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A modified generalized shift-splitting method for nonsymmetric saddle point problems*

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Abstract

In this paper, we propose a modified generalized shift-splitting (denoted by MGSSP) preconditioned method for solving large sparse saddle-point problems. By theoretical analyses, we verify the MGSSP iteration method unconditionally converges to the unique solution of the saddle point problems, estimate the sharp eigenvalue bounds of the related iteration matrix and point out the corresponding preconditioned matrix is positive real. Finally, we perform some numerical computations to show the efficiency and the feasibility of the MGSSP preconditioner.

Key words: modified generalized shift-splitting; convergence; saddle point problems; clustering property; Krylov subspace methods

1 Introduction

Consider the large sparse saddle-point system $\mathbb{A}u = b$ of form

$$\mathbb{A}u = \begin{pmatrix} B & E \\ -E^T & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} f \\ g \end{pmatrix}, \tag{1.1}$$

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