Cholesky Methods for Numerical Factorization in Interior Point Algorithms

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Abstract :

Interior point algorithms for liner programming achieve significant reductions in computer time over earlier methods for large linear programming problems and solve problems larger than previously possible. The most computationally intensive step in each iteration of any interior point algorithm is the numerical factorization of a sparse, symmetric, positive definite matrix. In large or relatively dense problems, 80--90 % or more of computational time is spent in this step.

This study concentrates on the numerical factorization methods such as column and multifrontal Cholseky methods, based on graph theory applied to sparse symmetric matrices. We use advanced techniques such as loop unrolling technique and equivalent sparse matrix ordering to improve the performance of the numerical factorization step. Our studies are incorporated into OB1 (Optimization with Barrier 1) which is an implementation of the primal-dual barrier algorithm. Computational experiments on relatively large LPs on a DECstation 3100 demonstrates that the primal-dual barrier algorithm using our advanced column Cholesky methods outperforms by 20--60 % the same algorithm using straightforward Cholesky ones.