

Chan, Raymond H.; Nagy, James G.; Plemmons, Robert J.

FFT-based preconditioners for Toeplitz-block least squares problems. (English)

Zbl 0793.65029

SIAM J. Numer. Anal. 30, No. 6, 1740-1768 (1993).

This interesting paper presents a comprehensive development of preconditioners for Toeplitz-block least squares problems, as those arising in two-dimensional deconvolution.

One and two-dimensional preconditioners using *T. Chan's* circulant approximation to Toeplitz matrices [SIAM J. Sci. Stat. Comput. 9, No. 4, 766-771 (1988; Zbl 0646.65042)] are defined for the least squares problem. The advantage of using this type of approximation is that its spectrum can be economically calculated using fast Fourier transforms (FFT's), which in turn can be used to obtain a pre-conditioned matrix with singular values clustered around 1, a most favorable situation for the convergence of the conjugate gradient method.

A complete error and complexity analysis makes the bulk of the paper, which is crown with a discussion of applications to two-dimensional deconvolution problems arising in imaging restoration, including some very promising preliminary numerical results.

Reviewer: V.Pereyra (Los Altos)

MSC:

65F20 Numerical solutions to overdetermined systems, pseudoinverses

65F35 Numerical computation of matrix norms, conditioning, scaling

Cited in **23** Documents

Keywords:

error bound; preconditioners; Toeplitz-block least squares problems; two- dimensional deconvolution; circulant approximation; fast Fourier transforms; singular values; convergence; conjugate gradient method; complexity; imaging restoration; numerical results

Software:

LSQR

Full Text: DOI