the formulas as operator equalities. Different applications of operator equalities to singular integral operators and to boundary value problems are considered.

[1] A. A. Karelin, On a relation between singular integral operators with a Carleman linear-fractional shift and matrix characteristic operators without shift, Boletin Soc. Mat. Mexicana Vol. 7 No. 12 (2001), pp. 235–246.

[2] A. Karelin, Aplications of operator equalities to singular integral operators and to Riemann boundary value problems, Math. Nachr. Vol. 280 No. 9-10 (2007), pp. 1108–1117.

Talk time: 2016-07-21 16:00— 2016-07-21 16:20
Talk location: Cupples I Room 215

Session: Operator theory, singular integral equations, and PDEs. Organized by R. Duduchava, E. Shargorodsky, and J. Lang

Johan Karlsson

KTH Royal Institute of Technology

Multidimensional Rational Covariance Extension with Applications to Spectral Estimation

Abstract

The rational covariance extension problem (RCEP) is an important problem in systems and control occurring in such diverse fields as control, estimation, system identification, and signal and image processing, leading to many fundamental theoretical questions. In fact, this inverse problem is a key component in many identification and signal processing techniques and plays a fundamental role in prediction, analysis, and modeling of systems and signals. It is well-known that the RCEP can be reformulated as a (truncated) trigonometric moment problem subject to a rationality condition. In this work we consider the more general multidimensional trigonometric moment problem with a similar rationality constraint. This generalization creates many interesting new mathematical questions and also provides new insights into the original one-dimensional problem. A key concept in this approach is the complete smooth parametrization of all solutions, allowing solutions to be tuned to satisfy additional design specifications without violating the complexity constraints. As an illustration of the potential of this approach we apply our results to multidimensional spectral estimation and image compression.

Talk time: 2016-07-21 15:00— 2016-07-21 15:20
Talk location: Cupples I Room 113

Session: Finite and infinite dimensional moment problems. Organized by M. Infusino, S. Kuhlmann, and T. Kuna.

Michael Kasigwa

Washington State University

Eventually Cone-Positive Semigroups of Linear Operators.

Abstract

We extend the theory of eventually nonnegative, eventually-exponentially nonnegative matrices and eventually positive semigroups to eventually cone-positive semigroups of linear operators on Banach lattices. We assume all the cones are proper and cone positivity is invariance of the cone under a given operator, while strong-cone-positivity is invariance of the interior of the cone. We examine the extension via properties of some classes of matrices, resolvent positive operators and Perron Frobenius type properties.

Talk time: 2016-07-21 15:30— 2016-07-21 15:50
Talk location: Cupples I Room 207

Session: Contributed talk

David Kimsey

Newcastle University

Quaternion-valued positive definite functions on locally compact Abelian groups and nuclear spaces

Abstract

In this talk we introduce and study quaternion-valued positive definite functions on locally compact Abelian groups, real countably Hilbertian nuclear spaces and on the space of countably infinite tuples of real numbers endowed with the Tychonoff topology. In particular, we prove a quaternionic version of the Bochner-Minlos theorem. We will see that in all these various settings the integral representation is with respect to a quaternion-valued measure which has certain symmetry properties.

This talk is based on joint work with D. Alpay, F. Colombo and I. Sabadini.

Talk time: 2016-07-22 15:00— 2016-07-22 15:20
Talk location: Cupples I Room 113

Session: Finite and infinite dimensional moment problems. Organized by M. Infusino, S. Kuhlmann, and T. Kuna.

David Kimsey

Newcastle University

The Spectral Theorem for d-tuples of strongly commuting unbounded normal operators on a quaternionic Hilbert space

Abstract

In this talk we shall show that corresponding to a d-tuple of strongly commuting normal operators $(T_1, \dots, T_d)$ on a quaternionic Hilbert space $\mathcal{H}$, there exists a spectral measure E on the Borel sets of $\mathbb{C}_+^d := \{(\lambda_1, \dots \lambda_d) \in \mathbb{C}^d : \operatorname{Im} \lambda_n \geq 0\}$ such that

$$\langle T_n x, y\rangle = \int_{\mathbb{C}_+^d} \operatorname{Re}(\lambda_n) d\langle E(\lambda_1, \dots, \lambda_d)x, y\rangle + \int_{\mathbb{C}_+^d} \operatorname{Im}(\lambda_n) d\langle J_n E(\lambda_1, \dots, \lambda_d)x, y\rangle,$$

where $x \in \mathcal{D}(T_n)$ and J_n is some anti self-adjoint and unitary operator on $\mathcal{H}$ for $n = 1, \dots, d$.

The study of spectral theory for operators on a quaternionic Hilbert spaces is motivated by a general formulation of quantum mechanics formulated by Birkhoff and von Neumann. We shall also touch upon this connection.

This talk is partially based on joint work with D. Alpay and F. Colombo.

Talk time: 2016-07-19 16:00— 2016-07-19 16:20
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Ersin Kizgut

Middle East Technical University

Isomorphisms of Cartesian products and smallness up to a complemented Banach subspace property

Abstract

Let $(X_i, Y_i), i = 1, 2$ be pairs of locally convex spaces satisfying $X_1 \times X_2 \cong Y_1 \times Y_2$. In this talk we discuss some conditions under which $X_1 \cong Y_1$ and $X_2 \cong Y_2$. We also mention about the property of smallness up to a complemented Banach subspace and its stability under topological tensor products.

Talk time: 2016-07-18 16:00— 2016-07-18 16:20
Talk location: Cupples I Room 218

Session: Contributed talk

Igor Klep

The University of Auckland, New Zealand

The tracial Hahn-Banach theorem and matrix convex sets

Abstract

This talk will discuss matrix convex sets and their tracial analogs which we call contractively tracial convex sets. In both contexts completely positive (cp) maps play a central role: unital cp maps in the case of matrix convex sets and trace preserving cp (CPTP) maps in the case of contractively tracial convex sets. CPTP maps, also known as quantum channels, are fundamental objects in quantum information theory. Free convexity is intimately connected with Linear Matrix Inequalities (LMIs) $L(x) = A_0 + A_1x_1 + \cdots + A_gx_g \succeq 0$ and their matrix convex solution sets $\{X : L(X) \text{ is positive semidefinite}\}$, called free spectrahedra. The Effros-Winkler Hahn-Banach Separation Theorem for matrix convex sets states that matrix convex sets are solution sets of LMIs with operator coefficients. Motivated in part by cp interpolation problems, we will develop the foundations of convex analysis and duality in the tracial setting, including tracial analogs of the Effros-Winkler Theorem. This is joint work with Bill Helton and Scott McCullough.

Talk time: 2016-07-19 15:00— 2016-07-19 15:20
Talk location: Cupples I Room 113

Session: State space methods in operator and function theory. Organized by J. Ball and S. ter Horst.

Craig Kleski

Miami University

A noncommutative Bishop-de Leeuw theorem

Abstract

The Bishop-de Leeuw theorem asserts the equivalence of various sort of peaking phenomena for function spaces in $C(X)$. We discuss a noncommutative version of this theorem for an operator system S in $B(H)$ in terms of either the representations of $C*(S)$ or of $C_e^*(S)$. Under certain conditions on S, $C^*(S)$, or $C_e^*(S)$, we exhibit connections between Choquet points and noncommutative peak points.

Talk time: 2016-07-22 15:00— 2016-07-22 15:20
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Lukasz Kosiński

Jagiellonian University

Nevanlinna-Pick interpolation problem in the ball

Abstract

We solve a three point Nevanlinna-Pick problem in the Euclidean ball. In particular, we determine a class of rational functions that interpolate this problem.

This is joint work with W. Zwonek.

Talk time: 2016-07-19 17:00— 2016-07-19 17:20
Talk location: Cupples I Room 207

Session: Contributed talk

Arundhathi Krishnan

Indian Institute of Technology Madras

Pseudospectra of elements of reduced Banach algebras

Abstract

Let A be a Banach algebra with identity 1. For $\epsilon > 0$, the ϵ-pseudospectrum of an element $a \in A$ is defined as $\Lambda_\epsilon(A,a) = \sigma(A,a) \cup \{\lambda \in \mathbb{C} : \|(\lambda - a)^{-1}\| \geq \frac{1}{\epsilon}\}$, where $\sigma(A,a)$ denotes the spectrum of a in A.

Let $p \in A$ be a non-trivial idempotent. Let $q = 1-p$. Then pAp and qAq are Banach algebras with identities p and q respectively. These algebras are called reduced Banach algebras. Suppose $a \in A$ such that $ap = pa$. We consider the relationship between the pseudospectrum of $a \in A$ and the pseudospectra of $pap \in pAp$ and $qAq \in qAq$. We show the following:

1. $\sigma(A,a) = \sigma(pAp, pap) \cup \sigma(qAq, qaq)$.
2. For $\epsilon > 0, \Lambda_{\frac{\epsilon}{2}}(A,a) \subseteq \Lambda_\epsilon(pAp,pap) \cup \Lambda_\epsilon(qAq,qaq) \subseteq \Lambda_{\max\{\|p\|,\|q\|\}\epsilon}(A,a)$. In particular, if $\|p\| = \|q\| = 1, \Lambda_{\frac{\epsilon}{2}}(A,a) \subseteq \Lambda_\epsilon(pAp,pap) \cup \Lambda_\epsilon(qAq,qaq) \subseteq \Lambda_\epsilon(A,a)$.
3. If $A = B(H)$ for a Hilbert space H, and $p \in A$ is an orthogonal projection ($p = p^* = p^2$), then $\Lambda_\epsilon(A,a) = \Lambda_\epsilon(pAp,pap) \cup \Lambda_\epsilon(qAq,qaq)$.
4. If $a \in A$ is of G_1 class, i.e., $\|(\lambda - a)^{-1}\| = \frac{1}{d(\lambda,\sigma(A,a))}\, \forall \lambda \notin \sigma(A,a)$, and $\|p\| = \|q\| = 1$, then $\Lambda_\epsilon(A,a) = \Lambda_\epsilon(pAp,pap) \cup \Lambda_\epsilon(qAq,qaq)$.
5. Suppose $p_1, \cdots, p_n$ are idempotents in A such that $ap_i = p_i a\, \forall i$ and $\sum_{i=1}^n p_i = 1$. Then $\sigma(A,a) = \cup_{i=1}^n \sigma(p_iAp_i, p_iap_i)$ and $\Lambda_{\frac{\epsilon}{n}}(A,a) \subseteq \cup_{i=1}^n \Lambda_\epsilon(p_iAp_i, p_iap_i) \subseteq \Lambda_{\max\limits_i\{\|p_i\|\}\epsilon}(A,a)$.

The talk is based on joint work with S. H. Kulkarni.

Talk time: 2016-07-18 14:30— 2016-07-18 14:50
Talk location: Cupples I Room 218

Session: Contributed talk

Mario Kummer

Universität Konstanz

On the size of spectrahedral descriptions

Abstract

A spectrahedron is a set defined by a linear matrix inequality. Given a spectrahedron, we are interested in the question of the smallest possible size r of the matrices in the description by linear matrix inequalities. After some generalities, we focus on the case of convex regions defined by quadratic and cubic polynomials.

