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On the Star Partial Ordering of Normal Matrices

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Abstract:

We order the space of complex $n \times n$ matrices by the star partial ordering $\leq^*$. So $\mathbf{A} \leq^* \mathbf{B}$ means that $\mathbf{A}^*\mathbf{A} = \mathbf{A}^*\mathbf{B}$ and $\mathbf{A}\mathbf{A}^* = \mathbf{B}\mathbf{A}^*$. We find several characterizations for $\mathbf{A} \leq^* \mathbf{B}$ in the case of normal matrices. As an application, we study how $\mathbf{A} \leq^* \mathbf{B}$ relates to $\mathbf{A}^2 \leq^* \mathbf{B}^2$. The results can be extended to study how $\mathbf{A} \leq^* \mathbf{B}$ relates to $\mathbf{A}^k \leq^* \mathbf{B}^k$, where $k \geq 2$ is an integer.

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