Dywayne Nicely

Restarted Lanczos Algorithms

Math Department
Baylor University
Waco
TX 76798-7328
Dywayne_Nicely@baylor.edu
Ron Morgan

Restarted versions of the symmetric and nonsymmetric Lanczos algorithms are given for computing eigenvalues. Approximate eigenvectors are retained at the restart as with implicitly restarted Arnoldi. In the nonsymmetric case, both the right and left eigenvectors are computed. Three-term recurrences are used to reduce expense, and the restarting limits the storage needs. Some reorthogonalization is needed, and several approaches will be discussed.

These restarted Lanczos methods can also be used to solve large systems of linear equations. In particular, a restarted BiCG algorithm will be given that solves both the linear equations and the eigenvalue problem. The inclusion of eigenvectors in the subspaces causes deflation of small eigenvalues that improves the convergence compared to other restarted approaches. For multiple right-hand sides, a deflated BiCGStab approach uses both the right and left eigenvectors that were generated by the restarted BiCG. Applications to quantum chromodynamics will be given.

We also investigate a restarted two-sided Arnoldi algorithm. We compare expense and stability of this approach with restarted nonsymmetric Lanczos.