TRIDIAGONALIZATION OF A SYMMETRIC MATRIX ON A SQUARE ARRAY OF MESH-CONNECTED PROCESSORS

A. BOJANCZYK AND R. P. BRENT

Abstract

A parallel algorithm for transforming an $n \times n$ symmetric matrix to tridiagonal form is described. The algorithm implements Givens rotations on a square array of $n \times n$ processors in such a way that the transformation can be performed in time $O(n \log n)$. The processors require only nearest-neighbor communication. The reduction to tridiagonal form could be the first step in the parallel solution of the symmetric eigenvalue problem in time $O(n \log n)$.

Comments

Only the Abstract is given here. The full paper appeared as [1]. It is interesting that both the direct reduction to tridiagonal form, and the iterative eigenvalue computation by Jacobi-like methods [2], seem to require time $\Omega(n \log n)$. The choice of which approach to the symmetric eigenvalue problem is best may depend on details of the parallel machine architecture.

References

[1] A. W. Bojańczyk and R. P. Brent, "Tridiagonalization of a symmetric matrix on a square array of mesh-connected processors", *J. Parallel and Distributed Computing* 2 (1985), 261–276. Also appeared as Report CMA-R45-83, CMA, ANU, December 1983, 23 pp. rpb086.

[2] R. P. Brent and F. T. Luk, "The solution of singular-value and symmetric eigenvalue problems on multiprocessor arrays", *SIAM J. Scientific and Statistical Computing* 6 (1985), 69–84. MR 86i:65089. rpb084.

Centre for Mathematical Analysis, Australian National University, Canberra

1991 *Mathematics Subject Classification.* Primary 65Y05; Secondary 65F15, 65Y10, 68Q35.

Key words and phrases. Tridiagonalization, eigenvalues, Givens rotations, plane rotations, similarity transformations, QR algorithm, parallel algorithms, special-purpose hardware, systolic arrays, VLSI.

Received October 22, 1984.

We thank H. T. Kung for suggesting the problem and for helpful discussions during November 1982.