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A PARAMETERIZED DELAY-DEPENDENT CONTROL OF SWITCHED DISCRETE-TIME SYSTEMS WITH TIME-DELAY

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Abstract. *For a class of discrete-time systems with time-varying delays under arbitrary switching sequence, this paper develops complete delay-dependent results for stability analysis and control synthesis using appropriate switched Lyapunov-Krasovskii functional. We characterize parameterized LMI-based conditions the feasibility of which guarantee that the switched delay system is delay-dependent asymptotically stable with an L_2-gain smaller than a prescribed constant level. Following this procedure, these conditions do not require overbounding or ill-posed inequalities. Switched state and static output feedback schemes are designed such that the corresponding switched closed-loop system is delay-dependent asymptotically stability with an L_2-gain smaller than a prescribed constant level. A representative example is worked out in detail to illustrate the theoretical developments.*

Keywords: Switched systems, Delay-dependent asymptotic stability, Switched Lyapunov-Krasovskii functional, Switched output-feedback, LMIs

1. **Introduction.** Switched systems have been the subject of numerous investigations in recent years for their wide applications, see [3,5,26] and the references therein. A particular class of switched systems, which is of interest in this work, is the one composed of many discrete subsystems and a rule that governs the switching between these subsystems. The stability and control synthesis of switched systems have been investigated in [1,4,11,13,21]. In [4], the stability of switched discrete systems is studied by checking for the existence of switched Lyapunov function for the system under consideration. In [1], multiple Lyapunov functions for the stability analysis of continuous hybrid systems is investigated, and the use of iterated function systems (IFS) as a tool for Lagrange stability is examined. Also, a survey of switched systems problems has been proposed in [13]. The control synthesis of switched systems has been investigated using different methodologies in [6,7,10,14,30]. For example, multiple Lyapunov functions were employed to establish certain general Lyapunov-like results for nonlinear switched systems [7], dwell-time and average dwell-time approaches were employed to study the stability and disturbance attenuation of switched systems [25,28], piecewise Lyapunov function approach was adopted in [9], and a switched Lyapunov function method has been applied to study the stability problem of discrete time switched systems.