

THE REGULARIZED PRECONDITIONED GMRES AND THE ITERATION METHODS FOR NONSYMMETRIC SADDLE-POINT PROBLEMS

Abstract. In the present paper we propose a new preconditioner for solving the saddle point problem. The preconditioner is obtained by replacing the $(1, 2)$ and $(2, 2)$ blocks in the original saddle-point matrix \mathcal{A} by another well chosen block. The proposed preconditioner can be used as a preconditioner corresponding to the stationary iterative method or to accelerate the convergence of the Generalized Minimal Residual method (GMRES). The convergence properties of the regularized iteration method are derived. Meanwhile, we analyzed the eigenvalue-distribution and the eigenvectors of the preconditioned matrix. Finally, numerical results show the effectiveness of the proposed preconditioner as compared to other preconditioners.

Key words. Krylov methods, Preconditioning, Saddle point, Kronecker product