

A $\sin 2\Theta$ Theorem for Graded Indefinite Hermitian Matrices

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Abstract

We give a bound for $\sin 2\theta$, which is a relative variant of a double angle theorem of Davis and Kahan, for the perturbations of invariant subspaces of a graded indefinite matrix $H = D^*AD$ perturbed to $\tilde{H} = D^*(A + \delta A)D$. One of the advantages this new bound has is that in it the relative gap uses the spectrum of either H or \tilde{H} , but not of both as in existing relative $\sin \theta$ theorems, and thus it may be more convenient to use. The bound, however, also contains the condition numbers of matrices arising from so-called hyperbolic singular value decompositions. In general, there is not much that can be said above these condition numbers, but in two special cases: scaled diagonal dominant matrices and quasi definite matrices, we obtain bounds that show these condition numbers behave nicely.