TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

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Numerical Solution of Eigenvalue Problems with Spectral Transformations (Part II)

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Abstract.

This series of two talks is concerned with inexact eigenvalue algorithms for solving large sparse matrix eigenvalue problems. In this second part, we study an inexact subspace iteration for solving generalized non-Hermitian eigenvalue problems with spectral transformation. We provide new insights into the preconditioner with tuning and propose a two-phase algorithm to use the tuned preconditioner in a simplified way to achieve similar performance for generalized problems. We discuss the connection between the two-phase algorithm and some methods for efficiently solving the linear systems arising in inexact inverse power method. In addition, we show that the cost of iterative solution of the linear systems can be further reduced by several additional techniques.

We then discuss an inexact implicitly restarted Arnoldi (IRA) method for solving the same type of eigenvalue problems. We present new analysis of two major strategies that help reduce the inner iteration cost. Specifically, we study a new tuning strategy constructed from vectors in both previous and the current IRA cycles, and show how the tuning is used in a new two-phase algorithm to greatly reduce inner iteration counts. We then give an upper bound of the allowable tolerances for the solution of the linear systems and propose an alternative estimate of the tolerances.