Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Applications & Algorithms* **10 (2003)** 681-693

NON-FRAGILE CONTROLLERS OF PEAK GAIN MINIMIZATION FOR UNCERTAIN SYSTEMS VIA LMI APPROACH

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Abstract. This paper is concerned with the problem of robust peak-to-peak gain minimization by linear matrix inequality (LMI) approach. Instead of minimizing the robustly induced L_∞-norm, we minimize its upper bound. Results on the state-feedback controllers are obtained by this approach, and the controllers are at most the same order as the plant. One of the main results shows that if there exists a linear dynamic state-feedback controller that achieves a certain level of robust performance, then there exists a static, linear, state-feedback controller that achieves the same performance level, and *vice versa*. Moreover, the existence of such controllers are equivalent to the existence of solution of an LMI problem. Based on the result, a sufficient condition for obtaining non-fragile state-feedback controller is presented. The condition guarantees simultaneously disturbance rejection in invariant set sense in [2] and the level of performance in [1].
Keywords. Uncertain systems, peak-to-peak gain minimization, persistent disturbances, L_1-control, non-fragile controllers.
AMS (MOS) subject classification: 34K20, 34K35, 34H05, 93D09.

1 Introduction

The $l_1(L_1)$ optimal control problem was formulated by [15]. The problems for discrete-time systems and continuous-time systems were solved by Dahleh and Pearson in [8, 9], where the signal norm is taken to be the signal's peak value. Many results are presented in [7], in which the authors discuss several approaches to obtaining nearly optimal solutions. Synthesizing these controllers requires solving a sequence of linear programming problems of increasing size. Another approach to l_1 control was taken by Shamma, where it is proven that if there exists a linear dynamic state-feedback controller that achieves a certain level of performance, then there exists a static, nonlinear, state-feedback controller that also achieves this level of performance [13, 14]. For rejection of persistent bounded disturbance, we are interested in knowing if there exists a bounded invariant set such that all the trajectories starting from inside of it will always remain in it. This problem was addressed in [2] and studied further in [3, 4] by invariant set methods.

Many papers (for example, see [1, 5]) pointed out continuous-time problem to be more difficult than discrete-time problem for $L_1(l_1)$ control prob-