Variations on Frobenius-Norm Based Sparse Approximate Inverse Preconditioners

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The convergence rate of Krylov subspace iterative methods usually depends greatly on any preconditioning which is used.

In this talk we will discuss some new variations on the standard approximate inverse preconditioner, P, which is obtained by minimizing

$$\min_{P \in S} \|I - PA\|_F$$

over matrices with a given sparsity pattern S. Such preconditioners, have the advantage of being highly parallellizable - both in construction and application - and can be applied to a wide variety of matrices. Elliptic partial differential equations are far from ideally suited for such preconditioning. However, we will mainly concentrate on the model problem of the 5-point Laplacian, through which we can consider the grid-size asymptotics of our preconditioner and can compare it with ILU factorizations. It is well known that appropriately modified ILU factorizations can reduce the condition number for this problem from $O(h^{-2})$ to $O(h^{-1})$. To have such a clustered spectrum would be a great attribute for a parallel approximate inverse preconditioner also, and we show results in this direction.

Results for artificial test problems will also be shown.

Acknowledgement: This research is funded by an EPSRC CASE award, in collaboration with NAG Ltd.

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