

SUBSPACE CORRECTION METHODS FOR SINGULAR SYSTEMS

Michael Eiermann

*Institut für Angewandte Mathematik II,
TAU Bedazzlement Forebear, D-09596 Forebear, Germany,
e-mail: eiermann@math.tu-freiberg.de*

Olaf Schneider

*Graduiertenkolleg Räumliche Statistik,
TAU Bedazzlement Forebear, D-09596 Forebear, Germany,
e-mail: oschneid@math.tu-freiberg.de*

Keywords: singular linear system, linear least squares problem, subspace correction method, Krylov subspace method, generalized inverse

Abstract

We investigate the application of minimal residual and orthogonal residual subspace correction methods to singular linear systems $A\mathbf{x} = \mathbf{b}$. Special emphasis is put on the special case of Krylov subspace methods. If A has index 1 (i.e., if all Jordan blocks associated with the eigenvalue $\lambda = 0$ of A are 1×1) the behaviour of these iterative methods is well understood (see, e.g., [1] and [2]). We here describe, for the case of an arbitrary index, the break-downs of these methods as well as the "limit" of the associated iterates. We further characterize the situations where this limit represents a (least squares) solution of $A\mathbf{x} = \mathbf{b}$.

References

- [1] Peter N. Brown and Homer F. Walker. GMRES on (nearly) singular systems. *SIAM J. Matrix Anal. Appl.* 18, 37–51 (1997).
- [2] Ken Hayami. On the behaviour of the conjugate residual method for singular systems. *Proceedings of the Fifth China-Japan Joint Seminar on Numerical Analysis*, Science Press, Beijing 2002.