ABSTRACTS

Operator Theory and Its Applications

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Reducibility of the power of a $C_0(1)$ operator

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Inspired by the work of Douglas and Foias in 2006 on the structure of the square of a $C_0(1)$ operator, we form a conjecture about a certain reducibility of any power $N$ of a $C_0(1)$ operator. We then prove this conjecture for $N = 3$ by determining explicitly the relevant reducing subspaces.
Hyponormal singular integral operators
and Toeplitz operators

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Let $\alpha$ and $\beta$ be functions in $L^\infty(\mathbb{T})$, where $\mathbb{T}$ is the unit circle. Let $P$ denote the orthogonal projection from $L^2(\mathbb{T})$ onto the Hardy space $H^2(\mathbb{T})$, and $Q = I - P$, where $I$ is the identity operator on $L^2(\mathbb{T})$. In this talk, we consider the hyponormality of singular integral operators $S_{\alpha,\beta}$ on $L^2(\mathbb{T})$ of the form $S_{\alpha,\beta}f = \alpha Pf + \beta Qf$, for $f \in L^2(\mathbb{T})$, and Toeplitz operators on $H^2(\mathbb{T})$ of the form $T_\alpha f = P(\alpha f)$, for $f \in H^2(\mathbb{T})$.

This is a joint work with Professor Takahiko Nakazi.

References

Difficulty on the existence of canonical system flows

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We will revisit the structure of Korteweg-de Vries (KdV) flows, especially KdV hierarchy, whose spectra are invariant, when the time passes. This iso-spectral flows are related to the existence of solitary waves like Tsunami. Except a traveling wave which is the simplest example, KdV equation is the most well-studied one having such solutions. Since KdV equations are naturally generalized to canonical systems, we may expect that iso-spectral canonical systems would be found. In this talk, we will, however, show that it will be very difficult for such canonical flows like KdV ones to exist. To see this, due to the lack of existence on operators related to canonical systems, so-called zero-curvature equation will be applied, which is equivalent to the famous Lax pair formalism.
Toeplitz operators with symbols of Borel measures

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In this talk, I consider Toeplitz operators $T_\mu$ with symbols of complex Borel measures $\mu$, and give a characterization of bounded Toeplitz operators: $T_\mu$ is bounded if and only if $\mu$ is a $T$-Carleson measure when the domain of $T_\mu$ contains all polynomials.

This is based on a joint work with Caixing Gu.
Semigroup $C^*$-algebras of non-amenable semigroups

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The study of semigroup $C^*$-algebras has started with the question whether the theory of group $C^*$-algebras can be extended to more basic cases, namely semigroups. The starting result was made by L.A. Coburn, which states all $C^*$-algebras generated by single non-unitary isometry are isomorphic. The generalization of Coburn’s result is called the uniqueness property of $C^*$-algebras generated by isometric representations of semigroups. A. Nica has introduced quasi-lattice ordered groups that could make the theory of the uniqueness property advance to a more interesting state. The uniqueness property of semigroup $C^*$-algebras is related with the amenability of semigroups as the amenability of locally compact groups is related with the isomorphism of group $C^*$-algebras. Xin Li has made a different construction of semigroup $C^*$-algebras to enlarge the amenability of semigroups. We show that how much the uniqueness property is related with the order structure of semigroups and also the structure of semigroup $C^*$-algebras of some non-quasi lattice ordered semigroups.
Normality, self-adjointness and isometry of truncated singular integral operators

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For truncated singular integral operators on the unit circle, self-adjointness, isometry, coisometry and normality will be characterized. These characterizations will be complete except for the case of self-adjointness.
Hamburger-type weighted shifts