Talk time: 2016-07-21 15:00— 2016-07-21 15:20
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Tobias Kuna

University of Reading

The truncated discrete moment problem from one to infinite dimensions.

Abstract

The discrete truncated moment problem considers the question whether given a discrete subsets $K \subset \mathbb{R}$ and a sequence of real numbers one can find a measure supported on K whose (power) moments are exactly these numbers. The truncated moment is a challenging problem. We derive a minimal set of necessary and sufficient conditions. This simple problem is surprisingly hard and not treatable with known techniques. Applications to the truncated moment problem for point processes, the so-called relizability or representability problem are given. This is a joint work with M. Infusino, J. Lebowitz and E. Speer.

Talk time: 2016-07-22 15:30— 2016-07-22 15:50
Talk location: Cupples I Room 113

Session: Finite and infinite dimensional moment problems. Organized by M. Infusino, S. Kuhlmann, and T. Kuna.

Ishwari Kunwar

Georgia Institute of Technology

Weighted Estimates for Multilinear Dyadic Operators and Their Commutators

Abstract

Multilinear dyadic paraproducts and Haar multipliers arise naturally in the decomposition of the pointwise product of two or more functions. I will present weighted estimates for these operators, as well as their commutators with dyadic BMO functions.

Talk time: 2016-07-22 14:30— 2016-07-22 14:50
Talk location: Crow 204

Session: Harmonic analysis. Organized by K. Bickel.

Gitta Kutyniok

Technical University of Berlin

Applied Harmonic Analysis meets Sparse Regularization of Operator Equations

Abstract

Sparse regularization of operator equations has already shown its effectiveness both theoretically and practically. The area of applied harmonic analysis offers a variety of systems such as wavelet systems which provide sparse approximations within certain model situations which then allows to apply this general approach provided that the solution belongs to this model class. However, many important problem classes in the multivariate situation are governed by anisotropic structures such as singularities concentrated on lower dimensional embedded manifolds, for instance, edges in images or shear layers in solutions of transport dominated equations. Since it was shown that the (isotropic) wavelet systems are not capable of sparsely approximating such anisotropic features, the need arose to introduce appropriate anisotropic representation systems. Among various suggestions, shearlets are the most widely used today. Main reasons for this are their optimal sparse approximation properties within a suitable model situation in combination with their unified treatment of the continuum and digital realm, leading to faithful implementations.

In this talk, we will first provide an introduction to sparse regularization of operator equations, followed by an introduction to the area of applied harmonic analysis, in particular, discussing the anisotropic representation system of shearlets and presenting the main theoretical results. We will then analyze the effectiveness of using shearlets for sparse regularization of exemplary operator equations both theoretically and numerically.

Talk time: 2016-07-19 09:40— 2016-07-19 10:30
Talk location: Brown Hall 100

Session: Plenary Talk

Jan Lang

OSU

Notes on 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; it is supposed that T has trivial kernel and range dense in the target space. We will try to find 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. Based on joint work/collaboration with Edmunds/Evans/Harris.

Talk time: 2016-07-21 15:30— 2016-07-21 15:50
Talk location: Cupples I Room 215

Session: Operator theory, singular integral equations, and PDEs. Organized by R. Duduchava, E. Shargorodsky, and J. Lang

Trieu Le

University of Toledo

Commutants of Toeplitz operators with separately radial polynomial symbols on the Fock space

Abstract

My talk concerns commuting Toeplitz operators on the Fock space $\mathcal{F}_n^2$. Let φ be a separately radial polynomial in z and $\bar{z}$ in $\mathbb{C}^n$. Then the Toeplitz operator T_φ is diagonal with respect to the standard orthonormal basis of $\mathcal{F}_n^2$. We obtain a characterization of polynomially bounded functions ψ for which T_ψ commutes with T_φ. Substantially different from the radial case, the characterization depends highly on the behavior of the polynomial φ. I will discuss several examples and consequences of our result. This is joint work with Amila Appuhamy.

Talk time: 2016-07-18 15:30— 2016-07-18 15:50
Talk location: Cupples I Room 215

Session: Toeplitz operators and related topics. Organized by S. Grudsky and N. Vasilevski.

Jakob Lemvig

Technical University of Denmark

Counterexamples to the B-spline conjecture for Gabor frames

Abstract

Frame set problems in Gabor analysis are classical problems that ask the question for which sampling and modulation rates the corresponding time-frequency shifts of a generating window allow for stable reproducing formulas of L^2-functions. In this talk we show that the frame set conjecture for B-splines of order two and greater is false. The arguments are based on properties of the Zak transform (also known as the Bloch-Floquet transform and Weil-Brezin transform). Our proof shows that, somewhat surprisingly, even nice Gabor windows in the Feichtinger algebra can have frame sets with a very complicated structure.

Talk time: 2016-07-18 17:30— 2016-07-18 17:50
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

Galina Levitina

University of New South Wales

Witten Index and spectral shift function

Abstract

Let D be a selfadjoint unbounded operator on a Hilbert space and let $\{B(t)\}$ be a one parameter norm continuous family of self-adjoint bounded operators that converges in norm to asymptotes $B_\pm$. Then setting $A(t) = D + B(t)$ one can consider the operator $\mathbf{D_A} = d/dt + A(t)$ on the Hilbert space $L_2(\mathbb{R}, H)$. We present a connection between the theory of spectral shift function for the pair of the asymptotes (A_+, A_-) and index theory for the operator $\mathbf{D_A}$.

Under the condition that the operator B_+ is a p-relative trace-class perturbation of A_- and some additional smoothness assumption we prove a heat kernel formula for all $t > 0$,

$$\operatorname{tr}\Big(e^{-t\mathbf{D_A}\mathbf{D_A}^*} - e^{-t\mathbf{D_A}^*\mathbf{D_A}}\Big) = -\Big(\frac{t}{\pi}\Big)^{1/2}\int_0^1 \operatorname{tr}\Big(e^{-tA_s^2}(A_+ - A_-)\Big)ds,$$

where $A_s, s \in [0,1]$ is a straight path joining A_- and A_+.

Using this heat kernel formula we obtain the description of the Witten index of the operator $\mathbf{D_A}$ in terms of the spectral shift function for the pair (A_+, A_-).

Theorem. *If* 0 *is a right and a left Lebesgue point of the spectral shift function* $\xi(\cdot; A_+, A_-)$ *for the pair* (A_+, A_-) *(denoted by* $\xi_L(0_+; A_+, A_-)$ *and* $\xi_L(0_-; A_+, A_-)$*, respectively), then the Witten index* $W_s(\mathbf{D_A})$ *of the operator* $\mathbf{D_A}$ *exists and equals*

$$W_s(\mathbf{D_A}) = \frac{1}{2}\big(\xi(0+; A_+, A_-) + \xi(0-; A_+, A_-)\big).$$

We note that our assumptions include the cases studied earlier. In particular, we impose no assumption on the spectra of $A_\pm$ and we can treat differential operators in any dimension.

As a corollary of this theorem we have the following result.

Corollary. *Assume that the asymptotes* $A_\pm$ *are boundedly invertible. Then the operator* $\mathbf{D_A}$ *is Fredholm and for the Fredholm index* $\operatorname{index}(\mathbf{D_A})$ *of the operator* $\mathbf{D_A}$ *we have*

$$\operatorname{index}(\mathbf{D_A}) = \xi(0; A_+, A_-) = \operatorname{sf}\{A(t)\}_{t=-\infty}^{+\infty},$$

where $\operatorname{sf}\{A(t)\}_{t=-\infty}^{+\infty}$ *denotes the spectral flow along the path* $\{A(t)\}_{t=-\infty}^{+\infty}$.

Talk time: 2016-07-18 16:00— 2016-07-18 16:20
Talk location: Cupples I Room 115

Session: Operator theory, singular integral equations, and PDEs. Organized by R. Duduchava, E. Shargorodsky, and J. Lang

Wing Suet Li

Georgia Institute of Technology

Horn inequalities for singular values of products of operators

Abstract

Consider Hermitian matices A, B, C such that $A + B = C$. Let $\{\lambda_j(A)\}$, $\{\lambda_j(B)\}$, and $\{\lambda_j(C)\}$ be sequences of eigenvalues of A, B, and C counting multiplicity, arranged in decreasing order. In 1962, A. Horn conjectured that the relations of $\{\lambda_j(A)\}$, $\{\lambda_j(B)\}$, and $\{\lambda_j(C)\}$ can be characterized by a set of inequalities defined inductively. This conjecture was proved true by Klyachko and Knutson-Tao in the late 1990s. A related question, the multiplicative Horn problem, asks to describe the possible singular values of AB when the singular values of A and B are given. This problem is fully solved in the case where A and B are invertible matrices as Klyachko showed that it is equivalent to the additive problem after taking logarithms. In this talk we will discuss the case when A and B are not necessarily invertible and its generalization to the von Neumann algebra setting. This is joint work with H. Bercovici, B. Collins, and K. Dykema.

Talk time: 2016-07-21 16:00— 2016-07-21 16:20
Talk location: Cupples I Room 115

Session: Function spaces. Organized by J. McCarthy.

Ji Li

Macquarie University

Weak factorization of Hardy spaces and characterization of BMO spaces in the Bessel setting and applications

Abstract

It is well-known that the classical Hardy space H^p, $0 < p < \infty$ on the unit disc $\mathbb{D} = \{z \in \mathbb{C} : |z| < 1\}$ has the factorization property, which is known as *the Riesz factorization theorem*: *"A function f is in $H^1(\mathbb{D})$ if and only if there exist $g, h \in H^2(\mathbb{D})$ with $f = g \cdot h$ and $\|f\|_{H^1(\mathbb{D})} = \|g\|_{H^2(\mathbb{D})}\|h\|_{H^2(\mathbb{D})}$."* This factorization plays an important role in studying function theory and operator theory connected to the spaces $H^1(\mathbb{D})$, $H^2(\mathbb{D})$ and the space $BMOA(\mathbb{D})$ (analytic BMO). The analogue of the Riesz factorization theorem, sometimes referred to as strong factorisation, is not true for real-variable Hardy space $H^1(\mathbb{R}^n)$. Nevertheless, Coifman, Rochberg and Weiss provided a suitable replacement that works in studying function theory and operator theory of $H^1(\mathbb{R}^n)$, the weak factorization via a bilinear form related to the Riesz transform (Hilbert transform in dimension 1).

We study the analogue of the result of Coifman, Rochberg and Weiss for the Hardy spaces associated with the Bessel operator Δ_λ studied by Weinstein, Huber, Muckenhoupt and Stein. Then we further provide a characterization of BMO spaces associated with Δ_λ in terms of the commutators related to the Riesz transform $\nabla\Delta_\lambda^{-1/2}$.

This is joint work with Xuan Duong, Brett D. Wick and Dongyong Yang.

Talk time: 2016-07-21 17:00— 2016-07-21 17:20
Talk location: Crow 204

Session: Harmonic analysis. Organized by K. Bickel.

