2-29-2016

Review: On rank one perturbations of complex symmetric operators

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Recommended Citation
(Reviewer: Stephan R. Garcia)
Let $\mathcal{H}$ denote a separable, complex Hilbert space. A bounded linear operator $T: \mathcal{H} \to \mathcal{H}$ is a complex symmetric operator (CSO) if there is a conjugation $C: \mathcal{H} \to \mathcal{H}$ so that $T = CT^*C$ (a conjugation is a conjugate-linear, isometric involution). One says that $T$ is decomposable if for every open cover $\{U, V\}$ of $\mathbb{C}$, there are $T$-invariant subspaces $\mathcal{X}$ and $\mathcal{Y}$ so that $\mathcal{H} = \mathcal{X} + \mathcal{Y}$, $\sigma(T|_\mathcal{X}) \subseteq \overline{U}$, and $\sigma(T|_\mathcal{Y}) \subseteq \overline{V}$. The authors study the decomposability of rank-one perturbations of CSOs. They also investigate conditions under which such a perturbation is hyponormal or satisfies the $\sigma$-Weyl theorem. They study several instructive examples based on shift operators and truncated Toeplitz operators.

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