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ROBUST GUARANTEED COST CONTROL FOR UNCERTAIN DISCRETE-TIME SWITCHED SYSTEMS WITH TIME-DELAY

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Abstract. The problem of guaranteed cost control for a class of uncertain discrete-time switched linear systems with time-delay is addressed. Based on the common Lyapunov function method, switching state feedback controllers are designed to make the closed-loop system asymptotically stable with an adequate level of performance under arbitrary switching laws. When the conditions for guaranteed cost control under arbitrary switching laws are not satisfied, the multiple Lyapunov function method is applied to construct a stabilizing switching law with guaranteed cost. A descriptor system approach is introduced to derive two linear matrix inequality based delay-dependent sufficient conditions for the existence of switching guaranteed cost controllers. The effectiveness of the proposed approach is demonstrated by simulation examples.
Keywords. Guaranteed cost control, discrete-time switched systems, descriptor systems, switching controllers, linear matrix inequality (LMI).

1 Introduction

Switched systems, as a class of important hybrid systems, have attracted considerable research interest in the control field during recent years. Typically, a switched system consists of a number of subsystems, either continuous-time systems or discrete-time systems, and a switching law defining the subsystem that is activated during a certain interval of time. Switched systems arise in many engineering applications [6,16,18]. The study of stability and stabilization for switched systems becomes a challenging issue due to their hybrid nature. Recently, a number of contributions have appeared, in which Lyapunov stability theory and its generalizations still play a dominating role [1,10,13-15,19]. Among three basic problems concerning stability and design of switched systems[10], stability under arbitrary switching laws has been a subject of great practical importance because it provides a possibility of pursuing other control goal in addition to stability. Also, in some practical