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LOCAL STABILIZATION OF UNCERTAIN TIME-DELAY SYSTEMS WITH SATURATING ACTUATORS

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Abstract. This paper considers the problem of local stabilization of uncertain continuous-time systems with time-delay and saturating actuators. A new closed-loop stability theorem based on the Lyapunov-Krasovskii stability theorem is obtained. Moreover, two methods are given to design a state feedback controller such that the stability region of the resultant closed-loop system is enlarged. Both the controller and the bound of the safe initial conditions can be obtained by solving LMI problems. Numerical examples are employed to demonstrate the effectiveness of the proposed techniques.
Keywords. Time-delay, Saturating actuators, LMI, Stability region, Robust control.

1 Introduction

Actuator saturation is a common feature of control systems. The stabilization of (uncertain) linear systems with saturating actuators has been widely investigated in the last few years (see for example, [1, 5, 9, 19] and the references therein). Some of these results have been extended to the case of (uncertain) linear systems with delayed state. For example, the *global* stabilization problem of time-delay systems with saturating actuators but *without uncertainties* has been considered in [2, 13, 17, 22]. The *delay-independent global* stabilization problem of *uncertain* time-delay systems with saturating actuators were studied in [16] (using state feedback controller) and [4] (using dynamic output feedback controller). In [12, 15], the *delay-dependent global* stabilization problem of *uncertain* time-delay systems with saturating actuators were investigated. The *local* stabilization problem for time-delay systems with saturating actuators but *without uncertainties* was considered in [10, 11, 18, 20, 21] and methods to determine simultaneously a control law and a local stability region were given. Recently, Oucheriah [14] studied the *exponential* stabilization of a class of *uncertain* time-delay systems with bounded controllers. However, the considered uncertainties satisfies the matching condition.