BASIC FACTS AND OPTIONS OF AUGMENTATION AND DEFLATION FOR LINEAR SOLVERS

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Abstract

The convergence of Krylov space solvers for linear systems is often hampered by a few small eigenvalues of the matrix. A suitable technique for dealing with such problems is to identify an approximately invariant subspace $\mathcal{U}$ that belongs to the set of these small eigenvalues. By using suitable orthogonal or oblique projections along $\mathcal{U}$ (that is, with null space $\mathcal{U}$) the Krylov solver can then be applied to a deflated problem that is restricted to a suitable complementary space. There are various ways to handle and implement this approach. They differ not only algorithmically and numerically, but often also mathematically. Some keywords associated with such methods are (spectral) deflation', 'augmented basis', 'recycling Krylov subspaces', and 'singular preconditioning'.

In this talk we want to review the basic facts, the various options, and some of the literature.