Influence of matrix reordering on the performance of the iterative methods for solve linear systems arising from interior point methods.

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The searching directions in interior-point method are computed through the solution of one or more linear systems. The solution of these systems is the most expensive step of these methods. Such systems are indefinite and can be reduced to a smaller positive-definite system, i.e. normal equations. For some classes of large-scale problems, the use of direct methods is prohibiting because of storage and running-time limitations. In such situations, iterative approaches are recommended.

The performance of implementations using iterative methods depends on the choice of an appropriate preconditioner, in particular for interior point methods; the linear system becomes highly ill-conditioned as an optimal solution of the problem is approached. Recently, a two phase hybrid preconditioner was proposed that uses the controlled Cholesky factorization during the initial iterations and in the remaining ones adopts the splitting preconditioner.

In context of direct methods to solve the interior point systems, sparse matrix reordering technique has been extensively adopted. For iterative methods, the use of matrix reordering can also improve the time of computing preconditioner based on incomplete Cholesky factorization and reducing inner iterations.

This work analyzes the influence of sparse matrix reordering over performance of preconditioner conjugate gradient method for solve normal equations systems of interior point methods using the hybrid preconditioner. The reordering of reverse Cuthill-Mckee heuristics, the Sloan algorithm and minimum degree are analyzed in this study. Numerical experiments indicate that these heuristics accelerate the convergence of iterative methods and improve the solution time.