Wenjing Liu

University of New Hampshire

An extension of the Beurling-Chen-Hadwin-Shen theorem for noncommutative Hardyspaces associated with finite von Neumann algebras

Abstract

In 2015, Yanni Chen, Don Hadwin and Junhao Shen proved a noncommutative version of Beurling's theorem for a continuous unitarily invariant norm α on a tracial von Neumann algebra (M, τ) such that α is one dominating with respect to τ. The role of H^∞ is played by a maximal subdiagonal algebra A. In the talk, we first will show that if α is a continuous normalized unitarily invariant norm on (M, τ), then there exists a faithful normal tracial state ρ on M and a constant $c > 0$ such that α is a c times one norm-dominating norm on (M, ρ). Moreover, $\rho(x) = \tau(xg)$, where $x \in M$, g is positive in $L^1(Z, \tau)$, where Z is the center of M. Here c and ρ are not unique. However, if there is a c and ρ so that the Fuglede-Kadison determinant of g is positive, then Beurling-Chen-Hadwin-Shen theorem holds for $L^{(\alpha)}(M, \tau)$. The key ingredients in the proof of our result include a factorization theorem and a density theorem for for $L^{(\alpha)}(M, \rho)$.

Talk time: 2016-07-19 15:00— 2016-07-19 15:20
Talk location: Cupples I Room 207

Session: Contributed talk

Maribel Loaiza

Cinvestav

On Toeplitz operators on poly-Bergman spaces

Abstract

We give a new isomorphic description of the poly-Bergman spaces of the upper half-plane Π, and describe the C^*-algebra generated by all Toeplitz operators, acting on each poly-Bergman space, whose symbols depend only on $\theta = \arg z$ and have limits values at $\theta = 0$ and $\theta = \pi$. This C^*-algebra is isomorphic and isometric to the C^*-algebra consisting of all matrices $M(x) \in M_n(\mathbb{C}) \otimes C[-\infty, +\infty]$ such that $M(-\infty), M(\infty) \in \mathbb{C}I$.

Talk time: 2016-07-18 16:00— 2016-07-18 16:20
Talk location: Cupples I Room 215

Session: Toeplitz operators and related topics. Organized by S. Grudsky and N. Vasilevski.

Jireh Loreaux

University of Cincinnati

Diagonals of operators with specified singular values

Abstract

Thompson's theorem provides a characterization of the diagonals of finite matrices with specified singular values. This theorem is part of the broader study of diagonals of operators including the Schur-Horn theorem. Here we present an extension of Thompson's theorem to compact operators and show how the techniques can also be used to characterize diagonals of unitary operators. This is joint work with John Jasper and Gary Weiss.

Talk time: 2016-07-21 15:30— 2016-07-21 15:50
Talk location: Cupples I Room 218

Session: Contributed talk

Martino Lupini

California Institute of Technology

The noncommutative Poulsen simplex

Abstract

The Poulsen simplex is a canonical object in the theory of Choquet simplices. It can be characterized as the unique metrizable Choquet simplex with dense extreme boundary. In my talk I will explain what is the noncommutative Poulsen simplex, and why it plays a similar canonical role in the theory of noncommutative simplices. This is joint work with Ken Davidson and Matt Kennedy.

Talk time: 2016-07-21 17:00— 2016-07-21 17:20
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Zinaida Lykova

Newcastle University

Algebraic and geometric aspects of rational Γ-inner functions

Abstract

The set

$$\Gamma \stackrel{\text{def}}{=} \{(z+w, zw) : |z| \leq 1, |w| \leq 1\} \subset \mathbb{C}^2$$

has intriguing complex-geometric properties; it has a 3-parameter group of automorphisms, its distinguished boundary is a ruled surface homeomorphic to the Möbius band and it has a special subvariety which is the only complex geodesic that is invariant under all automorphisms. We exploit this geometry to develop an explicit and detailed structure theory for the rational maps from the unit disc to Γ that map the boundary of the disc to the distinguished boundary of Γ.

The talk is based on joint work with Jim Agler and Nicholas Young.

[1] Jim Agler, Zinaida A. Lykova and N. J. Young: Algebraic and geometric aspects of rational Γ-inner functions, (arXiv: 1502.04216 [math.CV] 17 Febr. 2015) 22 pp.

Talk time: 2016-07-21 14:30— 2016-07-21 14:50
Talk location: Cupples I Room 115

Session: Function spaces. Organized by J. McCarthy.

Gregory Marx

Virginia Tech

Completely positive kernels: the noncommutative correspondence setting

Abstract

It is well known that a function $K : \Omega \times \Omega \to \mathcal{L}(\mathcal{Y})$ (where $\mathcal{L}(\mathcal{Y})$ is the set of all bounded linear operators on a Hilbert space $\mathcal{Y}$) being (1) a positive kernel in the sense of Aronszajn (i.e. $\sum_{i,j=1}^{N} \langle K(\omega_i, \omega_j) y_j, y_i \rangle \geq 0$ for all $\omega_1, \dots, \omega_N \in \Omega$, $y_1, \dots, y_N \in \mathcal{Y}$, and $N = 1, 2, \dots$) is equivalent to (2) K being the reproducing kernel for a reproducing kernel Hilbert space $\mathcal{H}(K)$, and (3) K having a Kolmogorov decomposition $K(\omega, \zeta) = H(\omega)H(\zeta)^*$ for an operator-valued function $H : \Omega \to \mathcal{L}(\mathcal{X}, \mathcal{Y})$ where $\mathcal{X}$ is an auxiliary Hilbert space.

Recent work of the authors extended this result to the setting of free noncommutative functions (i.e. functions defined on matrices over a point set which respects direct sums and similarities) with the target set $\mathcal{L}(\mathcal{Y})$ of K replaced by $\mathcal{L}(\mathcal{A}, \mathcal{L}(\mathcal{Y}))$ where $\mathcal{A}$ is a C^*-algebra. In this talk, we discuss the next extension where the target set of K is replaced by $\mathcal{L}(\mathcal{A}, \mathcal{L}_a(\mathcal{E}))$ where $\mathcal{A}$ is a W^*-algebra and $\mathcal{L}_a(\mathcal{E})$ is the set of adjointable operators on a Hilbert W^*-module over a W^*-algebra $\mathcal{B}$. Various special cases of this result correspond to results of Kasparov, Murphy, and Szafraniec in the Hilbert C^*-module literature.

Talk time: 2016-07-19 16:00— 2016-07-19 16:20
Talk location: Cupples I Room 113

Session: State space methods in operator and function theory. Organized by J. Ball and S. ter Horst.

scott mccullough

university of florida

Bianalytic mappings between free LMI domains

Abstract

(Joint work with Meric Augat, Bill Helton and Igor Klep). Given a g-tuple A of $d\times d$ matrices, the set $\overline{\mathbb{D}}_A(1)$ of those $x \in \mathbb{C}^g$ such that $I - \sum_{j=1}^g A_j x_j - \sum_{j=1}^g A_j^* x_j^*$ is positive semidefinite is an LMI domain. LMI domains find numerous applications. They are fundamental objects in semidefinite programming. Let $\overline{\mathbb{D}}_A(n)$ denote the set of g-tuples of $n \times n$ matrices X such that $I - \sum_{j=1}^g A_j \otimes X_j - \sum_{j=1}^g A_j^* \otimes X_j^*$ is positive semidefinite. The sequence $(\overline{\mathbb{D}}_A(n))$ is a free LMI domain. Free LMI domains arise naturally in a number of contexts, including engineering systems theory and in the theory of operator systems. They are the simplest examples of matrix convex sets.

This talk will report on progress on classifying triples (A, B, p) where A and B are g-tuples of matrices and p is a free bianalytic mapping between the free LMI domains determined by A and B. Under irreducibility inspired hypotheses on A and B, the map p takes a special form described by a g-tuple of $g \times g$ matrices Ξ that span an algebra for which Ξ is its own multiplication table and $B = VAU$ for unitaries V and U. Moreover, for each such p, there exists a family of pairs (A, B), roughly parameterized by the $g \times g$ unitary matrices, such that p is a bianalytic map between the free LMI domains determined by A and B.

Talk time: 2016-07-18 18:00— 2016-07-18 18:20
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Santeri Miihkinen

University of Helsinki

Strict singularity of a Volterra-type integral operator on H^p

Abstract

We consider a Volterra-type integral operator

$$T_g f(z) = \int_0^z f(\zeta) g'(\zeta) d\zeta,$$

acting on the Hardy spaces H^p of the unit disc. The operator T_g was introduced by Ch. Pommerenke and it has been studied systematically by several people including A. Aleman, A.G. Siskakis and R. Zhao among others. From a functional analytic point of view, one interesting notion is the strict singularity of a linear operator between Banach spaces. An operator is strictly singular if its restriction to any infinite-dimensional subspace is not an isomorphism onto its range. We discuss our recent result, which states that a non-compact T_g fixes an isomorphic copy of the sequence space l^p. In particular, the strict singularity of T_g coincides with its compactness on spaces H^p.

Talk time: 2016-07-18 14:30— 2016-07-18 14:50
Talk location: Cupples I Room 207

Session: Contributed talk

Dustin Mixon

Air Force Institute of Technology

The Voronoi Means Conjecture

Abstract

We recently developed a relax-and-round algorithm for k-means clustering. When applied to balanced spherical Gaussian mixtures of unit entrywise variance, this algorithm clusters most points according to Gaussian component provided the minimum distance between component centers is at least some polynomial in k. This talk introduces a new conjecture called the Voronoi Means Conjecture, which implies that this distance for successful clustering must exhibit k-dependence as an artifact of k-means. The conjecture is a statement about highly symmetric collections of vectors, and I will announce a prize for its resolution. (This is joint work with Soledad Villar and Rachel Ward at the University of Texas at Austin.)

Talk time: 2016-07-19 15:30— 2016-07-19 15:50
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

Kabe Moen

University of Alabama

Matrix A_p weights, degenerate Sobolev spaces, and mappings of finite distortion.

Abstract

We study degenerate Sobolev spaces where the degeneracy is controlled by a matrix A_p weight. We prove that the classical Meyers-Serrin theorem, H = W, holds in this setting. As applications we prove partial regularity results for weak solutions of degenerate p-Laplacian equations, and in particular for mappings of finite distortion.

Talk time: 2016-07-22 16:00— 2016-07-22 16:20
Talk location: Crow 204

Session: Harmonic analysis. Organized by K. Bickel.

