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AVERAGE DWELL TIME METHOD FOR STABILITY ANALYSIS OF SWITCHED UNCERTAIN DELAY SYSTEMS WITH ACTUATOR FAILURES

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Abstract. In this paper, we focus on the stability property of switched uncertain delay systems consisting of unstable and stable subsystems resulted from actuator failures. Based on the average dwell time approach, under the condition that the total activation time ratio between stable subsystems and unstable ones is not less than a specified value, a class of switching laws is constructed for this kind of system. It is proved theoretically that the resulting closed loop system is robustly exponentially stable for some allowable upper bound of delays and some perturbations if the kind of system with zero delay is exponentially stable. At last, the effectiveness and the applicability of the proposed method are demonstrated by using simulation examples.

Keywords. Exponential stability; actuator failures; average dwell time; switched uncertain delay systems; linear matrix inequality.

AMS (MOS) subject classification: This is optional. But please supply them whenever possible.

1 Introduction

Time-delay is often a common phenomenon encountered in engineering systems, biology, economics and other areas. Also, we notice that it is generally regarded as a main source of instability or poor performance of a system. Recent years have witnessed an enormous growth of interest in stability analysis [1-4] and controller syntheses [5-7].

On the other hand, In practical application, how to deal with actuator failures has been a hot issue since it inevitably occurs due to some unknown or/and purposeful reasons. So this motivates the development of so-called reliable control [8-11]. However, these reliable control design methods are all based on a basic assumption that the single controller must stabilize a given system. As the number of potential failures and the degree of system redundancy increase, the single controller for all possible failure conditions could not be achieved. This means the existing design methods of reliable control do not work. A hybrid strategy therefore provides a natural setting