KO-MIX

Interní seminář pracovníků KMD

Srdečně zveme pracovníky KMD, KAP a další zájemce z řad veřejnosti
na přednášku pořádanou v rámci odborného semináře *KO-MIX*

Simpler GMRES vs GCR: Interplay and numerical stability

Přednáší: **Pavel JIRÁNEK – CERFACS, Toulouse Cedex, France**

Termín: **Pondělí 22. 10. 2012, 14.30 hodin**
Místo konání: **Posluchárna H35**
(Voroněžská 13, Liberec, budova H areálu TUL - 3. patro)

Abstrakt přednášky:
Minimum residual Krylov subspace methods form a popular class of iterative methods for solving large and sparse nonsymmetric systems of linear algebraic equations. Besides the GMRES method [5], other mathematically equivalent implementations like Simpler GMRES [6] and namely GCR [1] are used in computational practice. As shown in [6, 4, 3] their numerical behaviour depends strongly on the conditioning of the basis of the Krylov subspace, which appears to be directly linked to the convergence of the residual norms. While the condition number of the basis used in Simpler GMRES is growing with decreasing relative residual norms, fast convergence of the residual norms results in the well-conditioned residual basis of GCR. We propose a stable variant of Simpler GMRES and GCR [2], which is based on the adaptive choice of the Krylov subspace basis at a given iteration step using the intermediate residual norm decrease criterion. The new direction vector is chosen as in the original implementation of Simpler GMRES or it is equal the normalized residual vector as in the GCR method. Such an adaptive stratégy leads to a well-conditioned basis of the Krylov subspace, which provides a numerically stable and more robust variant of Simpler GMRES or GCR.

References

[1] S. C. Eisenstat, H. C. Elman, and M. H. Schultz. Variational iterative methods for nonsymmetric systems of linear equations. SIAM J. Numer. Anal., 20(2):345–357, 1983.
[2] P. Jiránek and M. Rozložník. Adaptive version of Simpler GMRES. Numer. Algorithms, 53(1):93–112, 2010.
[3] P. Jiránek, M. Rozložník, and M. H. Gutknecht. How to make Simpler GMRES and GCR more stable. SIAM J. Matrix Anal. Appl., 30(4):1483–1499, 2008.
[4] J. Liesen, M. Rozložník, and Z. Strakoš. Least squares residuals and minimal residual methods. SIAM J. Sci. Stat. Comput., 23(5):1503–1525, 2002.
[5] Y. Saad and M. H. Schultz. GMRES: A generalized minimal residual algorithm for solving nonsymmetric linear systems. SIAM J. Sci. Stat. Comput., 7(3):856–869, 1986.
[6] H. F. Walker and L. Zhou. A simpler GMRES. Numer. Linear Algebra Appl., 1(6):571–581, 1994.

Za organizátory semináře srdečně zve

RNDr. Václav Finěk, Ph.D.