Title: An interior-point method for low-rank semidefinite programming

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Abstract: We are studying an Interior-Point (IP) method for solving large and sparse low-rank linear Semidefinite Programs. A general bottleneck of IP methods is assembling and solving the so-called Schur complement equation, in which the matrix becomes increasingly ill-conditioned as the interior-point method makes progress towards the solution. To tackle this challenge, instead of the direct solver (Cholesky factorization), we are using Preconditioned Conjugate Gradient (PCG) method. Furthermore, we are proposing new preconditioners for the low-rank situation. Efficient preconditioners allow PCG to converge to an approximate solution of the linear equation in a few iterations, independent of the ill-conditioning of the Schur complement matrix. We will present numerical results of applying these ideas to Truss Topology optimization problem which is formulated as large-scale SDP with the low-rank solution. The numerical results demonstrate that our preconditioner is working better than preconditioners recently proposed by Zhang and Lavaei, based on a similar idea. Also, our Matlab implementation outperforms MOSEK and other available IP-based software.