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We indicate how our subject emerges from the confluence of several streams of analysis, including the classical moment problems, the theory of positive matrices and subnormal operator theory. Some new properties $H(n)$ ($n = 1, 2, \ldots$) and a Hamburger-type weighted shift are considered via a Hamburger moment sequence. We discuss examples to show the various $H(n)$ are distinct; study flatness, backward $n$-step extensions and perturbations of weighted shifts; and, given three initial weights $\alpha_0, \alpha_1, \alpha_2$ with $\alpha_0 \leq \alpha_2 < \alpha_1$, we produce a completion: a weighted shift of Hamburger-type but not subnormal, extending a (subnormal) completion by Stampfli in the case $\alpha_0 < \alpha_1 < \alpha_2$. 
Conjugation on a Banach space

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Let $\mathcal{X}$ be a complex Banach space and $C$ be an operator on $\mathcal{X}$. $C$ is said to be a conjugation if

\[ C^2 = I, \quad \|C\| \leq 1, \quad C(x + y) = Cx + Cy, \quad C(\lambda x) = \lambda x \quad (\forall x, y \in \mathcal{X}, \forall \lambda \in \mathbb{C}). \]

From the definition, it holds $\|C\| = 1$. We have a talk about spectral properties of a bounded linear operator $T \in B(\mathcal{X})$ and others concerning with a conjugation $C$ on a Banach space $\mathcal{X}$.

References

On properties of \((m, C)\)-isometric commuting tuples of operators

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A commuting tuples of operators \(T = (T_1, \cdots, T_d) \in B^{(d)}(\mathcal{H})\) is said to be \((m, C)\)-isometric tuple if

\[
Q_m(T) := \sum_{0 \leq k \leq m} (-1)^{m-k}\binom{m}{k} \left( \sum_{|\beta|=k} \frac{k!}{\beta!} T^{\ast\beta} CT^\beta \right) = 0
\]

for some positive integer \(m\) and some conjugation \(C\). In this paper, we study the class of \((m, C)\)-isometries for tuple of commuting operators which is a generalization of the class of \((m, C)\)-isometric operators. We concentrate on a multivariable generalization of these single variable \((m, C)\)-isometric operators and give some of their basic properties of such operators.

The talk is based on joint work with Ould Ahmed Mahmoud Sid Ahmed and Muneo Chō.

References


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A subnormal completion problem for weighted shifts on directed trees

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Given a directed tree and a collection of weights on a subtree, the subnormal completion problem is to determine whether the weights may be completed to the weights of an injective, bounded, subnormal weighted shift on the Hilbert space arising from the full tree. We study this problem (which generalizes significantly the classical subnormal completion problem for weighted shifts) both from a measure-theoretic point of view and in terms of initial data, for various classes of trees with a single branching point. We give several characterizations of when such a completion is possible. Considered also are connections with Stieltjes moment sequences, flatness of a completion, completions in which the resulting measures may be taken to be finitely atomic, and we provide a result showing that in certain circumstances the present completion problem is equivalent to a related classical completion problem. (This is a joint work with G. Exner, J. Stochel, and H. Y. Yun.)
Toeplitz operators on the Fock spaces

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In this talk, we consider the properties of Toeplitz operators on the Fock spaces $\mathbb{F}^2$. Next, we characterize the necessary and sufficient conditions for the hyponormality of Toeplitz operators $T_\varphi$ on $\mathbb{F}^2$ with polynomial symbol $\varphi$. Moreover, we consider the necessary condition for hyponormality of $T_\varphi$ with trigonometric polynomial symbol $\varphi$.

References


Semicircular elements induced by orthogonal projections

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In this talk, we consider how to construct semicircular elements induced by mutually orthogonal integer-many projections in a certain $C^*$-probability space. As application, we consider the weighted-emicircular laws and the semicircular law from $p$-adic analysis on $p$-adic number fields over primes $p$. 
Symmetric properties and operator transforms

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The class of symmetric operators is a quite large class. It contains many standard operators such as normal operators, Hankel matrices, finite Toeplitz matrices, all truncated Toeplitz operators, and Volterra integration operators. We’ll present here some recent results on some transforms of symmetric operators.
The powers of quasinormal operators of a commuting pair

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In this talk we investigate some properties of jointly and spherically quasinormal operators for a commuting pair.
This is a joint work with Professors Raul Curto and Sang Hoon Lee