Chordal graphs and sparse semidefinite optimization.

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Chordal graphs have a rich history in several disciplines, including combinatorial optimization, statistics, signal processing, machine learning, sparse matrix algebra, and nonlinear optimization. This lecture will give a survey of some of the theory and applications of chordal graphs. The emphasis will be on techniques developed in the literature on sparse Cholesky factorization, and on sparse matrix algorithms formulated as recursions on elimination trees, supernodal elimination trees, or clique trees associated with the sparsity graph. The best known example is the multifrontal Cholesky factorization algorithm, but similar algorithms exist for related problems, for example, the computation of the partial inverse of a sparse positive definite matrix, positive semidefinite and Euclidean distance matrix completion problems, and the evaluation of gradients and Hessians of logarithmic barriers for cones of sparse positive semidefinite matrices and their dual cones. The techniques will be illustrated with applications to interior-point algorithms and decomposition methods in sparse semidefinite optimization.