A strategy for reduction of number of synchronization points of parallel Krylov subspace methods

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Abstract: We consider a strategy for reduction of number of synchronization points included in the Krylov subspace methods in order to solve efficiently a linear system of equations on parallel computers with the distributed memory. As well known, some operations for the innper product exist always in the Krylov subspace method, and the global synchronization is necessary for the computation of inner product under the computational circumstances of the distributed memory. Thus, for gaining high speedup of parallel computation, it is significant to minimize the communication time between many processors.

Therefore, we devised a strategy for reduction of number of synchronization points of parallel variants of the iterative methods. Conventional modification of the algorithm itself has been made for the reduction of number of synchronization points. In this case, however, complicated instability of convergence occured sometimes as reported in some references. We focused on existence of two parameters α_k and β_k included in the Lanczos polynomials in place of modification of the order concerned with vector-vector operations and matrix-vector multiplication in the algorithm. We devised two variants with A^{T} and without A^{T} in the parameters for the BiCGSafe and BiCGStar-plus methods proposed by K. Murakami *et al*.

In our talk, we would like to talk about the strategy for reduction of number of synchronization points of parallel efficient variants of iterative methods. Moreover, through many numerical experiments, we make clear that the proposed parallel iterative methods outperform other iterative methods in view of the elapsed time, stability of convergence and speed-up on parallel computers with the distributed memory.

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