A Survey of Incomplete Factorization Preconditioners

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Abstract: Given a sparse matrix A, an incomplete LU factorization computes a sparse approximation to the LU factors of A by "dropping" nonzeros in a Gaussian elimination process. Incomplete factorizations are among the most widely used preconditioners in practice. This talk will survey the algorithms used for computing these factorizations. We will view incomplete factorizations from various perspectives, for example, as operations with stencils, which is how ILU factorizations were first developed. New dropping strategies, for example, can be developed from multigrid ideas. Among the variants of these preconditioners, we will discuss "modified" ILU, Tismenetsky's factorization, and approximate block factorizations. On the practical side, we will also look at efficient implementations, and how these methods perform and behave in practice. Also necessary to our discussion will be how reordering affects the ILU factorization.