

ROBUST H_∞ RELIABLE CONTROL FOR A CLASS OF SWITCHED NONLINEAR SYSTEMS WITH TIME DELAY

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ABSTRACT. *This paper investigates the robust H_∞ reliable control for a class of uncertain switched nonlinear systems with time delay. Firstly, a criterion of exponential stability with H_∞ performance for switched nonlinear systems with time delay is proposed. Then, a design methodology of the robust H_∞ reliable control for switched nonlinear systems with time delay and parameter uncertainties is presented. The proposed state feedback controller, which can guarantee exponential stability of the resulting closed-loop system, can be obtained using a set of linear matrix inequalities (LMIs). Finally, a numerical example is given to illustrate the effectiveness of the proposed approach.*

Keywords: Reliable H_∞ control, Time delay, Exponential stabilization, LMI approach, Switched systems, Nonlinear systems

1. **Introduction.** Switched systems have attracted the interest of several scientists in the last decades. Typically, a switched system consists of a number of subsystems and a switching signal, which defines a specific subsystem being activated during a certain interval of time. Study of switched systems mainly focuses on stability and stabilization, and a number of works in this direction have appeared recently (see [1] and the references therein). In the study of stability analysis for switched systems, multiple Lyapunov functions (MLFs) approach has been shown to be an effective tool (see [2-4]). Most recently, on the basis of dwell time method, the stability and stabilization for switched systems have been further investigated (see [5-6]).

Time delay is very common in many kinds of engineering systems, it is frequently a source of instability and often causes undesirable performance, time delay systems have also received an increasing attention among the control community, many valuable results have been obtained for switched delay systems (see [7-14]).

On the other hand, it is well known that the actuators may be subjected to failures in practical operation. Therefore, it is of practical interest to design a control system which can tolerate faults of actuators. Several approaches to the design of the reliable controllers have been proposed for linear system (see [15-16]). The results for linear system have been extended to uncertain nonlinear systems (see [17, 18]). A reliable H_∞ controller is designed for switched nonlinear systems by multiple Lyapunov functions (MLFs) approach in [19]. In our recent work [20], a reliable control problem for uncertain switched systems with time varying delay is considered to guarantee asymptotic stability of the closed loop systems in the case of the possible presence of failures of partial actuators. In addition, we have studied robust reliable control for uncertain switched nonlinear systems with time delay in [21,24]. However, to the best of our knowledge, the issue of robust H_∞ reliable