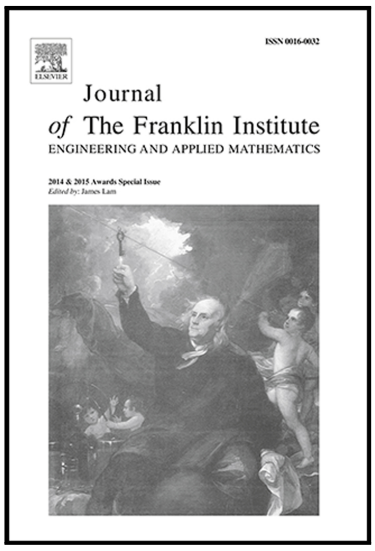

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PII: S0016-0032(17)30435-0
DOI: 10.1016/j.jfranklin.2017.08.041
Reference: FI 3124

To appear in: *Journal of the Franklin Institute*

Received date: 18 April 2017
Revised date: 10 July 2017
Accepted date: 27 August 2017

Please cite this article as: Qian Wang, Zhengguang Wu, Peng Shi, Anke Xue, Robust control for switched systems subject to input saturation and parametric uncertainties, *Journal of the Franklin Institute* (2017), doi: 10.1016/j.jfranklin.2017.08.041

Robust control for switched systems subject to input saturation and parametric uncertainties

Qian Wang [*], Zhengguang Wu [†‡], Peng Shi[§], Anke Xue [¶]

Abstract

This paper studies the exponential stability problem for switched systems with input saturation and parametric uncertainties. On the basis of the gain scheduling scheme (GSS) and the low gain feedback (LGF), a robust controller is constructed. The main contributions of this paper are increasing the state convergence speed of the closed-loop system by the introduced parameters and estimating the maximized region of attraction by the designed outermost ellipsoids. The corresponding conditions of the designed controller are expressed as the linear matrix inequalities (LMIs). The constructed controller is easily computed by solving the optimization problem. The numerical simulation is performed to show the feasibility and the effectiveness of the obtained results.

Keywords: Switched system, Robust, Input saturation.

1 Introduction

In the past few years, switched systems have drawn considerable attention [1]. The switched systems contain a series of subsystems and include a switching law to supervise the switching among them. The switching law is determined by time, state or the other factors among these subsystems. The switched system has been applied in many fields, such as aircraft and air traffic control, the chemical process and pharmaceutical industries, and many other fields [2, 3, 4, 5, 6, 7, 8].

The input saturation is an important problem for all dynamical system. If the analysis and design of the control system fails to consider the saturation nonlinearity, the system performance will degrade and the system will be instable [9, 10]. During the past several decades, many results were available for this problem. For example, the low gain feedback (LGF) was studied in [11, 12], the piecewise control method was proposed in [13], the anti-windup approaches were given in [14, 15], the stabilisation of non-linear systems by considering quantisation and input saturation was studied in [16], a robust H_∞ static output feedback control method by considering the tire force saturation was proposed in [17], the local synchronization of the chaotic neural networks with sampled-data and input saturation was studied in [18], the analysis and controller design for a saturated linear system with disturbance was studied in [19] and a distributed-delay-dependent polytopic method of uncertain time-delay system with saturation was proposed in [20].

The gain scheduling scheme (GSS) is commonly used in the nonlinear system control [21, 22]. Many constructive results have been obtained on this topic [10, 13].

The switched systems were widely studied [23, 24, 25, 26, 27]. Many results have been obtained on the switched system with input saturation, for example, the disturbance tolerance and rejection of saturated switched systems was studied in [28], the state feedback and dynamic output feedback controller was designed in [29] and the anti-windup compensator for the switched systems with input saturation was designed in [30]. Most of the results focused on the stability and stabilization problem, however, relatively little attention has

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