

ROBUST EXPONENTIAL STABILITY OF LINEAR SWITCHED DELAY SYSTEMS: AN AVERAGE DWELL TIME METHOD

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Abstract. This paper deals with the problem of exponential stability of linear switched delay systems. An average dwell time method is introduced into linear switched delay systems for the first time and LMIs' conditions are presented to guarantee robust exponential stability of such systems. A lower bound of average dwell time is given. Exponential decay estimates for the states of such systems are also explicitly developed. At last, two numerical examples are given to illustrate the effectiveness of the proposed method.

Keywords. Average dwell time, Switched delay systems, Exponential stability, Decay estimate, Linear matrix inequalities.

AMS (MOS) subject classification: 93C30, 93D05, 93D15.

1 Introduction

Recent years have witnessed an enormous growth of interest in switched systems which are an important class of hybrid systems. Typically, a switched system consists of a number of subsystems, either continuous-time or discrete-time dynamic systems, and a switching law, which specifies a subsystem being activated during a certain time interval [1-4]. One of the key issues in the study of switched systems is stability. The existence of a common Lyapunov function for all subsystems was shown to be a necessary and sufficient condition for a switched system to be asymptotically stable under an arbitrary switching law [5]. A considerable number of techniques have been proposed to construct such a Lyapunov function [6]. Most switched systems in practice, however, do not possess a common Lyapunov function, yet they still may be asymptotically stable under certain classes of switching laws. Average dwell time technique is an effective tool of choosing such switching laws. (see, for example [7-11]). The concept of average dwell time was presented in [8] at the premise that each subsystem is stable and later was extended by Zhai et al [9] to the case where stable and unstable subsystems co-exist. Besides, the average dwell time method was also employed to the problem of disturbance attenuation of switched systems in [10]. In [11] dwell-time switching scheme was employed to prevent the actuator from fast switching or chattering.