International Journal of Innovative Computing, Information and Control
Volume **5**, Number **6**, June **2009**

ICIC International ©2009 ISSN 1349-4198
pp. 1735–1745

OUTPUT FEEDBACK STABILIZATION OF UNCERTAIN SATURATED DISCRETE-TIME SWITCHING SYSTEMS

Abdellah Benzaouia[1], Ouahiba Benmessaouda[1] and Yan Shi[2]

[1]EACPI, Faculty of Sciences Semlalia
University Cadi Ayyad
B.P. 2390, Marrakech 40 000, Morocco
benzaouia@ucam.ac.ma

[2]School of Industrial Engineering
Tokai University
9-1-1, Toroku, Kumamoto 862-8652, Japan
yshi@ktmail.tokai-u.jp

Received October 2007; revised March 2008

Abstract. *This paper presents sufficient conditions for the stabilization of uncertain switching discrete-time linear systems subject to actuator saturations. These conditions are obtained by using output feedback control laws. The obtained results are formulated in terms of LMI's. Two sets of LMI's are presented. A numerical example is used to illustrate the proposed technique.*
keywords: Switching systems, Actuator saturations, Invariant sets, Lyapunov functions, LMI's, Uncertain parameters

1. **Introduction.** Switched systems are a class of hybrid systems encountered in many systems practical situations which involve switching between several subsystems depending on various factors. Generally, a switching system consists of a family of continuous-time subsystems and a rule that supervises the switching between them. This class of systems have numerous applications in the control of mechanical systems, the automotive industry, aircraft and air traffic control [23], switching power converters and many other fields. Two main problems are widely studied in the literature according to the classification given in [11]: The first one deals with the obtention of testable conditions that guarantee the asymptotic stability of a switching system under arbitrary switching rules, while the second is to determine a switching sequence that renders the switched system asymptotically stable (see [19], [22], [16], [24] and the reference therein).

A main problem which is always inherent to all dynamical systems is the presence of actuator saturations [18]. Even for linear systems this problem has been an active area of research for many years. Two main approaches have been developed in the literature: The first is the so-called positive invariance approach which is based on the design of controllers which work inside a region of linear behavior where saturations do not occur (see [2], [3], [10], [7] and the references therein). This approach was applied to a class of hybrid systems involving jumping parameters [12]. It has also been used to design controllers for switching systems with constrained control given under complete modelling as reset functions and different system's dimension [9]. The second approach, however allows saturations to take effect while guaranteeing asymptotic stability (see [20]- [21], [8] and the references therein). This technique was also applied to switching systems by [5] and [6]. The main challenge in these two approaches is to obtain a large enough domain