Sivaram Narayan

Central Michigan University

Minimal scalings and structural properties of scalable frames

Abstract

For a unit-norm frame $F = \{f_i\}_{i=1}^k$ in $\mathbb{R}^n$, a scaling is a vector $c = (c(1), \ldots, c(k)) \in \mathbb{R}^k{}_{\geq 0}$ such that $\{\sqrt{c(i)} f_i\}_{i=1}^k$ is a Parseval frame in $\mathbb{R}^n$. If such a scaling exists, F is said to be scalable. A scaling c is a minimal scaling if $\{f_i : c(i) > 0\}$ has no proper scalable subframe. It is known that the set of all scalings of F is a convex polytope with vertices corresponding to minimal scalings. In this talk, we provide a method to find a subset of contact points which provides a decomposition of the identity, and an estimate of the number of minimal scalings of a scalable frame. We provide a characterization of when minimal scalings are affinely dependent. Using this characterization, we can conclude that all strict scalings $c = (c(1), \ldots, c(k)) \in \mathbb{R}^k{}_{>0}$ of F have the same structural property. We also present the uniqueness of orthogonal partitioning property of any set of minimal scalings, which provides all possible tight subframes of a given scaled frame

Talk time: 2016-07-21 14:30— 2016-07-21 14:50
Talk location: Cupples I Room 218

Session: Contributed talk

Jiawang Nie

University of California, San Diego

Quantum entanglement and separable matrices

Abstract

A real symmetric matrix is separable if it can be written as a sum of Kronecker products of positive semidefinite matrices. This talk concerns how to check if a matrix is separable or not. We propose a numerical algorithm, based on Lasserre type semidefinite relaxations, for solving the question. To check the separability of a matrix, we construct a hierarchy of semidefinite relaxations. If it is not separable, we can get a mathematical certificate for that; if it is, we can get a decomposition for the separability. This is a joint work with Xinzhen Zhang.

Talk time: 2016-07-21 15:30— 2016-07-21 15:50
Talk location: Cupples I Room 113

Session: Finite and infinite dimensional moment problems. Organized by M. Infusino, S. Kuhlmann, and T. Kuna.

Shahaf Nitzan

Georgia Tech

Persistence as a spectral property

Abstract

A Gaussian stationary sequence is a random function $f : Z \to R$, for which any vector $(f(x_1), ..., f(x_n))$ has a centered multi-normal distribution and whose distribution is invariant to shifts. Persistence is the event of such a random function to remain positive on a long interval $[0, N]$. Estimating the probability of this event has important implications in engineering , physics, and probability. However, though active efforts to understand persistence were made in the last 50 years, until recently, only specific examples and very general bounds were obtained. In the last few years, a new point of view simplifies the study of persistence, namely - relating it to the spectral measure of the process. In this work we use this point of view to develop new spectral and analytical methods in order to study the persistence in cases where the spectral measure is 'small' near zero. This talk is based on Joint work with Naomi Feldheim and Ohad Feldheim.

Talk time: 2016-07-21 16:00— 2016-07-21 16:20
Talk location: Crow 204

Session: Harmonic analysis. Organized by K. Bickel.

Santhosh Kumar pamula

IIT Hyderabad

SPECTRAL THEOREM FOR QUATERNIONIC NORMAL OPERATORS : MULTIPLICATION FORM

Abstract

In this talk we present the multiplication form of a spectral theorem for normal operators in quaternionic Hilbert spaces. Also we give the correspondence between complex Hilbert spaces and quaternionic Hilbert spaces.

Talk time: 2016-07-21 14:30— 2016-07-21 14:50
Talk location: Cupples I Room 207

Session: Contributed talk

James Pascoe

Washington University in St. Louis

Monotonicity in several non-commuting variables

Abstract

Let $f : (a, b) \to \mathbb{R}$. The function f is said to be matrix monotone if $A \leq B$ implies $f(A) \leq f(B)$ for all pairs of like- sized self-adjoint matrices with spectrum in (a, b). Classically, Charles Loewner showed that a bounded Borel function is matrix monotone if and only if it is analytic and extends to be a self-map of the upper half plane. The theory of matrix montonicity has profound consequences for any general theory of matrix inequalities. For example, it might seem surprising that $X \leq Y$ does not imply that $X^2 \leq Y^2$, which is a consequence of Loewner's theorem. We will discuss commutative and noncommutative generalizations to several variables of Loewner's theorem

Talk time: 2016-07-22 14:30— 2016-07-22 14:50
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Benjamin Passer

Washington University in St. Louis

Iterated Joins of Compact Groups

Abstract

(Joint work with Alexandru Chirvasitu.) The Borsuk-Ulam theorem in algebraic topology indicates restrictions for equivariant maps between spheres; in particular, there is no odd map from a sphere to another sphere of lower dimension. This idea may be generalized greatly in both the topological and operator algebraic settings for actions of compact (quantum) groups, leading to the the noncommutative Borsuk-Ulam conjectures of Baum, Dabrowski, and Hajac. I will present our recent progress (both positive and negative) toward resolving these conjectures using properties of iterated compact group joins.

Talk time: 2016-07-22 17:00— 2016-07-22 17:20
Talk location: Cupples I Room 115

Session: Non-commutative geometry. Organized by X. Tang.

Maria Cristina Pereyra

University of New Mexico

Quantitative two weight estimates for dyadic operators

Abstract

In this talk we present quantitative two weight estimates for the dyadic paraproduct and the dyadic square function. We compare known results of Holmes, Lacey, and Wick for the paraproduct when both weights are in A_2 involving Bloom's BMO, and a different Carleson condition when the weights are in joint A_2 plus an additional Carleson condition on the weights (both necessary and sufficient conditions for a dual two-weight boundedness of the dyadic square function). We compare these to necessary and sufficient testing conditions for each particular dyadic paraproduct when viewed as a well-localized operator in the sense of Nazarov, Treil, and Volberg.

Talk time: 2016-07-21 15:30— 2016-07-21 15:50
Talk location: Crow 204

Session: Harmonic analysis. Organized by K. Bickel.

Armenak Petrosyan

Vanderbilt University

Frames and Bessel systems generated by the iterative actions of operators

Abstract

We consider systems of vectors of the form

$$\{A^n h_i : \ i \in I, n \geq 0\}$$

where $\{h_i\}_{i\in I}$ is a countable (finite or infinite) system of vectors in a separable Hilbert space $\mathcal{H}$ and $A \in B(\mathcal{H})$ is a bounded operator. We show that a system of that form can never be both complete and minimal, and find conditions that the operator A needs to satisfy for the system to be a frame or a complete Bessel system.

We also investigate systems of form

$$\{\pi(g)h_i : \ i \in I, g \in \Gamma\}$$

where π is a unitary representation on $\mathcal{H}$ of a discrete group Γ and extract information about the spectrum of the operators $\pi(g)$ when the system is minimal or complete and Bessel.

The initial motivation for considering these problems comes from what is called dynamical sampling problem.

Talk time: 2016-07-21 15:00— 2016-07-21 15:20
Talk location: Cupples I Room 218

Session: Contributed talk

Markus Pflaum

University of Colorado

Brylinski's sheaf complex for proper Lie groupoids

Abstract

In this talk we generalize Brylinski's sheaf complex from G-manifolds to proper Lie groupoids. Moreover, we explain the connection between this complex and the cyclic homology theory of the convolution algebra of the underlying proper Lie groupoid. The talk is on joint work with H. Posthuma and X. Tang.

Talk time: 2016-07-22 15:00— 2016-07-22 15:20
Talk location: Cupples I Room 115

Session: Non-commutative geometry. Organized by X. Tang.

Friedrich Philipp

Universidad de Buenos Aires

Bessel sequences from iterated operator actions

Abstract

The subject of the talk is motivated by questions related to the new field of Dynamical Sampling which was recently initiated by A. Aldroubi et al. In short, the general Dynamical Sampling problem deals with sequences $(A^k x_i)_{i\in I,\, k=0,\dots,K_i}$, where A is a linear operator and the x_i are vectors. The question then is for which A, x_i, and K_i the sequence constitutes a frame for the underlying Hilbert space. Clearly, for this it is necessary that each of the subsequences $(A^k x_i)_{k=0,\dots,K_i}$ is a Bessel sequence. As this is only interesting when $K_i = \infty$, we consider sequences of the form $(A^k x)_{k\in\mathbb{N}}$. In order to exploit a comprehensive spectral theory, we restrict ourselves to normal operators A and completely characterize the normal operators A and vectors x for which $(A^k x)_{k\in\mathbb{N}}$ is a Bessel sequence. The characterization is formulated in terms of the measure $\mu_x := \|E(\cdot)x\|^2$, where E is the spectral measure of the operator A: *The sequence* $(A^k x)_{k\in\mathbb{N}}$ *is a Bessel sequence if and only if* (i) μ_x *is concentrated on the closed unit disc* $\overline{\mathbb{D}}$, (ii) *The restriction of* μ_x *to the unit circle is absolutely continuous with respect to arc length measure with* L^∞*-density function,* (iii) $\mu_x|\mathbb{D}$ *is a Carleson measure.* If time permits, we will apply the results to a certain sampling framework with the heat equation in the background.

Talk time: 2016-07-18 18:00— 2016-07-18 18:20
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

Derk Pik

University of Amsterdam

Generalized Solutions of Riccati Equalities and Inequalities

Abstract

In this talk we present the Riccati inequality and equality for infinite dimensional linear discrete time stationary systems with respect to the scattering supply rate. The results are based on earlier work on the Kalman-Yakubovich-Popov inequality in [AKP1].

The main theorems are closely related to the results of Yu.M. Arlinskiĭ [ARL]. The main difference is that we do not assume the original system to be a passive scattering system, and we allow the solutions of the Riccati inequality and equality to satisfy weaker conditions.

This talk is based on recent joint work [AKP2] with Marinus Kaashoek and Damir Arov.

References

[AKP1] D.Z. Arov, M.A. Kaashoek, D.R. Pik, The Kalman-Yakubovich-Popov Inequality and Infinite Dimensional Discrete Time Dissipative Systems, *J. Operator Theory*, 55 (2006), 393?438.

[AKP2] D.Z. Arov, M.A. Kaashoek, D.R. Pik, Generalized Solutions of Riccati Equalities and Inequalities, *Methods Funct. Anal. Topology*, 22 (2016).

[ARL] Y. Arlinskiĭ, The Kalman-Yakubovich-Popov inequality for passive discrete time-invariant systems, *OAM* 2 (2008), 15-51.

Talk time: 2016-07-18 18:00— 2016-07-18 18:20
Talk location: Cupples I Room 113

Session: State space methods in operator and function theory. Organized by J. Ball and S. ter Horst.

Ariel Pinhas

Ben-Gurion University

Real Parts of Pair of Nonselfadjoint Commuting Operators Associated to an Algebraic Curve with Application to System Theory

Abstract

It is a well known fact that transfer functions of scattering conservative systems and impedance conservative system are the analytic contractive function in the unit disk and functions with positive real part on the upper half plane, respectively. In this case, the interplay between the transfer functions is via the Moebius transformation. In the system representation the interplay is by the so called diagonal transformation on the system variables. The functional models of these systems lead to two reproducing kernel Hilbert spaces. In the case of real positive functions in the upper half-plane, Carathéodory integral representation plays a major role.

In this talk, we consider these phenomena and relations in the setting of $2D$ conservative systems (or vessels). First, we present the Carathéodory integral representation for real compact Riemann surfaces and study the corresponding reproducing kernel space. The $2D$ scattering conservative systems or equivalently the corresponding quasi–hermitian vessels are well studied. For the $2D$ impedance conservative systems we introduce a new notion, *the Hermitian vessel*. The interplay between these two type of systems is by a generalized diagonal transform and the joint transfer functions are related by the Moebius transformation. In this case, two functional models arise. The first is a reproducing kernel Hilbert space with reproducing kernel $T(q)K_\zeta(q,r) + K_{\widetilde{\zeta}}(q,r)T(r)^*$ where $K_\zeta(q,r)$ is a Cauchy kernel. The second functional model is a L^2 space (with respect to a specific measure) of sections of a vector bundle over the fixed point (with respect to the involution) of a real compact Riemann surface X.

