THE PARALLEL MULTISHIFT QR ALGORITHM WITH AGGRESSIVE EARLY DEFLATION

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Abstract

The QR algorithm which computes the Schur decomposition of a matrix is by far the most important approach for solving dense nonsymmetric eigenvalue problems. Recently a novel parallel QR algorithm has been developed by incorporating some modern techniques such as small-bulge multishift and aggressive early deflation (AED). The novel parallel approach significantly outperforms the pipelined QR algorithm in ScaLAPACK v1.8.0 and earlier versions. But AED becomes a computational bottleneck in the new parallel QR algorithm. We develop multilevel AED algorithms which indeed decrease the total amount of communications and further improve the performance of the parallel QR algorithm. The improved version is now available as a part of ScaLAPACK version 2.0. Both performance models and numerical experiments demonstrate the efficiency of the new approach.