Abstracts

On a Banach space substitute of the orthogonal projections on Hilbert spaces

Dijana Ilišević, *University of Zagreb, Zagreb, Croatia*
ilisevic@math.hr

Let P_0 be a nonzero projection on a complex Banach space $\mathcal{X}$, and $n \geq 2$. We call P_0 a generalized n-circular projection if there exists a surjective isometry $T\colon \mathcal{X} \to \mathcal{X}$ with $\sigma(T) = \{1, \lambda_1, \ldots, \lambda_{n-1}\}$ consisting of n distinct modulus one eigenvalues such that P_0 is the eigenprojection of T associated to $\lambda_0 = 1$. In this case, there are nonzero projections $P_1, \ldots, P_{n-1}$ on $\mathcal{X}$ such that

$$P_0 \oplus P_1 \oplus \cdots \oplus P_{n-1} = I \quad \text{and} \quad T = P_0 + \lambda_1 P_1 + \cdots + \lambda_{n-1} P_{n-1}.$$

In this talk it will be presented how generalized n-circular projections arise as generalizations of orthogonal projections in the Banach space setting. The structure of these mappings on some important Banach spaces will be described.

—————————→ ∞ ←—————————

Fluid dynamics from a Fourier analysis perspective

Carlos Pinilla Suarez, *University of Colorado at Boulder, CO*
Carlos.PinillaSuarez@colorado.edu

The Navier Stokes equations are supposed to model the behavior of the motion of an incompressible fluid. However well posedness of these equations is still an open question. In the sense of them being deterministic: any physically reasonable initial condition will evolve under these equations to a physically reasonable field of velocities for all times. For simplicity no external force and a bounded domain will be considered throughout the presentation. In this setting they allow a nice representation if one uses the Fourier decomposition of these velocity field, then the evolution can be seen as governed by a non-local operator in Fourier space, a complete derivation of this operator will be discussed, some advantages and in a bigger quantity some difficulties that one encounters when dealing with this description will be discussed.

—————————→ ∞ ←—————————

Banach spaces with spreading bases

Bentuo Zheng, *University of Memphis, Memphis TN*
bzheng@memphis.edu

In this talk, we will present the structure of Banach spaces with a conditional spreading basis. The geometry of such spaces exhibit a striking resemblance to the geometry of James' space. Further, we show that the averaging projections onto sub- spaces spanned by constant coefficient blocks with no gaps between supports are bounded. As a consequence, every Banach space with a spreading basis contains a complemented subspace with an unconditional basis. This gives an affirmative answer to a question of H. Rosenthal.

—————————→ ∞ ←—————————

Average of two isometries on the Hardy space of the Torus

Raena King, *Christian Brothers University, Memphis TN*
rking2@cbu.edu

A generalized bi-circular projection is a projection P such that $P + \lambda(I - P)$ is an isometry for some $|\lambda| = 1$ other than $\lambda = 1$. For the Hardy space of the torus, the generalized bi-circular projections are known and are the average of the identity and a reflection. In this paper we use a case analysis on conformal maps of the unit disc onto itself to find when the average of two isometries on the Hardy space of the torus gives a projection.

—————————————→ ∞ ←—————————————

Lumer's methodd for certain admissible quadruples

Osamu Hatori, *Niigata University, Niigata, Japan*
hatori@math.sc.niigata-u.ac.jp

An admissible quadruple is defined by Nikou and A. G. O'Farrell.

Definition. (cf. [1]) Let X be a compact Hausdorff space and E a commutative Banach algebra with unit. By an admissible quadruple we mean a quadruple $(X; E; B; \tilde{B})$, where (1) $B \subset C(X)$ is a natural $\mathbf{C}$-valued function algebra on X, (2) $\tilde{B} \subset C(X; E)$ is an E-valued function algebra on X in the strong sense, (3) $B \otimes E \subset \tilde{B}$ and (4) $\{\lambda \circ f : f \in \tilde{B}; \lambda \in M(E)\} \subset B$.

