Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **11 (2004)** 871-884

STABILIZATION OF THE SYSTEMS WITH COPRIME FACTOR UNCERTAINTIES BY CONVEX PARAMETERIZATION APPROACH

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Abstract. In this paper, a convex parameterization methodology is presented for the problem of robust stabilization of the systems with coprime factor uncertainties. By this approach, the robust stabilization problem is converted to a convexly parameterized robust SPR synthesis problem. To solve this convexly parameterized robust SPR synthesis problem, the S-procedure is used to convert the problem to finding the feasible solutions of frequency dependent LMIs which can be solved by combining the techniques of griding the frequency range to get a limited number of LMIs and using KYP lemma to check the feasibility of the solutions. An numerical example is included to demonstrate the application of the method.

Keywords. Robust stabilization, Convex parameterization, Structured uncertainty, LMIs

1 Introduction

The most important issue in the control system synthesis is the designing of the controller which robustly stabilizes the system when there exist uncertainties. As one of the designing method, controller convex parameterization approach (the more popular name is the so called "rank one" problem)[1] is an efficient technique in dealing with controller design for linear time invariant system with rank one uncertainties. This approach convexly parameterizes all the robustly stabilizing controllers, which make the problem of the controller design can be solved by convex optimization procedure. In the concluding remarks of the seminal paper [1], the authors put forward two questions: one is the generalization of rank one case uncertainty to matrix case uncertainty. The other is the improvement of the computation of the intrinsic optimization problem by exploiting the problem structure. For the latter question, Ranzer [2] and Lu [3] use Linear Matrix Inequality in solving computing problem. Recently Ghulchak and Rantzer [4 - 6] developed primal-dual convex analysis method, which showed a quite satisfied computing result. While for the former question, i.e., the problem of generalization of the approach to the system with higher rank uncertainty, the problem seems to go to standstill and to get little progress. But the problem itself is obviously important to the control system synthesis. This paper is trying to make some contributions in this direction.