

A Preconditioned global method for solving the saddle point problem with multiple right-hand sides

Achraf BADAHMANE, LMPA

Hafid Abdeslam BENTBIB, FST-Marrakech

Hassan SADOK, LMPA

In the present paper, we propose the preconditioned global approach [5] as a new strategy to solve saddle point problems with several right-hand sides. The preconditioner is obtained by replacing the saddle block $(2, 2)$ by another block of the Saddle-point matrix \mathcal{A} . We applied the global GMRES method for this problem with several right hand sides and we gave new convergence results and we analyzed the eigenvalue-distribution and the eigenvectors of the preconditioner. Finally, numerical results show that our preconditioned global GMRES method, has high performance as compared to other preconditioned global GMRES methods for solving the saddle point problem with several right hand sides.

Références

- [1] Bellalij M, Jbilou K, Sadok H. New convergence results on the global GMRES method for diagonalizable matrices. *Journal of Computational and Applied Mathematics.*, 219 (2008). pp. 350-358.
- [2] Benner P, Saak J, Stoll M, Weichelt KH. Efficient solution of large-scale saddle point systems arising in riccati-based boundary feedback stabilization of incompressible stokes flow. *Siam J. Sci. Comput.*, 35 (2013), pp. S150-S170.
- [3] Bissuel A, Allaire G, Daumas L, Chalot F, Mallet M. Linear Systems with multiple right-hand sides with GMRES, an application to aircraft design. *ECCOMAS congress 2016* .
- [4] Bouyouli R, Jbilou K, Sadaka R, Sadok H. Convergence proprieties of some block Krylov subspace methods for multiple linear systems. *J. Comput. Appl. Math.*, 196 (2006), pp. 498-511.
- [5] Cao HZ. Augmentation block preconditioners for saddle point-type matrices with singular $(1, 1)$ blocks. *Linear Algebra Appl.*, 15 (2008) , pp. 515-533 .
- [6] Elman CH, Ramage A, Silvester JD, IFISS: A Matlab toolbox for modelling incompressible flow, *ACM Trans. Math. Software.* 33 (2007) Article 14.
- [7] Elbouyahyaoui L, Messaoudi A, Sadok H. Algebraic properties of the block GMRES and block arnoldi methods. *Electronic Transaction on Numerical Analysis.*, 33 (2009), pp. 207-220.
- [8] Jbilou K, Messaoudi A, Sadok H. Global FOM and GMRES algorithms for matrix equation. *App. Num.Math.*, 31 (1999), pp. 49-43.

Achraf BADAHMANE, LMPA, Université du Littoral Côte d'Opale, 50 Rue F. Buisson, BP 699 - 62228 Calais cedex, France.

`Badahamane.achraf@gmail.com`

Hafid Abdeslam BENTBIB, FST-Marrakech, Laboratoire de Mathématiques Appliquées et Informatique, Marrakech, Morocco.

`a.bentbib@uca.ma`

Hassan SADOK, LMPA, Université du Littoral Côte d'Opale, 50 Rue F. Buisson, BP 699 - 62228 Calais cedex, France.

`Hassane.Sadok@lmpa.univ-littoral.fr`