These results are based on joint work with Daniel Alpay and Victor Vinnikov.

Talk time: 2016-07-18 16:00— 2016-07-18 16:20
Talk location: Cupples I Room 113

Session: State space methods in operator and function theory. Organized by J. Ball and S. ter Horst.

Sandra Pott

Lund University

Matrix weights: On the way to the linear bound

Abstract

In recent years, the attempts to prove sharp bounds for Calderon-Zygmund operators on weighted L^p spaces in terms of the A_p-characteristic of the weight has been an im- portant driving force in Harmonic Analysis. After the work of many authors, this culminated with the proof of the conjectured linear bound for $p = 2$ for all Calderon-Zygmund operators by Tuomas Hytönen in 2010.

Recently, the question of the validity of the linear bound for all Calderon-Zygmund operators in the matrix-weighted setting has attracted some interest. In the talk, I want to present the reduction of this question to the case of Haar multipliers and dyadic paraproducts. I also want to talk about the remaining obstacles, some of which have recently been resolved, and focus on the matrix techniques being used.

This is joint work with Andrei Stoica.

Talk time: 2016-07-18 09:40— 2016-07-18 10:30
Talk location: Brown Hall 100

Session: Plenary Talk

Malabika Pramanik

University of British Columbia, Vancouver

Configurations in sets big and small

Abstract

When does a given set contain a copy of your favorite pattern (for example, specially arranged points on a line or spiral, or the vertices of a polyhedron)? Does the answer depend on how thin the set is in some quantifiable sense? Problems involving identification of prescribed configurations under varying interpretations of size have been vigorously pursued both in the discrete and continuous setting, often with spectacular results that run contrary to intuition. Yet many deceptively simple questions remain open. I will survey the literature in this area, emphasizing some of the landmark results that focus on different aspects of the problem.

Talk time: 2016-07-18 11:40— 2016-07-18 12:30
Talk location: Brown Hall 100

Session: Plenary Talk

Yunied Puig de Dios

Ben Gurion University of the Negev (Israel)

A mixing operator T for which the tuple (T, T^2) is not disjoint transitive.

Abstract

Using a result from ergodic Ramsey theory, we answer a question posed by Bes, Martin, Peris and Shkarin by showing a mixing operator T on a Hilbert space such that the tuple (T, T^2) is not disjoint transitive.

Talk time: 2016-07-21 16:00— 2016-07-21 16:20
Talk location: Cupples I Room 207

Session: Contributed talk

Katie Quertermous

James Madison University

Composition C^*-algebras Induced by Linear-fractional Non-automorphism Self-maps of the Unit Disk

Abstract

If φ is an analytic self-map of the unit disk $\mathbb{D}$, then the composition operator $C_\varphi : f \mapsto f \circ \varphi$ is a bounded operator on the Hardy space $H^2(\mathbb{D})$. We are particularly interested in composition operators induced by linear-fractional self-maps of $\mathbb{D}$. Several authors have investigated the structures of C*-algebras generated by these operators and either the unilateral shift or the ideal of compact operators on $H^2(\mathbb{D})$. For non-automorphism self-maps of the disk, these structure results have required restrictions on the behavior of the inducing maps on the unit circle. In this talk, we relax these restrictions and investigate the structures of C^*-algebras generated by the ideal of compact operators and arbitrary finite collections of composition operators induced by linear-fractional, non-automorphism self-maps of $\mathbb{D}$.

Talk time: 2016-07-19 15:30— 2016-07-19 15:50
Talk location: Cupples I Room 207

Session: Contributed talk

Raul Quiroga-Barranco

Cimat

Commuting Toeplitz operators and representation theory

Abstract

An important pair of objects to study are given by the Bergman spaces on bounded symmetric domains and the Toeplitz operators on these spaces. It is well known that the bounded symmetric domains are closely related to the semisimple Lie groups of Hermitian type, the latter providing the biholomophisms of the former. Furthermore, this relationship goes as far as representation theory since the simple Lie groups of Hermitian type admit representations on the Bergman spaces that yield their holomorphic discrete series. We will explain how this interplay allows to obtain and understand large and nontrivial commutative C*-algebras generated by Toeplitz operators.

Talk time: 2016-07-19 14:30— 2016-07-19 14:50
Talk location: Cupples I Room 215

Session: Toeplitz operators and related topics. Organized by S. Grudsky and N. Vasilevski.

Robert Rahm

Washington University in St. Louis

Sharp Weighted Bounds for the Bergman Projection and Related Operators on $A^2(\mathbb{B}^n)$

Abstract

Using techniques of dyadic harmonic analysis, we are able to prove sharp estimates for the Bergman projection and Berezin transform and more general operators in weighted Bergman spaces on the unit ball in $\mathbb{C}^n$. The estimates are in terms of the Bekolle-Bonami constant of the weight. This generalizes results of Pott-Reguera to several variables and to a more general class of operators. This is joint work with Brett Wick and Edgar Tchoundja.

Talk time: 2016-07-21 14:30— 2016-07-21 14:50
Talk location: Crow 204

Session: Harmonic analysis. Organized by K. Bickel.

Maria Carmen Reguera

University of Birmingham

A B_∞ theory for the Bergman projection

Abstract

The Bergman space $A^2(\mathbb{D})$ is the closed subspace of $L^2(\mathbb{D})$ consisting of analytic functions, where $\mathbb{D}$ denotes the unit disk. One considers the projection from $L^2(\mathbb{D})$ into $A^2(\mathbb{D})$, such a projection can be written as a convolution operator with a singular kernel. In this talk, we will present the recent advances on the one weight theory for the Bergman projection that resulted from combining techniques from complex analysis and the theory of singular integrals in harmonic analysis. We will pay special attention to the development of a B_∞ theory and its applications in Operator Theory. This is joint work with A. Aleman and S. Pott.

Talk time: 2016-07-19 09:00— 2016-07-19 09:30
Talk location: Brown Hall 100

Session: Plenary Talk

Rudy Rodsphon

Vanderbilt University

Quantizations and index theory

Abstract

One way to describe succinctly local index theory on closed spin manifolds could be the following slogan of Quillen : Dirac operators are a "quantization" of connections, and index theory is a "quantization" of the Chern character. For non necessarily spin manifolds, pseudodifferential operators and their symbolic calculus play a crucial role in the original proofs of the index theorem. However, symbols may also be viewed as a deformation quantization of functions on the cotangent bundle, which has led to other fruitful approaches to index theory through a "quantization" process. Methods used in these two different quantization pictures do not seem to be quite related a priori. The upshot of the talk will be to see that these different theories might have more to say to each other, and that far reaching index problems may be solved very directly from such an interaction.

Talk time: 2016-07-22 14:30— 2016-07-22 14:50
Talk location: Cupples I Room 115

Session: Non-commutative geometry. Organized by X. Tang.

Benjamin Russo

University of Florida

Sub-Jordan Operator Tuples

Abstract

In this talk we will discuss tuples of 3-isometric and 3-symmetric operators. These operators have connections with Sturm-Liouville theory and are natural generalizations of self-adjoint and isometric operators. We call an operator J a Jordan operator of order 2 if $J = A + N$, where A is either unitary or self-adjoint, N is nilpotent of order 2, and A commutes with N. As shown in the work of Agler, Ball and Helton, and joint work with McCullough, 3-symmetric and 3-isometric operators are the restriction of a Jordan operator to an invariant subspace. In this talk we discuss the extension of these theorems to the multi-variable case and an application to disconjugacy for Schödinger operators.

Talk time: 2016-07-18 17:30— 2016-07-18 17:50
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Jaydeb Sarkar

Indian Statistical Institute

Factorizations of Kernels and Reproducing Kernel Hilbert Spaces

Abstract

In this talk we will explain a series of results concerning reproducing kernel Hilbert spaces, related to the factorization of their kernels. In particular, we will talk about (trivial) isometric multipliers for a large class of reproducing kernel Hilbert spaces. We will then discuss a particular type of dilation, as well as a classification of Brehmer/Beurling type invariant subspaces of natural reproducing kernel Hilbert spaces. This is joint work with R. Kumari, S. Sarkar and D. Timotin.

Talk time: 2016-07-19 11:00— 2016-07-19 11:30
Talk location: Brown Hall 100

Session: Plenary Talk

Carsten Scherer

University of Stuttgart

Operator Techniques in Controller Synthesis

Abstract

Feedback control requires to achieve desired robust stability and performance properties for the fractional interconnection of a given plant and a to-be-desired controller, both described by suitable operators. In this talk we develop the basic ideas how to design controllers based on graph separation techniques. It is our goal to illustrate the power of this paradigm for novel approaches to the synthesis of optimal 2D controllers for 2D systems, of controllers that can be adapted to varying dynamic system components or of distributed controllers.

Talk time: 2016-07-21 11:00— 2016-07-21 11:30
Talk location: Brown Hall 100

Session: Plenary Talk

Stephan Schmitz

University Missouri Columbia

On invariant Graph subspaces

Abstract

For unbounded 2×2 block operator matrices $B = \begin{pmatrix} A_0 & W1 \\ W_0 & A_1 \end{pmatrix}$ we investigate the relation between pairs of reducing graph subspaces, solutions to the Riccati equation

$$A_1 X - X A_0 - X W_1 X + W_0 = 0$$

and block diagonalization of the operator B.

Under mild additional assumptions, we show that such a pair of subspaces decomposes the operator matrix if and only if its domain is invariant for the angular operators associated with the graphs. As a byproduct of our considerations, we suggest a new block diagonalization procedure that resolves related domain issues. In the case when only a single invariant graph subspace is available, we obtain block triangular representations for the operator matrix B.

As an application, we provide a way for block diagonalization of a massless two dimensional graphene Hamiltonian.

This talk is based on joint work with K. A. Makarov and A. Seelmann.

Talk time: 2016-07-19 17:30— 2016-07-19 17:50
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

Felix Schwenninger

University of Hamburg

Infinite-dimensional input-to-state stability

Abstract

In this talk we discuss infinite-dimensional versions of well-known stability notions relating the external input u and the state x of a linear system governed by the equation

$$\dot{x} = Ax + Bu, \quad x(0) = x_0.$$

Here, A and B are unbounded operators. For instance, the system is called *L^p-input-to-state stable* if

$$u(\cdot) \mapsto x(t)$$

is bounded as a mapping from $L^p(0,t)$ to the state space X for all $t > 0$. In particular, we elaborate on the relation of this notion to *integral input-to-state* stability and *(zero-class) admissibility* with a special focus on the case $p = \infty$.
This is joint work with B. Jacob, R. Nabiullin and J.R. Partington.

