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Bounds on variation of eigenvectors and spectral subspaces under a perturbation

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We are reviewing known bounds on the variation of a spectral subspace (and, in particular, of an eigenvector) of a self-adjoint operator under an additive Hermitian perturbation. To this end we first recall the concept of operator angle between two subspaces of a Hilbert space. Then we recollect the spectral dispositions for which sharp norm bounds on the variation of the spectral subspace associated with an isolated spectral set have already been established. Starting from the celebrated Davis-Kahan trigonometric theorems in the subspace perturbation theory, all of these bounds have the form of an estimate of a norm of some trigonometric function of the operator angle Θ between the unperturbed and perturbed spectral subspaces through the same norm of the perturbation operator. The latest known sharp norm estimate called the a priori $\tan\Theta$ theorem serves for the case where the unperturbed spectral set lies in a finite gap of the remainder of the spectrum. We conclude the presentation by mentioning those questions of the subspace perturbation theory that still remain open.

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