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Deflation Techniques for Preconditioned Gradient Subspace Iterations

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Simultaneous computation of several eigenpairs by subspace iteration has two important advantages over computing them succesively by single vector iterations with deflation: (i) generally faster convergence to extreme eigenpairs, and (ii) 'cluster robustness', that is, the ability to efficiently compute clustered eigenvalues. However, when the number of computed eigenpairs is large, so is the computational cost per iteration, and in order to reduce this cost one has to resort to this or that deflation technique that would allow to effectively remove the eigenpairs computed to a desired accuracy from the computation. This paper discusses various deflation techniques that can be used in the framework of the so-called preconditioned gradient subspace iterations, which combine the preconditioned steepest descent and its conjugate gradient accelerations with the Rayleigh-Ritz method.