Talk time: 2016-07-18 17:30— 2016-07-18 17:50
Talk location: Cupples I Room 113

Session: State space methods in operator and function theory. Organized by J. Ball and S. ter Horst.

Geethika Sebastian

Indian Institute of Technology Hyderabad

On the open ball centered at an invertible element of a Banach algebra.

Abstract

The open ball centered at an invertible element a of a Banach algebra A, with radius $\frac{1}{\|a^{-1}\|}$, is contained inside the open set of all invertible elements, $G(A)$ in A. An invertible element a of a Banach algebra A is said to satisfy BOBP (Biggest Open Ball Property) if the boundary of the ball $B\left(a, \frac{1}{\|a^{-1}\|}\right)$ intersects the set of non invertible elements in A. We say a Banach algebra A satisfies BOBP if every a in $G(A)$ satisfies BOBP.

The origin of this problem is connected with condition spectra and almost multiplicative functionals. We see that, in general, uniform algebras and C^*-algebras satisfy BOBP but group algebras need not.

Talk time: 2016-07-18 15:30— 2016-07-18 15:50
Talk location: Cupples I Room 218

Session: Contributed talk

Ameur Seddik

Batna II University (Algeria)

CHARACTERIZATION OF SOME DISTINGUISHED CLASSES OF OPERATORS IN TERMS OF OPERATOR INEQUALITIES

Abstract

In this note, we shall give some characterizations of some distin- guished classes of operators (selfadjoint, normal, unitary, partial isometry and isometry) in terms of operator inequalities.

Talk time: 2016-07-21 17:00— 2016-07-21 17:20
Talk location: Cupples I Room 207

Session: Contributed talk

Orr Shalit

Technion

Dilations, inclusions of matrix convex sets, and completely positive maps

Abstract

In this talk I will present a part of a recent joint work with Davidson, Dor-On, and Solel (a complementary talk will be given by Adam Dor-On in the *Multivariable Operator Theory* special session).

If $A = (A_1, \ldots, A_d)$ is a tuple of operators on H and $B = (B_1, \ldots, B_d)$ is a tuple of operators on K, then B is said to be a *dilation* of A, denoted $A \prec B$, if $A_i = P_H B_i\big|_H$ for all i. For a long time it seemed that the name of the game was: given a commuting tuple of operators A, find a commuting tuple of *normal* operators B such that $A \prec B$ (usually with additional conditions on the joint spectrum $\sigma(B)$, and requiring the dilation to hold for powers as well). Quite recently, Helton, Klep, McCullough and Schweighofer changed the rules, and started dilating tuples of *noncommuting* operators to commuting tuples of normal operators. They showed that there is a universal constant ϑ_n, such that given a tuple of $n \times n$ selfadjoint contractions A, there exists a tuple of commuting selfadjoints B, such that $\sigma(B) \subseteq [-1,1]^d$ and $\frac{1}{\vartheta_n} A \prec B$. This result had deep implications to spectrahedral inclusion problems.

The constant ϑ_n behaves roughly like $\sqrt{n}$, and was shown to be the best constant possible. We were led to ask whether it is possible to obtain such a dilation result with a constant that does not depend on $n = \operatorname{rank} A$ (necessarily fixing d). Moreover, we sought a normal dilation B with more precise control on the joint spectrum $\sigma(B)$. As a representative of our results, I will present the following theorem, as well as some applications.

Theorem. *Let K be a convex set in $\mathbb{R}^d$ satsfying some reasonable conditions. Then for every d-tuple A of selfadjoint operators with a joint numerical range contained in K, there is a d-tuple of commuting selfadjoint operators B with joint spectrum $\sigma(B) \subseteq K$, such that*

$$\frac{1}{d} A \prec B.$$

Talk time: 2016-07-20 11:00— 2016-07-20 11:30
Talk location: Brown Hall 100

Session: Plenary Talk

Eli Shamovich

Technion, Israel

Non-Commutative Functions on the Non-Commutative Ball

Abstract

In this talk we will discuss nc-functions on the unit nc-ball $\mathfrak{B}_d$. The focus of the talk will be the algebra $H^\infty(\mathfrak{B}_d)$ of multipliers of the nc-RKHS on the unit ball obtained from the non-commutative Szego kernel. We will give a new proof for the fact that the non-commutative Szego kernel is completely Pick. Then we will consider subvarieties of $\mathfrak{B}_d$ and quotients of $H^\infty(\mathfrak{B}_d)$ arising as multipliers on those varieties. We are interested in determining when the multiplier algebras of two varieties are completely isometrically isomorphic. It is natural to conjecture that two such algebras are completely isometrically isomorphic if and only if there is an automorphism of the nc ball that maps one variety onto the other. We present several partial results in this direction.

Talk time: 2016-07-21 17:30— 2016-07-21 17:50
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Petr Siegl

University of Bern

Approximations of spectra of Schrödinger operators with complex potentials on $\mathbb{R}^d$

Abstract

We study spectral approximations of Schrödinger operators $T = -\Delta + Q$ with complex potentials on $\Omega = \mathbb{R}^d$, or exterior domains $\Omega \subset \mathbb{R}^d$, by domain truncation. Our weak assumptions cover wide classes of potentials Q for which T has discrete spectrum, of approximating domains Ω_n, and of boundary conditions on $\partial\Omega_n$ such as mixed Dirichlet/Robin type. In particular, $\Re Q$ need not be bounded from below and Q may be singular. We prove generalized norm resolvent convergence and spectral exactness, i.e. approximation of all eigenvalues of T by those of the truncated operators T_n without spectral pollution. Moreover, we estimate the eigenvalue convergence rate and prove convergence of pseudospectra. Our results are illustrated by numerical computations for several examples, such as complex harmonic and cubic oscillators for $d = 1, 2, 3$.

The talk is based on a joint work with S. Bögli and C. Tretter.

Talk time: 2016-07-19 17:00— 2016-07-19 17:20
Talk location: Cupples I Room 218

Session: Contributed talk

Anna Skripka

University of New Mexico

Spectral shift functions for differential operators.

Abstract

We will discuss extensions of the Lifshits-Krein-Koplienko spectral shift functions to cases of more general operators that include some classical differential operators.

Talk time: 2016-07-21 15:00— 2016-07-21 15:20
Talk location: Cupples I Room 215

Session: Operator theory, singular integral equations, and PDEs. Organized by R. Duduchava, E. Shargorodsky, and J. Lang

Anna Skripka

University of New Mexico

Multiple operator integrals and their applications.

Abstract

Multiple operator integrals are multilinear transformations on operators that naturally arise as remainders of Taylor approximations of operator functions and also as extensions of Schur multipliers to a multilinear case. Theory of multiple operator integrals has been developing for over 60 years and has accumulated a number of important results and interesting applications. We will discuss recently established analytic properties of these transformations and their applications to perturbation theory.

Talk time: 2016-07-21 11:40— 2016-07-21 12:30
Talk location: Brown Hall 100

Session: Plenary Talk

Ilya Spitkovsky

New York University Abu Dhabi/College of William and Mary

Almost periodic factorization in the twenty first century

Abstract

The set AP of (Bohr) almost periodic functions is the closed subalgebra of $L_\infty(\mathbb{R})$ generated by all the exponents $e_\lambda(x) := e^{i\lambda x}$, $\lambda \in \mathbb{R}$. An AP factorization of an n-by-n matrix function G is its representation as a product

$$G = G_+ \mathrm{diag}[e_{\lambda_1}, \dots, e_{\lambda_n}] G_-,$$

where $G_+^{\pm 1}$ and $G_-^{\pm 1}$ have all entries in AP with non-negative (resp., non-positive) Bohr-Fourier coefficients. This is a natural generalization of the classical Wiener-Hopf factorization of continuous matrix-functions on the unit circle, arising in particular when considering convolution type equation on finite intervals. The state of AP factorization theory as of the beginning of the century can be found in the monograph "Convolution Operators and Factorization of Almost Periodic Matrix Functions" by A. Böttcher, Yu. I. Karlovich and myself. In this talk I will describe, time permitting, further results obtained and problems still open.

Talk time: 2016-07-18 15:00— 2016-07-18 15:20
Talk location: Cupples I Room 215

Session: Toeplitz operators and related topics. Organized by S. Grudsky and N. Vasilevski.

Sanne ter Horst

North West University

Recent developments on equivalence after extension and Schur coupling

Abstract

Two Banach space operators $U : \mathcal{X}_1 \to \mathcal{X}_2$ and $V : \mathcal{Y}_1 \to \mathcal{Y}_2$ are said to be (a) *equivalent after extension* if there exist Banach spaces $\mathcal{X}_0$ and $\mathcal{Y}_0$ such that $U \dotplus I_{\mathcal{X}_0}$ and $V \dotplus \mathcal{Y}_0$ are equivalent and (b) *Schur coupled* in case there exists an operator matrix $\left[\begin{smallmatrix} A & B \\ C & D \end{smallmatrix}\right] : \left[\begin{smallmatrix} \mathcal{X}_1 \\ \mathcal{Y}_1 \end{smallmatrix}\right] \to \left[\begin{smallmatrix} \mathcal{X}_2 \\ \mathcal{Y}_2 \end{smallmatrix}\right]$ with A and D invertible and

$$U = A - BD^{-1}C, \quad V = D - CA^{-1}B.$$

In the 1990s Bart and Tsekanovskii [1, 2] studied the relation between these two notions, and the notion of *matricial coupling* which coincides with equivalence after extension, and proved that Schur coupling implies equivalence after extension. The converse question, whether equivalence after extension implies Schur coupling, was answered affirmatively only for rather special classes of operators, until recently [4, 5, 3]. In this talk we discuss some of these recent developments.

References

[1] H. Bart and V.E. Tsekanovskii, Matricial coupling and equivalence after extension, in: *Operator Theory and Complex Analysis*, OT **59**, 1992, pp. 143—160.

[2] H. Bart and V.E. Tsekanovskii, Complementary Schur complements, *Linear Algebra Appl.* **197** (1994) 651-–658.

[3] S. Ter Horst, M. Messerschmidt, and A.C.M. Ran, Equivalence after extension for compact operators on banach spaces, *J. Math. Anal. Appl.* **431** (2015), 136—149.

[4] S. ter Horst and A.C.M. Ran, Equivalence after extension and matricial coupling coincide with Schur coupling, on separable Hilbert spaces, *Linear Algebra Appl.* **439** (2013), 793–805.

[5] D. Timotin, Schur coupling and related equivalence relations for operators on a Hilbert space, *Linear Algebra Appl.* **452** (2014), 106–119.

Talk time: 2016-07-18 17:00— 2016-07-18 17:20
Talk location: Cupples I Room 113

Session: State space methods in operator and function theory. Organized by J. Ball and S. ter Horst.

Derek Thompson

Taylor University

Complex Symmetric Composition Operators on H^2

Abstract

Garcia has motivated much interest in complex symmetric operators. He and Hammond initiated the search for composition operators exhibiting complex symmetry, with only one example so far: involutive disk automorphisms. In this talk, we give new examples of linear-fractional maps that induce complex symmetric composition operators and also identify the conjugation that induces the complex symmetry. Joint work with Sivaram Narayan and Daniel Sievewright of Central Michigan University.

