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SIMILARITY ORBITS OF COMPLEX SYMMETRIC OPERATORS

SEN ZHU[1*] and JIAYIN ZHAO[2]

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ABSTRACT. An operator T on a complex Hilbert space $\mathcal{H}$ is said to be *complex symmetric* if T can be represented as a symmetric matrix relative to some orthonormal basis for $\mathcal{H}$. In this article we explore the stability of complex symmetry under the condition of similarity. It is proved that the similarity orbit of an operator T is included in the class of complex symmetric operators if and only if T is an algebraic operator of degree at most 2.

1. Introduction and preliminaries

Throughout this paper, $\mathcal{H}$ will always denote a complex separable Hilbert space. We let $\mathcal{B}(\mathcal{H})$ denote the algebra of all bounded linear operators on $\mathcal{H}$. An operator $T \in \mathcal{B}(\mathcal{H})$ is said to be *complex symmetric* if there exists a conjugation C on $\mathcal{H}$ such that $CTC = T^*$; in this case, T is said to be *C-symmetric*. Recall that a conjugate-linear map C on $\mathcal{H}$ is called a *conjugation* if C is invertible, $C^{-1} = C$, and $\langle Cx, Cy\rangle = \langle y, x\rangle$ for all $x, y \in \mathcal{H}$. Note that T is complex symmetric if and only if there is an orthonormal basis of $\mathcal{H}$ with respect to which T has a complex symmetric (i.e., self-transpose) matrix representation (see [4, Lemma 2.16]).

The general study of complex symmetric operators was initiated by Garcia, Putinar and Wogen in [5]–[8], and has recently received much attention (see [3], [9], [11]). The class of complex symmetric operators is surprisingly large and

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*Corresponding author.

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