ON A PARALLEL IMPLEMENTATION OF THE ONE-SIDED BLOCK JACOBI SVD ALGORITHM

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Abstract

Recent progress in the serial one-sided Jacobi method is the consequence of two main ideas. The first one is that of preconditioning of an original matrix by one (two) QR (and LQ) decomposition(s) with column pivoting. Drmač and Veselić [1] have shown (experimentally and, to some degree, also theoretically) that such a preconditioning leads to a significant concentration of an off-diagonal matrix norm near the main diagonal. Then the one-sided Jacobi method is applied to the R-factor (L-factor) together with a clever modification of a cyclic ordering. Consequently, less sweeps are needed for the convergence, and the efficiency of the one-sided Jacobi method with preconditioning is suddenly comparable to that of bidiagonalization or divide-and-conquer approach.

The second idea is that of working with matrix blocks instead of matrix elements, which is usually much more efficient on modern computer architectures (serial or parallel) due to the hierarchical memory organization. Hari [2] has shown how to use matrix blocks and cyclic matrix orderings in the one-sided Jacobi method and how to organize fast computations using the CS decomposition of those matrix blocks.

In this contribution we design the parallel one-sided block Jacobi SVD algorithm using both above mentioned ideas. The data layout, computational and communication complexity are discussed in detail, and the results of first numerical experiments obtained on a cluster of personal computers are presented.

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References

[1] Z. Drmač, K. Veselić, *New fast and accurate Jacobi SVD algorithm: I. and II.*, LAPACK Working Note 169 and 170, August 2005.

[2] V. Hari, *Accelerating the SVD block-Jacobi method*, Computing, 75 (2005), pp. 27–53.