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ABSTRACTS

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On the representation theory of infinite-dimensional unitary groups

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We explore the relationship between $*$ -representations of C^* -algebras and unitary representations of their unitary groups. Thus, by following the pattern of the classical Schur-Weyl duality, to each irreducible infinite dimensional $*$ -representation of a C^* -algebra we associate an infinite collection of irreducible norm-continuous unitary representations of its unitary group on tensor spaces, whose equivalence classes are parameterized by highest weights. We show how these representations can be realized by sections of holomorphic line bundles over homogeneous Kaehler manifolds on which the unitary group acts transitively. Suitable momentum sets distinguish the equivalence classes of representations of this type. Moreover, the extreme points of the corresponding momentum set of any of these group representations allow us to recover the algebra representation involved in the construction.

On invertibility of some operator sums and trace characterization on C^* -algebras

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1) We study invertibility of certain sums of linear bounded operators on Hilbert space \mathcal{H} over \mathbb{C} (Theorem 1). We generalize one result of [1] in Theorem 1, by using algebraic Lemma 2 from [2]. A criterion on invertibility of sums of projections is found. Some equivalent conditions on invertibility of difference of two projections are obtained. We prove that block projection operators preserve invertibility of positive operators. We present three corollaries from Theorem 1; it is shown for instance that if A, B from $\mathcal{B}(\mathcal{H})$ are nonnegative and $A - B$ is invertible, then $A + B$ is also invertible.

We also prove the following result: Let X, Y belong to $\mathcal{B}(\mathcal{H})$ be self-adjoint operators, $X \geq 0$ and $-X \leq Y \leq X$. If Y is invertible, then X is also invertible. It is shown that for unitary operators U, V the operator $U + V$ is invertible if and only if the norm of the operator $U - V$ is less than 2. Let \mathcal{H} be a separable infinite-dimensional Hilbert space and U be a unilateral shift operator on \mathcal{H} . Then the operator $U + V$ is not left invertible for any unitary operator V from $\mathcal{B}(\mathcal{H})$.

2) We present a new characterizations of trace on C^* -algebras via inequalities and obtain an answer to the question of V.Kaftal (Cincinnati University) at Operator Theory'23.