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A New Approach for Finding a Base for the Splitting Preconditioner for Linear Systems from Interior Point Methods

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ABSTRACT

A Class of *Splitting Preconditioners* for the iterative solution of Linear Systems arising from Interior Point Methods for Linear Programming Problems needs to find a base by a sophisticated process based in a *lying* rectangular *LU* factorization, that involves reordering columns many times until certain conditions are satisfied. At the same time, it is necessary to prevent excessive fill-in in *L* matrix, sometimes this process may be computationally expensive. The class of Splitting Preconditioners works better near a solution of the Linear Programming Problems when the matrices are highly ill-conditioned. An efficient implementation of the Splitting Preconditioners is divided in two phases, in the first one the Normal Equations system is solved by the conjugate gradient method preconditioned by a generic preconditioner such as Controlled Cholesky factorization. In the second phase the linear system is solved by applying Splitting Preconditioner.

In this work, we propose to implement penalty parameters in Interior Point Method in order to reduce the ill-conditioning of the matrix near to a solution. In addition, we propose a new approach to find a basis based upon *standing* rectangular *LU* factorization with partial permutation of the transpose of the scaled Linear programming constraint matrix, the basis will be better conditioned than the existing one. The constraint matrix is preprocessed in order to eliminate redundant rows giving raise to a full row rank matrix. Therefore, the rectangular *LU* factorization with partial permutation always exist. The challenge is design an approach to avoid excessive fill-in in the factorization process.

Key Words: Linear Programming, Splitting Preconditioner, Transpose Base.