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ROBUST ADAPTIVE CONTROL FOR A CLASS OF UNCERTAIN SWITCHED DELAY SYSTEMS WITH ACTUATOR FAILURES

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Abstract. The problem of the reliable control for a class of uncertain switched delay systems containing actuator failures is addressed in this paper. The upper bounds of uncertainties are assumed to be unknown. When actuators suffer "serious failure"——the never failed actuators can not stabilize the given system, based on multiple-Lyapunov function method, the adaptive feedback controllers being able to estimate the upper bounds of uncertainties are derived in terms of linear matrix inequalities (LMIs) such that the resulting closed-loop system is uniform ultimate boundedness. Finally, an example illustrates the effectiveness of the proposed approach.

Keywords. Switched delay systems, Reliable control, Adaptive control, Multiple-Lyapunov function, Linear matrix inequalities (LMIs).

1 Introduction

In recent years, there has been a great interest in the switched systems in the control community [1-5]. In the study of stability analysis for switched systems, multiple-Lyapunov function approach has been shown to be an effective tool [6, 7]. Switched systems with time delays are referred to as switched delay systems, which are a brand new type of systems. This class of systems has strong engineering background. For example, power systems [8, 9] and networked control systems [10, 11] can be modeled as switched delay systems. Due to the interaction between continuous dynamics and discrete dynamics and the impact of time delays, the behavior of switched delay systems is usually much more complicated. Very few results on switched delay systems have appeared [12, 13].

On the other hand, owing to the growing demands of system reliability in aerospace and industrial process, the study of reliable control has recently attracted considerable attention [14-18]. The objective of this study is to design an appropriate controller such that the closed-loop system can tolerant some specific control components failures and preserve an overall system stability. Among the existing reliable control studies, a number of design methods have been proposed. For example, Veillette et al. [14] presented a methodology