Review of the convergence of some Krylov subspace methods for linear systems of equations with one or several right hand sides

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Abstract

Krylov subspace methods are widely used for the iterative solution of a large variety of linear systems of equations with one or several right hand sides or for solving nonsymmetric eigenvalue problems.
It is the purpose of the present talk to compare three variants of GMRES for multiple right hand-sides including a block GMRES [1, 3, 4, 5]. These schemes are based on block Arnoldi-types methods and differ in the choice of inner product. We provide a unified description of the methods discussed and derive new expressions and bounds for the residual errors.
We will also discuss the block version of the BiCGSTAB algorithm[2], for solving multiple linear systems using some algebraic orthogonalities.

References

[1] L. ELBOUYAHYAOUI, A. MESSAOUDI AND H. SADOK, *Algebraic Properties of Block Arnoldi algorithm and Block GMRES method*, Elect. Trans. Num. Anal., 33 (2009) pp. 207–220.

[2] M. EL GUENNOUNI, K. JBILOU AND H. SADOK, *A Block version of BICGSTAB for linear systems with multiples right-hand sides*, Elect. Trans. Num. Anal., 16 (2003) pp. 129–146.

[3] K. JBILOU, A. MESSAOUDI AND H.SADOK, *Global FOM and GMRES algorithms for matrix equations*, App. Num. Math., 31 (1999) pp. 49–43.

[4] M.H. GUTKNECHT, *Block Krylov Space Methods for Linear Systems With Multiple Right-hand Sides: an Introduction*, [Aug. 2005; to appear 2006 in: Modern Mathematical Models, Methods and Algorithms for Real World Systems (A.H. Siddiqi, I.S. Duff, and O. Christensen, eds.), Anamaya Publishers, New Delhi, India.]

[5] V. SIMONCINI AND E. GALLOPOULOS, *Convergence properties of block GMRES and matrix polynomials*, Linear Algebra Appl., 247(1996), pp. 97-119.