Approximation of Controllable Set by Semidefinite Programming for Open-Loop Unstable Systems with Input Saturation

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Abstract

In order to test the efficiency of semidefinite programming (SDP), we apply SDP software package to the solution of open-loop unstable systems under input saturation. And we compare the ease of programming and the execution time for solving the problem between the classical approach (which applies a nonlinear equation solver to the Kuhn-Tucker conditions) and the SDP approach (which exploits interior-point algorithms) for three techniques in this paper. It is also shown that, for certain types of optimization problems, SDP is indeed very efficient. However, our examples show that SDP has limitations in solving non-convex optimization problems. It is also shown that the technique we proposed, namely that of approximating the controllable set inside the Lyapunov descent criterion, is better than the controllable set found by SDP, even though the execution time is inferior to the latter.

Keyword：Controllable Set, Semidefinite Programming (SDP), Lyapunov descent criterion, Kuhn-Tucker Theorem