ILU Preconditioning Based on the FAPINV Algorithm

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Abstract

A technique for computing an ILU preconditioner based on the factored approximate inverse (FAPINV) algorithm is presented. We show that this algorithm is well-defined for H-matrices. Moreover, when used in conjunction with Krylov-subspace-based iterative solvers such as the GMRES algorithm, results in reliable solvers. Numerical experiments on some test matrices are given to show the efficiency of the new ILU preconditioner.

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1. Introduction

Consider the linear system of equations

$$Ax = b, \tag{1}$$

where the coefficient matrix $A \in \mathbb{R}^{n \times n}$ is nonsingular, large, sparse and $x, b \in \mathbb{R}^n$. Such linear systems are often solved by Krylov subspace methods such as the GMRES [24] and the BiCGSTAB [32] methods. In general, the convergence of the Krylov subspace methods is not guaranteed or it may be extremely slow. Hence, the original system (1) is transformed into a more tractable form. More precisely, to obtain good convergence rates, or even to converge, Krylov subspace methods are applied to the left preconditioned linear system

$$MAx = Mb,$$

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