

Abstract

Linear Programming, LP, problems with finite optimal value have a zero duality gap and a primal-dual strictly complementary optimal solution pair. On the other hand, there exists Semidefinite Programming, SDP, problems which have a nonzero duality gap (difference primal and dual optimal values; not both infinite). The duality gap is assured to be zero if a constraint qualification, e.g. Slater's condition (strict feasibility) holds. And, there exist SDP problems which have a zero duality gap but no strict complementary primal-dual optimal solution. We refer to these problems as *hard instances* of SDP.

In this paper, we introduce a procedure for generating hard instances of SDP. We then introduce *measures of hardness* and illustrate empirically that these measures correlate well with the size of the gap in strict complementarity as well as with the asymptotic local convergence rate, and also with the number of iterations required to obtain optimal solutions to a specified accuracy. In addition, our numerical tests show that no correlation exists between the complementarity gaps and recently introduced geometrical measures or with Renegar's condition number. We include tests on the SDPLIP problem set.