INEXACT SHIFT-AND-INVERT ARNOLDI'S METHOD AND IMPLICIT RESTARTS WITH PRECONDITIONING FOR EIGENCOMPUTATIONS

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Abstract

We consider the computation of a few eigenvectors and corresponding eigenvalues of a large sparse nonsymmetric matrix. In order to compute eigenvalues in an isolated cluster around a given shift we apply shift-and-invert Arnoldi's method with and without implicit restarts. For the inner iterations we use GMRES as the iterative solver. The costs of the inexact solves are measured by the number of inner iterations needed by the iterative solver at each outer step of the algorithm.

We first extend the relaxation strategy developed by Simoncini [2] to implicitely restarted Arnoldi's method which yields an improvement in the overall costs of the method.

Secondly we apply a new preconditioning strategy to the inner solver. We show that small rank changes of the preconditioner can produce significant savings in the total number of iterations. This property has been observed in [1]. Numerical experiments illustrate the theory.

References

[1] M.A. Freitag and A. Spence, *Convergence rates for inexact inverse iteration with application to preconditioned iterative solves*, to appear in BIT.

[2] V. Simoncini, *Variable accuracy of matrix-vector products in projection methods for eigencomputation*, SIAM J. Numerical Analysis 43, 3 (2005), pp. 1155–1174.