Communication Avoiding ILU0 Preconditioner

We present a communication avoiding ILU0 preconditioner for solving large systems of linear equations by using iterative Krylov subspace methods. Recent research has focused on communication avoiding Krylov subspace methods based on so called s-step methods. However there is no communication avoiding preconditioner yet, and this represents a serious limitation of these methods. Our preconditioner allows to perform s iterations of the iterative method with no communication, through ghosting some of the input data and performing redundant computation. It thus reduces data movement by a factor s between different levels of the memory hierarchy in a serial computation and between different processors in a parallel computation. To avoid communication, an alternating reordering algorithm is introduced, that requires the input matrix to be ordered by using nested dissection or kway partitioning. We show that the reordering does not affect the convergence rate of the ILU0 preconditioned system as compared to nested dissection and kway ordering, while it reduces data movement and should improve the expected time needed for convergence.

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