The Rotation of Eigenspaces of Perturbed Matrix Pairs

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We present new $\sin\Theta$ theorems for relative perturbations of Hermitian definite generalized eigenvalue problem $A - \lambda B$, where both A and B are Hermitian and B is positive definite. The rotation of eigenspaces is measured in the matrix dependent scalar product. We assess the sharpness of the new estimates in terms of the effectivity quotients (the quotient of the measure of the perturbation with the estimator). The known $\sin\Theta$ theorems for relative perturbations of the single matrix Hermitian eigenspace problem are included as special cases in our approach. We also present the upper bound for the norm of J-unitary matrix F ($F^*JF = J$), which plays important role in the relative perturbation theory for *quasi-definite* Hermitian matrices H, where $H_{qd} \equiv P^T H P = [H_{11}\,, H_{12}; H_{12}^*\,, -H_{22}]$ and $J = \mathrm{diag}(I_k, -I_{n-k})$, for some permutation matrix P and $H_{11} \in \mathbb{C}^{k\times k}$ and $H_{22} + H_{12}^* H_{11}^{-1} H_{12} \in \mathbb{C}^{n-k\times n-k}$ positive definite .

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