Mixed precision iterative refinement for least squares with linear equality constraints and generalized least squares problems

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Abstract

Recent development on mixed precision techniques has largely enhanced the performance of various linear algebra solvers, one of which being the solver for the least squares problem min_x ——b-Ax——_2. By transforming least squares problems into augmented linear systems, mixed precision techniques are capable of refining the lower precision solution to the working precision. In this paper, we propose mixed precision iterative refinement algorithms for two variants of least squares problems—the least squares problem with linear equality constraints (LSE) and the generalized least squares problem (GLS). Both classical and GMRES-based iterative refinement can be applied to augmented systems of these two problems to improve the accuracy of the solution. For reasonably well-conditioned problems our algorithms reduce the execution time by a factor of 40% in average compared to the fixed precision ones from LAPACK on the x86-64 architecture.

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