Partitioned triangular tridiagonalization: rounding error analysis

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We consider a partitioned algorithm for reducing the symmetric matrix A to tridiagonal form, which computes a factorization $PAP^T = LTL^T$ where P is a permutation matrix, L is lower triangular with a unit diagonal and bounded off-diagonal elements, and T is symmetric tridiagonal. We show that such a partitioned factorization is backward stable provided that the corresponding growth factor is not too large (the entries can grow in the factor T). The only slight change with respect to the basic (nonpartitioned) algorithm is in the constant that includes the the size of partition which, on the other hand, allows to exploit modern computer architectures through the use of the level-3 BLAS. Experimental results demonstrate that such algorithm achieves approximately the same level of performance as the blocked Bunch-Kaufman code implemented in Lapack. The Bunch-Kaufman method is also conditionally backward stable (assuming no or moderate growth in triangular factors) making these two main approaches comparable also from the numerical stability point of view.

References

[1] M. Rozloznik, G. Shklarski and S. Toledo: Partitioned triangular tridiagonalization, accepted in ACM Transactions on Mathematical Software, 2009.