

Orthogonality in $\mathbb{M}_n(\mathbb{C})$ and geometry of the numerical range

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Let \mathbb{C}^n be the linear space of all ordered n -tuples $x = (x_1, \dots, x_n)$ of complex numbers equipped with the Euclidean norm $\|x\| = (\sum_{i=1}^n |x_i|^2)^{1/2}$. Let $\mathbb{M}_n(\mathbb{C})$ denote the space of all $n \times n$ complex matrices with the norm defined by $\|A\| = \max_{\|x\|=1} \|Ax\|$, $A \in \mathbb{M}_n(\mathbb{C})$. In this talk, we consider two types of orthogonality in $\mathbb{M}_n(\mathbb{C})$: the Birkhoff–James and the Roberts orthogonality. Some geometric properties of the (generalized) numerical range of a matrix are described in terms of these orthogonalities.

Key words: Birkhoff–James orthogonality, Roberts orthogonality, numerical range

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