Talk time: 2016-07-19 14:30— 2016-07-19 14:50
Talk location: Cupples I Room 207

Session: Contributed talk

Edward Timko

Indiana University Bloomington

On polynomial n-tuples of commuting isometries

Abstract

We extend some of the results of Agler, Knese, and McCarthy concerning pairs of commuting shifts to the case of n-tuples of commuting isometries, where n>2. Let $V = (V_1, \ldots, V_n)$ be an n-tuple of commuting isometries on a Hilbert space and let $\mathrm{Ann}(V)$ denote the set of all n-variable polynomials p such that $p(V) = 0$. When $\mathrm{Ann}(V)$ defines an affine algebraic variety of dimension 1 and V is completely non-unitary, we show that V decomposes as a direct of n-tuples $(W_1, \ldots, W_n)$ with the property that, for each i, W_i is either a shift or a scalar multiple of the identity. If V is a cyclic n-tuple of commuting shifts, then we show that V is determined by $\mathrm{Ann}(V)$ up to near unitary equivalence.

Talk time: 2016-07-18 16:00— 2016-07-18 16:20
Talk location: Cupples I Room 207

Session: Contributed talk

Richard Timoney

Trinity College Dublin

Elementary operators and their lengths

Abstract

Elementary operators on an algebra, which are finite sums of operators $x \mapsto axb$, provide a way to study properties of the algebra. In particular, for C^*-algberas we consider results that are related to the length ℓ of the operator, defined as the minimal number of summands required. We will review some results concerning complete positivity or complete boundedness. Although all elementary operators on a C*-algebra A are completely bounded, that is induce uniformly bounded operators on the algebras $M_n(A)$, the supremum is always attained for $n = \ell$, or for smaller n in case A has special structure. For positivity, there are also results couched in analagous terms, but with different bounds.

In recent work with I. Gogić, we have shown that for prime C*-algebras A the elementary operators of length (at most) 1 are norm closed, but that for the rather tractable class of homogeneous C*-algebras more subtle considerations are required for closure. For instance $A = C_0(X, M_n)$ fails to have this closure property if X is an open set in $\mathbb{R}^d$ with $d \geq 3$, $n \geq 2$ ($X \neq \emptyset$).

Talk time: 2016-07-22 09:00— 2016-07-22 09:30
Talk location: Brown Hall 100

Session: Plenary Talk

Maria Tjani

University of Arkansas

Weighted composition operators from Banach spaces of analytic functions into Bloch-type spaces

Abstract

Let X be a Banach space of analytic functions on the unit disk $\mathbb{D}$ whose point evaluation functionals are continuous. We study weighted composition operators from X into Bloch type spaces. Imposing certain natural conditions on X we are able to characterize all at once the bounded and the compact operators as well as in many cases give estimates or precise formulas for the essential norm. One condition used is:

(VI) There exists $C > 0$ such that $\|Sf\| \leq C\|f\|$, for all f in X and for all disk automorphisms S.

When X is either the Bloch space or the space of analytic functions, S^p, whose derivatives are in the Hardy space H^p though, (VI) fails. So when X is continuously contained in the Bloch space, we impose two other conditions on the norm of the point evaluation functionals. In the end our results apply to known spaces that include the Hardy spaces, the weighted Bergman spaces, $BMOA$, the Besov spaces and all spaces S^p. This is joint work with Flavia Colonna.

Talk time: 2016-07-21 15:30— 2016-07-21 15:50
Talk location: Cupples I Room 115

Session: Function spaces. Organized by J. McCarthy.

Sergii Torba

CINVESTAV del IPN, Mexico

Representation of solutions to one-dimensional Schrödinger and perturbed Bessel equations in terms of Neumann series of Bessel functions

Abstract

The new representations of solutions to the one-dimensional Schrödinger equation $-y'' + q(x)y = \omega^2 y$ and to the perturbed Bessel equation $-y'' + \frac{\ell(\ell+1)}{x^2} + q(x)y = \omega^2 y$ are introduced.

For the first equation a pair of linearly independent solutions has the form

$$c(\omega, x) = \cos \omega x + 2\sum_{n=0}^{\infty}(-1)^n \beta_{2n}(x) j_{2n}(\omega x)$$

and

$$s(\omega, x) = \sin \omega x + 2\sum_{n=0}^{\infty}(-1)^n \beta_{2n+1}(x) j_{2n+1}(\omega x),$$

where j_n are the spherical Bessel functions and the coefficients β_j can be calculated by the simple recursive procedure.

For the second equation the regular solution u_ℓ satisfying the asymptotics $u_\ell(\omega, x) \sim x^{\ell+1}$, $x \to 0$ has the form

$$u_\ell(\omega, x) = \frac{2^{\ell+1}\Gamma(\ell + 3/2)}{\sqrt{\pi}\omega^\ell} x j_\ell(\omega x) + \sum_{n=0}^{\infty}(-1)^n \beta_n(x) j_{2n}(\omega x),$$

where the coefficients β_n can be obtained by a similar recursive procedure.

The representations are based on the expansion of the integral kernels of the transmutation operators into Fourier-Legendre series and the recent results obtained by the author jointly with V. V. Kravchenko. It is shown that the partial sums of the series approximate the solutions uniformly with respect to ω. Convergence rate estimates and representations for the derivatives of the solutions are given.

The talk is based on the results obtained with V. V. Kravchenko, Luis J. Navarro and R. Castillo-Perez.

Talk time: 2016-07-19 16:00— 2016-07-19 16:20
Talk location: Cupples I Room 218

Session: Contributed talk

Ryan Tully-Doyle
Hampton University

TBA

Abstract

TBA

Talk time: 2016-07-22 17:00— 2016-07-22 17:20
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Nikolai Vasilevski

CINVESTAV, Mexico City

Algebras of Toeplitz operators on the unit ball

Abstract

One of the common strategies in the study of Toeplitz operators consists in selecting of various special symbol classes $S \subset L_\infty$ so that the properties of both the individual Toeplitz operators T_a, with $a \in S$, and of the algebra generated by such Toeplitz operators can be characterized.

A motivation to study an algebra generated by Toeplitz operators (rather than just Toeplitz operators themselves) lies in a possibility to apply more tools, in particular those coming from the algebraic toolbox, and furthermore the results obtained are applicable not only for generating Toeplitz operators but also for a whole variety of elements of the algebra in question.

To make our approach more transparent we restrict the presentation to the case of the two-dimensional unit ball $\mathbb{B}^2$. We consider various sets S of symbols that are invariant under a certain subgroup of biholomorphisms of $\mathbb{B}^2$ ($\{1\} \times \mathbb{T}$ in the talk). Such an invariance permits us *to lower the problem dimension* and to give a recipe, supplied by various concrete examples, on how the known results for the unit disk $\mathbb{D}$ can be applied to the study of various algebras (both commutative and non-commutative) that are generated by Toeplitz operators on the two-dimensional ball $\mathbb{B}^2$.

Although we consider the operators acting on the weighted Bergman space on $\mathbb{B}^2$ with a *fixed* weight parameter, the Berezin quantization effects (caused by a *growing* weight parameter of the corresponding weighted Bergman spaces on the unit disk $\mathbb{D}$) have to be taken into account.

Talk time: 2016-07-18 14:30— 2016-07-18 14:50
Talk location: Cupples I Room 215

Session: Toeplitz operators and related topics. Organized by S. Grudsky and N. Vasilevski.

Selvarajan Veeramani

Indian Institute of Technology, Hyderabad, India

Level sets of condition spectrum

Abstract

For $0 < \epsilon \leq 1$ and an element a of a complex Banach algebra $\mathcal{A}$ with unit e, the level set of ϵ- condition spectrum is defined as

$$L_\epsilon(a) ::= \left\{ \lambda \in \mathbb{C} : \|(a - \lambda.e)\| \left\|(a - \lambda.e)^{-1}\right\| = \frac{1}{\epsilon} \right\}.$$

We prove the following topological properties about $L_\epsilon(a)$

1. If $\epsilon = 1$ then $L_1(a)$ has an empty interior unless a is a scalar multiple of the unit.
2. If $0 < \epsilon < 1$ then $L_\epsilon(a)$ has an empty interior in the unbounded component of the resolvent set of a. Further, we show that, if the Banach space X is complex uniformly convex or X^* is complex uniformly convex, then for any operator $T \in B(X)$, $L_\epsilon(T)$ has an empty interior.

Talk time: 2016-07-18 15:00— 2016-07-18 15:20
Talk location: Cupples I Room 218

Session: Contributed talk

Victor Vinnikov

Ben Gurion University of the Negev

Finite dimensional contractive realizations of rational Schur–Agler functions

Abstract

It is well known that a contractive rational matrix-valued function admits a finite dimensional contractive realization. There are various proofs of this basic result, but most of them use in an essential way the uniqueness of a minimal realization hence cannot generalize to the multivariable setting. I will prove that a rational matrix-valued function that is regular on a product of closed matrix balls (or much more generally of polynomially defined domains whose defining matrix polynomials satisfy an Archimedean condition) and whose corresponding Agler norm is strictly less than 1 admits a finite dimensional contractive realization. The proof proceeds by applying a matrix-valued version of a Hermitian Positivstellensatz originally due to Putinar to obtain a Hermitian sum of squares decomposition, and then using a variation of the usual lurking isometry argument, that we call a lurking contraction argument, to produce a contractive realization. This is a joint work with D. Kalyuzhnyi-Verbovetskyi, A. Grinshpun, and H. Woerdeman.

Talk time: 2016-07-18 16:00— 2016-07-18 16:20
Talk location: Crow 206

Session: Multivariable operator theory. Organized by H. Woerdeman.

Victor Vinnikov

Ben Gurion University of the Negev

Power series expansions and realization theory for noncommutative rational functions around a matrix point

Abstract

A noncommutative rational function which is regular at 0 can be expanded into a noncommutative formal power series. In fact, by the results of Kleene, Schützenberger, and Fliess, a noncommutative formal power series is rational (i.e., belongs to the smallest subring containing the noncommutative polynomials and closed under the inversion of invertible power series) if and only if the corresponding Hankel matrix has finite rank, and the image of the Hankel matrix can be used to construct the unique minimal (equivalently, controllable and observable) state space realization of a noncommutative rational function which is regular at 0. We use the Taylor–Taylor expansion around an arbitrary matrix point coming from noncommutative function theory to generalize these results to noncommutative rational function regular at an arbitrary matrix point, covering thereby all noncommutative rational functions.

Talk time: 2016-07-22 16:00— 2016-07-22 16:20
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Victor Vinnikov

Ben Gurion University of the Negev

Noncommutative completely positive kernels and noncommutative interpolation

Abstract

In free noncommutative function theory one replaces functions between vector spaces by functions between disjoint unions of square matrices over these vector spaces that respect matrix size, direct sums, and similarities. The respect of similarities has striking consequences, akin to the Cauchy–Riemann equations in the usual function theory. Noncommutative completely positive kernels play the same role in free noncommutative function theory as usual positive kernels play in usual function theory; they are in fact a simultaneous generalization of both usual positive kernels and of completely positive maps. They also provide a key technical ingredient for the noncommutative counterparts of the classical interpolation problems. I will discuss some aspects of these topics, including a large class of noncommutative domains that have a striking extension property: any bounded noncommutative function defined on a relatively similarity invariant full noncommutative subset can be extended to all of the domain without increasing its supremum norm. This is a joint work with J. Ball and G. Marx.

