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A generalized shift-splitting preconditioner for complex symmetric linear systems*

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Abstract In this paper, the generalized shift-splitting (GSS) preconditioner is implemented for solving a class of generalized saddle point problems which stem from the solution of complex symmetric linear systems. The GSS preconditioner is induced by the generalized shift-splitting iterative method. Theoretical analysis shows that the generalized shift-splitting iterative method is unconditionally convergent. Some numerical experiments are provided to show the effectiveness of the proposed preconditioner.

Keywords: complex symmetric linear systems; generalized shift-splitting; convergence; preconditioner.

1 Introduction

Consider the iterative solution of the system of linear equations

$$\mathcal{A}u = b,\ \mathcal{A} \in \mathbb{C}^{n\times n},\ u, b \in \mathbb{C}^n, \tag{1.1}$$

where $\mathcal{A}$ is a complex symmetric matrix of the form

$$\mathcal{A} = W + \mathtt{i}T,\ (\mathtt{i} = \sqrt{-1}) \tag{1.2}$$

and $W, T \in \mathbb{R}^{n\times n}$ are symmetric matrices. Here and in the sequel, we let W be positive definite and T be positive semidefinite. Such linear systems arise in a variety of scientific

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