
GMRES-based iterative refinement in five precisions for the solution of large sparse linear systems

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Résumé

The increasing support of low floating-point precisions in modern hardware has generated renewed interest in the solution of linear systems in mixed precision arithmetic. GMRES-based iterative refinement can handle much more ill-conditioned problems than traditional iterative refinement by solving the correction equation with GMRES preconditioned by a low precision LU factorization. The practical interest of this method in its original version is mitigated by the need to apply the preconditioner within the GMRES solver in high precision. We show that this requirement can be relaxed, leading to a more flexible variant of GMRES-based iterative refinement that uses up to five precisions. We will present the rounding error analysis of this new method and will showcase its use for the solution of large and sparse linear systems by harnessing a low precision, parallel sparse direct solver.

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