A ROBUST ALGEBRAIC DOMAIN DECOMPOSITION PRECONDITIONER FOR SPARSE NORMAL EQUATIONS

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Solving the normal equations corresponding to large sparse linear least-squares problems is an important and challenging problem. For very large problems, an iterative solver is needed and, in general, a preconditioner is required to achieve good convergence. In recent years, several preconditioners have been proposed. These are largely serial and reported results demonstrate that none can solve all sparse least-squares problems. Our interest is thus in designing new preconditioners for the normal equations that are efficient, robust, and can be implemented in parallel. Our proposed preconditioners can be constructed efficiently and algebraically without any knowledge of the problem and without any assumption on the least- squares matrix except that it is sparse. We exploit the structure of the symmetric positive definite normal equations matrix and use the concept of algebraic local symmetric positive semi-definite splittings to introduce two-level Schwarz preconditioners for least-squares problems. We implement the proposed preconditioners within the PETSc library and illustrate their performance using problems arising from practical applications.

References:

[1] https://arxiv.org/pdf/2107.09006.pdf

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