Arioli, M.; Scott, J.
Chebyshev acceleration of iterative refinement. (English) Zbl 1296.65052

Summary: It is well known that the flexible inner-outer preconditioned generalized minimal residual (FGMRES) algorithm of Y. Saad [SIAM J. Sci. Comput. 14, No. 2, 461–469 (1993; Zbl 0780.65022)] can be used as an alternative to iterative refinement and, in some instances, is successful in computing a backward stable solution when iterative refinement fails to converge. In this study, we analyse how variants of the Chebyshev algorithm can also be used to accelerate iterative refinement without loss of numerical stability and at a computational cost at each iteration that is less than that of FGMRES and only marginally greater than that of iterative refinement. A component-wise error analysis of the procedure is presented and numerical tests on selected sparse test problems are used to corroborate the theory.

MSC:
65F10 Iterative numerical methods for linear systems
65F05 Direct numerical methods for linear systems and matrix inversion
65F50 Computational methods for sparse matrices

Keywords:
Chebyshev method; iterative refinement; Gaussian elimination; sparse matrices; flexible inner-outer preconditioned generalized minimal residual algorithm; numerical stability; error analysis; numerical test

Software:
HSL_MAI497; SparseMatrix; mctoolbox

Full Text: DOI

References:


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