THEORETICAL AND NUMERICAL COMPARSION OF ABSTRACT PROJECTION METHODS DERIVED FROM DEFLATION, DOMAIN DECOMPOSITION AND MULTIGRID METHODS

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Abstract

For various applications, it is well-known that a two-level-preconditioned Krylov method is an efficient method for solving large and sparse linear systems. Beside a traditional preconditioner like incomplete Cholesky decomposition, a projector has been included as preconditioner to get rid of a number of small and large eigenvalues of the matrix. In literature, various projection methods are known coming from the fields of deflation, domain decomposition and multigrid.

From an abstract point of view these methods are closely related. The aim of this talk is to compare these projection methods both theoretically and numerically. We investigate their convergence properties and stability by considering implementation issues, rounding-errors, inexact coarse solves and severe termination criteria. Finally, we end up with a suggestion of the optimal second-level preconditioner, which is as stable as the balancing preconditioner and as cheap and fast as the deflation preconditioner.

This talk is based on joint papers with K. Vuik, Y. Erlangga, and J. Tang