Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Applications & Algorithms* **14 (2007)** 321-333
 http://www.watam.org

DISTURBANCE ATTENUATION OF SWITCHED LINEAR SYSTEMS WITH NORM-BOUNDED TIME-VARYING UNCERTAINTIES

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Abstract. This paper studies the disturbance attenuation for switched linear systems with norm-bounded time-varying uncertainties. Based on the multiple Lyapunov functions methodology and the largest region function strategy, a sufficient condition is derived for the robust stabilization with a prescribed disturbance attenuation level γ. The condition is constructively formulated as a bilinear matrix inequality (BMI) problem. The disturbance attenuation via switched state feedback is studied as well. All the switching rules are constructively designed and do not rely on uncertainties.

Keywords. Uncertain switched systems, Lyapunov methods, stability, disturbance attenuation, feedback, switching rule.

AMS (MOS) subject classification: 93A99, 93B50, 93D15.

1 Introduction

A switched system is a hybrid dynamical system consisting of a family of subsystems and a rule that orchestrates the switching among them. During the last decade there has been considerable interest in modelling, analysis and design of hybrid and switched systems. For recent progress in the field of switched systems, we refer to the survey papers [2], [11], [16].

The construction of stabilizing switching rules is one of three basic problems [11]. A switching rule is required to guarantee the stability and other performances for a switched system when none of individual subsystems is asymptotically stable or stabilizable. For example, the quadratic stabilization of switched systems is investigated in some papers (e.g., [4] [7, 8] [17] [20]) using constructively designed state-dependent switching rules. In this paper, based on the multiple Lyapunov functions methodology, we investigate stability and disturbance attenuation properties for switched systems when none of individual subsystems is stable or stabilizable. The terminology and approach of multiple Lyapunov functions have been discussed precisely in [1] [9] [11] [15] where candidate Lyapunov functions were with respect to