ON THE STABILITY OF THE BAREISS AND RELATED TOEPLITZ FACTORIZATION ALGORITHMS

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Abstract

This paper contains a numerical stability analysis of factorization algorithms for computing the Cholesky decomposition of symmetric positive definite matrices of displacement rank 2. The algorithms in the class can be expressed as sequences of *elementary downdating* steps. The stability of the factorization algorithms follows directly from the numerical properties of algorithms for realizing elementary downdating operations. It is shown that the Bareiss algorithm for factorizing a symmetric positive definite Toeplitz matrix is in the class and hence the Bareiss algorithm is stable. Some numerical experiments that compare behavior of the Bareiss algorithm and the Levinson algorithm are presented. These experiments indicate that in general (when the reflection coefficients are not all of the same sign) the Levinson algorithm can give much larger residuals than the Bareiss algorithm.

Comments

Only the Abstract is given here. The full paper will appear as [2]. For a preliminary version, see [1].

References

1. A. W. Bojanczyk, R. P. Brent and F. R. de Hoog, *Stability Analysis of Fast Toeplitz Linear System Solvers*, Report CMA-MR17-91, Centre for Mathematical Analysis, ANU, August 1991, 23 pp. rpb126tr.
2. A. W. Bojanczyk, R. P. Brent, F. R. de Hoog, and D. R. Sweet, "On the stability of the Bareiss and related Toeplitz factorization algorithms", *SIAM J. Matrix Anal. Appl.*, to appear. Available as Report TR-CS-93-14, CS Lab, ANU, November 1993, 18 pp. rpb144.

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