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EXTENDED PARAMETER DEPENDENT H_∞ CONTROL FOR POLYTOPIC UNCERTAIN SYSTEMS WITH TIME-DELAY

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Abstract. The parameter dependent H_∞ control problem for continuous-time uncertain time-delay systems is investigated. The uncertainties are supposed to belong to a polytope domain described by its vertices. Based on bounded real lemma of time-delay systems, extended H_∞ performance criterion is derived by means of parameter dependent Lyapunov function. Using it, a sufficient condition for the existence of parameter dependent H_∞ state-feedback controllers is presented, and the corresponding controller design is cast into a convex optimization problem which can be efficiently handled by standard numerical algorithms. It is shown that the proposed design strategy allows parameter dependent Lyapunov functions and hence it is less conservative. A numerical example is employed to demonstrate the feasibility and advantage of the proposed design.

Keywords. Conservativeness, parameter-dependence, H_∞ Control, time-delay systems, LMI.

1 Introduction

Increasing attention has been devoted to the problem of robust stability and performance of polytopic systems during the last decades. The main motivation for its development was the possibility to analyze and to design control strategies to cope with uncertain parameters [1].

The problem of time delays has received considerable attention. Time delays as a source of instability and poor performance often appears in many dynamic systems, such as, chemical processing system, biological system, environmental system, electrical network and power system. Control methodology, especially the H_∞ control approach is widely used in the study of control systems with time-delays. Hence, considerable efforts have been devoted to the study of time-delay systems, and many interesting and important results have been reported in the literature (see for instance, [2–9] and the references therein). Most of these results have been obtained via Lyapunov based approaches. The simplest approach consists in looking for a common quadratic