Mixed Precision Strategies for Solving Sparse Linear Systems with BiCGStab

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Abstract

Most numerical simulations are carried out in double precision, however, the emergence of efficient hardware using lower precision has motivated its introduction in hope to decrease the energy consumption and to have an optimal use of the memory. Iterative linear solvers based on Krylov subspace like BiCGStab or GMRES are often used in combination with a preconditioner to speed up their convergence. In this presentation, we propose different solutions for using lower precision in BiCGStab while maintaining a convergence to high accuracy. First, we show that the use of the flexible variant of BiCGStab allows for the preconditioner to be applied in lower precision. Second, we show that we can even switch the rest of the operations to lower precision and refine the solution to high accuracy with an iterative refinement algorithm and a variation tailored to BiCGStab. We assess the potential of our algorithms for solving large linear systems coming from various industrial applications.

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