Improved algorithms for solving nonsymmetric eigenvalue problems

Daniel Kressner
Technische Universität Berlin

Still being the method of choice for computing all the eigenvalues of a nonsymmetric matrix, the QR algorithm has recently undergone significant improvements. New techniques, in particular aggressive early deflation and small-bulge multishift iterations, help decrease its execution time by up to a factor of ten. The first part of this talk summarizes these developments and proposes extensions to other eigenvalue algorithms, such as the QZ algorithm for solving generalized eigenvalue problems associated with a matrix product AB^{-1}. It is planned that the corresponding implementations replace existing LAPACK functionality for solving generalized eigenvalue problems.

The second part is concerned with product eigenvalue problems involving more than two factors, which appear in various areas of control theory and bifurcation analysis. Algorithms that work on the factors instead of forming a matrix product explicitly usually attain higher numerical accuracy. A general framework for developing and understanding such algorithms is presented.

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