In this talk we characterize Hermitian operators on certain admissible quadruples. An element a in a unital Banach algebra is called Hermitian if the algebraic numerical range for a is a subset of real numbers. It is well known that a is Hermitian if and only if $\|exp^{ita}\| = 1$ for all $t \in \mathbf{R}$. Let $\mathbf{B}(E)$ be the usual Banach algebra of all bounded linear operators on E equipped with the operator norm. We call $T \in \mathbf{B}(E)$ a Hermitian operator on E if T is Hermitian in $B(E)$. We apply Lumer's method in characterizing isometries for certain admissible quadruples.

References

[1] A. Nikou and A. G. O'Farrell, Banach algebras of vector-valued functions, Glasgow Math. J., 56 (2014), 419-426.

—————————————→ ∞ ←—————————————

The spectrum of orbifold connected sums and collapsing

Christopher Seaton, *Rhodes College, Memphis TN*
seaton@rhodes.edu

Let O be a Riemannian orbifold, a topological space locally of the form $\mathbb{R}^n/G$ where G is a finite group and $\mathbb{R}^n$ is equipped with a G-invariant Riemannian metric. The Laplace operator Δ is a non-negative self-adjoint operator on functions on O, and the spectrum of Δ is an invariant of O. *Isospectral* orbifolds are orbifolds whose Laplace spectra coincide. Though many geometric quantities, such as the volume and dimension of O, are determined by the spectrum, it is known that there are pairs of isospectral orbifolds with different numbers and kinds of singular points. In particular, by the work of Rossetti–Schueth–Weildandt, there are isospectral pairs for whom the maximum order of the groups G is different. The question of whether an orbifold with singular points can be isospectral to a manifold, i.e. an orbifold without singular points, is currently open.

Generalizing work of Anné, Colbois, and Takahashi for manifolds, we study the behavior of the spectrum of a connected sum of orbifolds when one component of the connected sum is collapsed to a point. We use this to demonstrate that there are singular orbifolds and manifolds whose spectra are arbitrarily close to one another.
Joint work with Carla Farsi and Emily Proctor.

Wavelets, spectral triples, and Hausdorff measure for infinite path spaces of graphs

Carla Farsi, *University of Colorado, Boulder CO*
carla.farsi@euclid.co.edu

In joint work with Gillaspy, Julien, Kang, and Packer, we recast a spectral triples Cantor set construction by Julien and Savinien (who built on work by Pearson and Bellissard) in the graph set-up; the Cantor set is the infinite path space of the graph. We also have discovered that the spectral triple Laplacian eigenspace decomposition agrees with a wavelet-type orthogonal decomposition first introduced by Marcolli and Paolucci, and generalized by Farsi, Gillaspy, Kang, Julien, and Packer. Moreover, the Dixmier trace measure associated to the spectral triples agree with the Hausdorff measure on the infinite path space.

———————————→ ∞ ←———————————

Norms and isometries on $C^1([0,1])$

Takeshi Miura, *Niigata University, Niigata Japan*
miura@math.sc.niigata-u.ac.jp

Let $C^1([0,1])$ be the complex linear space of all continuously differentiable functions on the closed unit interval $[0,1]$. $C^1([0,1])$ is a Banach space under several norms, say $\|f\|_\Sigma = \|f\|_\infty + \|f'\|_\infty$, $\|f\|_C = \max_{t\in[0,1]}(|f(t)|+|f'(t)|)$, $\|f\|_\sigma = |f(0)| + \|f'\|$ for $f \in C^1([0,1])$, where $\|g\|_\infty = \max_{t\in[0,1]} |g(t)|$. A mapping $S\colon A \to B$ between two normed linear spaces $(A, \|\cdot\|_A)$ and $(B, \|\cdot\|_B)$ is an *isometry* if and only if

$$\|S(f) - S(g)\|_B = \|f - g\|_A \qquad (\forall f, g \in A).$$

We give the characterization of surjective isometries, which need not be linear, on $C^1([0,1])$ with respect to several norms.
Joint work with Kazuhiro Kawamura (University of Tsukuba) and Hironao Koshimizu (Yonago National College of Technology).

