

Unsymmetric Nested Dissection

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George's nested dissection method has proven highly successful in reducing fill for sparse Cholesky factorization of symmetric matrices. We present generalizations of nested dissection for unsymmetric matrices. The goal is to reorder to reduce fill in sparse LU factorization. A popular approach is to use standard nested dissection on the symmetrized matrix, $A + A^T$, but this does not work well on highly unsymmetric matrices. We focus on the HUND method [HUND], which uses hypergraph partitioning to permute the matrix (recursively) into singly-bordered block diagonal form. This method is closely related to nested dissection on $A^T A$ but we never form the denser matrix $A^T A$. A significant feature is that the method can be used as a column ordering and allows for partial pivoting along rows, while preserving sparsity. We discuss several implementation choices in the method, for example how to do local ordering within the column blocks. We show some results on highly unsymmetric matrices from the UF collection.

[HUND] *Hypergraph-based Unsymmetric Nested Dissection Ordering for Sparse LU Factorization*, L. Grigori, E.G. Boman, S. Donfack, and T.A. Davis, SIAM J. Sci. Comp., vol. 32, iss. 6, pp. 3426-3446, 2010.

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