Talk time: 2016-07-22 11:00— 2016-07-22 11:30
Talk location: Brown Hall 100

Session: Plenary Talk

Jurij Volcic

The University of Auckland

Regular and positive noncommutative rational functions

Abstract

Call a noncommutative rational function r regular if it has no singularities, i.e., $r(X)$ is defined for all tuples of self-adjoint matrices X. In this talk regular noncommutative rational functions r will be characterized via the properties of their (minimal size) linear systems realizations $r = c^*L^{-1}b$. Our main result states that r is regular if and only if $L = A_0 + \sum_j A_j x_j$ is privileged. Roughly speaking, a linear pencil L is privileged if, after a finite sequence of basis changes and restrictions, the real part of A_0 is positive definite and the other A_j are skew-adjoint. Afterwards I will speak about a solution to a noncommutative version of Hilbert's 17th problem: a positive regular noncommutative rational function is a sum of squares.

The talk is based on the joint work with I. Klep and J. E. Pascoe.

Talk time: 2016-07-21 15:30— 2016-07-21 15:50
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Jurij Volcic

The University of Auckland

Free loci of matrix pencils and domains of noncommutative rational functions

Abstract

Consider a monic linear pencil $L(x) = I - A_1x_1 - \cdots - A_gx_g$ whose coefficients A_j are $d \times d$ matrices. It is naturally evaluated at g-tuples of matrices X using the Kronecker tensor product, which gives rise to its free locus $Z(L) = \{X : \det L(X) = 0\}$. Our main result is the following: $Z(L) \subseteq Z(L')$ if and only if the natural map sending the coefficients of L' to the coefficients of L induces a homomorphism $A'/\operatorname{rad} A' \to A/\operatorname{rad} A$. Since linear pencils are a key ingredient in studying noncommutative rational functions via linear systems realization theory, the above result leads to a characterization of all noncommutative rational functions with a given domain. Finally, an answer to a quantum version of Kippenhahn's conjecture on linear pencils will be given: if hermitian matrices $A_1, \ldots, A_g$ generate $M_d(\mathbb{C})$ as an algebra, then there exist hermitian matrices $X_1, \ldots, X_g$ such that $\sum_i A_i \otimes X_i$ has a simple eigenvalue.

The talk is based on the joint work with I. Klep.

Talk time: 2016-07-19 15:30— 2016-07-19 15:50
Talk location: Cupples I Room 113

Session: State space methods in operator and function theory. Organized by J. Ball and S. ter Horst.

Eric Weber

Iowa State University

Fourier Series on Fractals and the Kaczmarz Algorithm

Abstract

The Kaczmarz algorithm is a well-known technique for solving systems of linear equations. We show that the algorithm can be used to construct Fourier series expansions for functions which are square-integrable with respect to a fractal measure (or any singular measure) on the unit interval. The algorithm also gives rise to reproducing kernel subspaces of the Hardy space of the disc with specified boundary representations, which in turn is related to the spectral theory of the backward shift on the Hardy space. This is joint work with John Herr and Palle Jorgensen.

Talk time: 2016-07-19 18:00— 2016-07-19 18:20
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

Hugo Woerdeman

Drexel University

Rational Schur-Agler functions on polynomially-defined domains

Abstract

When $p(z_1, \ldots, z_d)$ is a polynomial in d variables that can be represented as

$$p(z_1, \ldots, z_d) = p_0 \det \left(I - K(\oplus_{j=1}^d z_j I_{n_j}) \right),$$

where $p_0 \neq 0$ and K is a $(\sum_{j=1}^d n_j) \times (\sum_{j=1}^d n_j)$ contraction, then the rational inner function

$$f(z_1, \ldots, z_d) = \frac{\left(\prod_{j=1}^d z_j^{n_j} \right) \overline{p(1/\bar{z}_1, \ldots, 1/\bar{z}_d)}}{p(z_1, \ldots, z_d)}$$

is in the Schur-Agler class of the polydisk; that is, if $(T_1, \ldots, T_d)$ are commuting strict contractions then $\|f(T_1, \ldots, T_d)\| \leq 1$.

The converse question,"is every rational inner function in the Schur-Agler class of the polydisk necessarily of the above form?" led to questions regarding finite dimensional realizations of rational Schur-Agler functions, determinantal representations of stable polynomials, rational inner functions that are not Schur-Agler, and so forth. In this work we study these questions in Schur-Agler classes defined via a matrix-valued polynomial $\mathbf{P}$, leading to domains of the type

$$\mathcal{D}_{\mathbf{P}} := \{z = (z_1, \ldots, z_d) \in \mathbb{C}^d \ : \ \mathbf{P}(z)^* \mathbf{P}(z) < I\}.$$

Aside from the polydisk this general setting also includes the unit ball $\mathbb{B}^d$, and more generally, Cartan's classical domains. Using methods of Free Noncommutative Analysis, Systems Theory, and Algebraic Geometry, several new results were obtained. This talk is based on joint work with A. Grinshpan, D. S. Kaliuzhnyi-Verbovetskyi, and V. Vinnikov.

Talk time: 2016-07-19 11:40— 2016-07-19 12:30
Talk location: Brown Hall 100

Session: Plenary Talk

YiJun Yao

Fudan University

TBA

Abstract

TBA

Talk time: 2016-07-22 15:30— 2016-07-22 15:50
Talk location: Cupples I Room 115

Session: Non-commutative geometry. Organized by X. Tang.

Ozgur Yilmaz

The University of British Columbia

Off the grid low-rank matrix recovery

Abstract

Matrix sensing problems capitalize on the assumption that a data matrix of interest is low-rank or it can be well-approximated by a low-rank matrix. This low dimensional structure sometimes arises because the data matrix is obtained by sampling a “smooth" function on a regular (or structured) grid. However, in many practical situations the measurements are taken on an irregular grid (that is accurately known). This results in what we call an "unstructured data matrix" that is a worse fit for the low rank model compared to its regular counterpart and results in degraded reconstruction via rank penalization techniques. In this talk, we propose a modified low-rank matrix recovery work-flow that admits unstructured observations. Specifically, we incorporate into the nuclear-norm minimization problem a regularization operator that (sufficiently accurately) maps structured data to unstructured data. As a result, we are able to compensate for data irregularity. We establish recovery error bounds for our method. Furthermore, we will present numerical experiments, both in the matrix sensing and matrix completion settings, including applications to seismic trace interpolation to demonstrate the potential of the approach.

This is joint work with Oscar Lopez, Rajiv Kumar, and Felix Herrmann.

Talk time: 2016-07-19 16:00— 2016-07-19 16:20
Talk location: Crow 204

Session: Applied harmonic analysis, frame theory, and operator theory. Organized by G. Kutyniok.

Nicholas Young

Leeds and Newcastle Universities

A Nagy-Foias model for commuting pairs of contractions

Abstract

The starting point for the Nagy-Foias model for a contractive operator T on Hilbert space is Sz.-Nagy's observation that T has a canonical minimal unitary dilation to a larger Hilbert space. For a *pair* $T = (T_1, T_2)$ of commuting contractions, Ando's theorem asserts that there exist commuting unitary dilations of T to larger Hilbert spaces, and one might aspire to extend the Nagy-Foias model to such operator pairs. However, the dilations provided by Ando's theorem are far from being canonical, and this fact appears to rule out a good model theory for T.

It has recently been shown that nevertheless there *is* such a model theory, though it requires a slight shift in perspective. One focuses on the commuting pair (S, P), where $S = T_1 + T_2,\ P = T_1T_2$. The operator pair (S, P) is a Γ-*contraction*, which means that the set

$$\Gamma = \{(z + w, zw) : |z| \leq 1,\ |w| \leq 1\}$$

is a spectral set for (S, P). One constructs a canonical dilation, and thereafter a functional model, not for the individual operators T_1, T_2, but for the pair (S, P). The model parallels closely the original Nagy-Foias model.

This line of investigation was begun by Agler and Young, and successfully developed and brought to a conclusion by members of the Indian school of operator theory.

Talk time: 2016-07-22 11:40— 2016-07-22 12:30
Talk location: Brown Hall 100

Session: Plenary Talk

Aljaz Zalar

Institute of Mathematics, Physics, and Mechanics, Ljubljana, Slovenia

Operator positivstellensätze for noncommutative polynomials positive on matrix convex sets

Abstract

In the talk we will study algebraic certificates of positivity for noncommutative (nc) operator-valued polynomials on matrix convex sets, such as the solution set D_L, called a free Hilbert spectrahedron, of the linear operator inequality (LOI) $L(X) = A_0 \otimes I + \sum_{j=1}^{g} A_j \otimes X_j \succeq 0$, where A_j are self-adjoint linear operators on a separable Hilbert space, X_j matrices and I is an identity matrix. If A_j are matrices, then $L(X) \succeq 0$ is called a linear matrix inequality (LMI) and D_L a free spectrahedron. For monic LMIs, i.e., $A_0 = I$, and nc matrix-valued polynomials the certificates of positivity were established by Helton, Klep and McCullough [1, 2]. We extend the characterization of the inclusion $D_{L_1} \subseteq D_{L_2}$ from monic *LMIs* to monic *LOIs* L_1 and L_2.Using this characterization in a separation argument, we obtain a certificate for matrix-valued nc polynomials F positive semidefinite on a free Hilbert spectrahedron defined by a monic LOI. Finally, focusing on the algebraic description of the equality $D_{L_1} = D_{L_2}$, we remove the assumption of boundedness from the description in the LMIs case and present counterexamples for the extension to LOIs case.

References

[1] J.W. Helton, I. Klep, S. McCullough: The convex Positivstellensatz in a free algebra, *Adv. Math.* **231** (2012) 516–534.

[2] J.W. Helton, I. Klep, S. McCullough: The matricial relaxation of a linear matrix inequality, *Math. Program.* **138** (2013) 401–445.

[3] A. Zalar, Operator Positivstellensätze for noncommutative polynomials positive on matrix convex sets. *Preprint* `http://arxiv.org/abs/1602.00765.`

Talk time: 2016-07-21 16:00— 2016-07-21 16:20
Talk location: Crow 206

Session: Non-commutative inequalities. Organized by J.W. Helton and I. Klep.

Bertin Zinsou

University of the Witwatersrand

Fourth order Birkhoff regular problems with eigenvalue parameter dependent boundary conditions

Abstract

A regular fourth order differential equation which depends quadratically on the eigenvalue parameter λ is considered with classes of separable boundary conditions independent of λ or depending on λ linearly. Conditions are given for the problems to be Birkhoff regular.

Talk time: 2016-07-19 14:30— 2016-07-19 14:50
Talk location: Cupples I Room 218

Session: Contributed talk