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GAUSSIAN ELIMINATION AS A COMPUTATIONAL PARADIGM

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Abstract

An abstract view of symmetric gaussian elimination is presented. Problems are viewed as an assembly of computational entities whose interdependence is modeled by a graph. An algorithmic transformation on the entities which can be associated with vertex removal, is assumed to exist. The elimination tree of the symmetric gaussian elimination figures the order in which these transformations are applied and captures any potential parallelism. The inherently sequential part of the computational effort depends on the height of the tree. The paradigm is illustrated by block structured LP problems with nested decomposition and basis factorization approaches, problems of blocked symmetric and unsymmetric systems of linear equations, with respectively blocked Cholesky factorization and blocked gaussian elimination. Contributions are: demonstration of the paradigm expressive power through graph concepts (eliminations sets, elimination chains, etc.); emphasis on patterns of similarity in the use of the graph concepts and finally an effective parallelization tool for blocked Cholesky factorization of matrices arising in time phased or dynamic LP models solved by interior point algorithms.

Keywords: sparse gaussian elimination, elimination tree, parallel Cholesky factorization, linear programming, nested decomposition, basis factorization.

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