———————————→ ∞ ←———————————

Nonlinear Functionals and Their Support Sets

Jessica Stovall, *University of North Alabama, Florence AL*
jstovall@una.edu

Any Dedekind complete Banach lattice E with a quasi-interior point e is lattice isomorphic to a space of continuous, extended real-valued functions defined on a compact Hausdorff space X. An orthogonally additive, continuous, monotonic, and subhomogeneous nonlinear functional $T : E \to \mathbf{R}$ and its support set are examined.

———————————→ ∞ ←———————————

M-ideal properties in Orlicz-Lorentz spaces

Hyung-Joon Tag, *University of Memphis, Memphis TN*
htag@memphis.edu

We provide explicit formulas for the norm of bounded linear functionals on Orlicz-Lorentz function spaces $\Lambda_{\varphi,w}$ equipped with two standard Luxemburg and Orlicz norms. Any bounded linear functional is a sum of regular and singular functionals, and we show that the norm of a singular functional is the same regardless of the norm in the

space, while the formulas of the norm of general functionals are different for the Luxemburg and Orlicz norm. The relationship between equivalent definitions of the modular $P_{\varphi,w}$ generating the dual space to Orlicz-Lorentz space is discussed in order to compute the norm of a bounded linear functional on $\Lambda_{\varphi,w}$ equipped with Orlicz norm. As a consequence, we show that the order-continuous subspace of Orlicz-Lorentz space equipped with the Luxemburg norm is an M-ideal in $\Lambda_{\varphi,w}$, while this is not true for the space with the Orlicz norm when φ is an Orlicz N-function not satisfying the appropriate Δ_2 condition. The analogous results on Orlicz-Lorentz sequence spaces are given.
This is a joint work with Anna Kamińska and Han Ju Lee.

$\longrightarrow \infty \longleftarrow$

Fuzzy Banach Algebras as generalizations of classical Banach Algebras
Farnaz Solatikia, *University of Memphis, Memphis TN*
fsltikia@memphis.edu

In this presentation we first introduce the notion of fuzzy Banach algebra and α-fuzzy Banach algebra. Then show that for given α in (0, 1), and (α-norms , X) is a Banach algebra then the pair $(X, \mathbf{N})$ is a fuzzy Banach algebra. We give an example that shows that the converse does not hold true, however it remains true if $(X, \mathbf{N})$ is an α-fuzzy Banach algebra instead of fuzzy Banach algebra. By using the latter we will verify the fuzzy version of some important classical results.

$\longrightarrow \infty \longleftarrow$

Hahn Banach Type extension in Banach and Hilbert modules
Sudeshna Basu, *George Washington University, Washington D.C.*
sbasu@gwu.edu

Suppose X is a Banach space and M a closed subspace of X. We know from Hahn Banach Theorem that any bounded linear functional from M to R has a norm preserving extension to the whole of X Subsequently, one defines a Hahn Banach Operator between operator spaces. The question whether this operator is linear has been extensively studied and solved. We investigate the situation of existence, of Hahn Banach type extension for module homomorphisms in the case of Banach and Hilbert Modules and its submodules. Further ,we investigate the existence of Hahn Banach type operator and study its linearity with respect to the Banach Algebra associated with the modules.

$\longrightarrow \infty \longleftarrow$

Operator Systems Associated with Spaces of Matrix Affine Maps
Kimberly Duran, *University of Illinois at Urbana, Champaign IL*
kimalduran@gmail.com

Matrix affine maps on a matrix convex set are the noncommutative generalization of affine maps on compact, convex sets. Motivated by a result of P. D. Taylor on when a Banach space is a space of affine functions on a compact, convex set, we demonstrate that in the real case, this result does not hold for spaces of matrix affine functions using a correspondence with real operator systems.
This is a joint work with R. Araiza, H. Buyu, D. Hay, R. Morris, S. Samarakoon

$\longrightarrow \infty \longleftarrow$