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ROBUST GUARANTEED COST CONTROL FOR DISCRETE-TIME SYSTEMS WITH MULTIPLE DELAYS IN STATE

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Abstract. This paper deals with the problem of robust guaranteed cost control for generalized discrete time-delay systems with norm-bounded uncertainties. Based on linear matrix inequality (LMI) technique, we develop discrete Lyapunov function approach for robust performance analysis and robust stabilization via linear memoryless state feedback. We show that the feasibility of a linear matrix inequality guarantees the solvability of the addressed robust guaranteed cost control problem. Moreover, we show that the robust guaranteed cost control for the generalized discrete time-delay systems with norm-bound uncertainties can be viewed as an H_∞ type condition for an uncertainty-free system. We also have presented an upper bound for the cost function of the underlying system with the designed controller for the case of initial state values being a zero mean random variables. An example is given to show the potential of the proposed techniques.

Keywords. Discrete-time system, Guaranteed cost control, Robust control, Multiple time-delay, parametric uncertainty.

AMS (MOS) subject classification: 37N35, 93C55

1 Introduction

Robust stability and stabilization of dynamic systems which include time delays and uncertainties in their physical models are problems of recurring interest because the existence of delays and uncertainties often induce instability (see for example, [6, 11, 9]). The interest is justified by the fact that stability is the most important objective in control system design.

In recent years, with the development of robust control and H_∞ control theory, robust guaranteed cost control approach to the design of state feedback control laws for uncertain systems has been a subject of intensive research: see, e.g. quadratic guaranteed cost control for uncertain non-delay systems was dealt with in the work of, for example, [12, 4, 17, 28], and the continuous counterpart of the above problem was considered in, for example, [10, 13, 7]. On the other hand, the study on control and filtering of discrete-time uncertain systems with delays has quite active for the last decade, and a number of results have been reported in the literature, for