GRADUATE SEMINAR

Saleh Mustafa

Higher Rank Numerical Range

PhD Student supervised by Martin Argerami

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Abstract: In this talk, I will present the higher rank numerical range and discuss some of its properties. Let $Mn(\mathbb{C})$ be the algebra of matrices, and let $A \in M_n(\mathbb{C})$ Then for some integer $K \geq 1$, the higher rank numerical range can be defined by $\Lambda_k(A) = \{\lambda \in \mathbb{C}: PAP = \lambda P, \textit{for some rank-k orthogonal projection } P\}$.

If $k = 1$, the higher rank numerical range will be the classical numerical range. Accordingly, higher rank numerical range generalize the classical numerical range. Second, we will see that the problem of finding the quantum error correction code for a given error operators is equivalent to the problem of finding the scaler λ and the projection P inside $\Lambda_k(A)$.Therefore, the motivation of our study comes from the quantum error correction code in the quantum computing. Finally, we will discuss some properties of the higher rank numerical range. One of these properties will be the convexity of the higher rank numerical range. We will see that by discussing the following definition

$\Lambda_k(A) = \bigcap_{\xi \in [0,2\pi)} \{\mu \in \mathbb{C}: e^{i\xi}\mu + e^{-i\xi}\mu \leq \lambda_k(e^{i\xi}A + e^{-i\xi}A^*)\}$.

University of Regina

Mathematics and Statistics