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Randomization and the parallel solution of linear algebra problems. (English) Zbl 0835.65062

Summary: We present randomized algorithms for the solution of some numerical linear algebra problems. The problems studied are the approximation of the dominant eigenvalue of a matrix, the computation of the determinant and of the rank of a matrix. The parallel cost of these methods is lower than that of the best deterministic algorithms for the same problems. In particular, we show an $O(\log n)$ algorithm for the parallel computation of the determinant of a matrix and an $O(\log n + \log k)$ algorithm that allows to approximate the vector produced at the $k$th step of the power method. The “probabilistic” error is bounded in terms of the Chebyshev inequality.

MSC:
65F15 Numerical computation of eigenvalues and eigenvectors of matrices
65C05 Monte Carlo methods
65F40 Numerical computation of determinants
65F30 Other matrix algorithms (MSC2010)
65Y05 Parallel numerical computation

Keywords:
error bound; randomization; Monte Carlo method; randomized algorithms; dominant eigenvalue; determinant; rank; parallel computation; power method

Full Text: DOI

References:
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