Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Applications & Algorithms* **14 (2007)** 155-173

ROBUST H_∞ CONTROL OF UNCERTAIN DISTRIBUTED DELAY SYSTEMS: PARAMETER-DEPENDENT LYAPUNOV FUNCTIONAL APPROACH

Ligang Wu[1], Changhong Wang[1] and Huijun Gao[1]

[1]Space Control and Inertial Technology Research Center
Harbin Institute of Technology, Harbin, Heilongjiang Province, P. R. China

Abstract. This paper presents delay-dependent robust $\mathbf{H}_\infty$ controller design for a class of uncertain linear systems with a time-varying discrete delay and a constant distributed delay. The parameter uncertainties are assumed to reside in a polytope. Designing a linear memoryless state feedback H_∞ controller, and a sufficient condition with delay-dependent is derived for the robust asymptotic stability of the closed-loop system in terms of linear matrix inequalities (LMIs) by applying the parameter-dependent Lyapunov functional approach. The desired controller can be found by solving a convex optimization problem. The proposed methods can be easily extended to the case of multiple time delays. A numerical example is included to demonstrate the effectiveness of the proposed methods.

Keywords. Distributed delay systems; $\mathbf{H}_\infty$ control; Robust; Parameter-dependent Lyapunov functional; Linear matrix inequalities (LMIs).

1 Introduction

Time-delays are frequently encountered in many practical engineering systems, such as communication, electronics, hydraulic and chemical systems. Their existence may induce instability, oscillation and poor performance. In the past few years, considerable attentions were paid to the robust stability analysis (see, for instance [10, 11, 12, 14, 15, 16, 17, 20] and the references therein) and robust stabilization of uncertain time-delay systems (see, for instance [2, 4, 5, 6, 18, 19, 22, 25] and the references therein). It is noted that these results are derived for systems with discrete delays. When the number of summands in a system equation is increased and the differences between neighboring argument values are decreased, systems with distributed delays will arise. Distributed delay occurs in the modeling of feeding systems and combustion chambers in a liquid monopropellant rocket motor with pressure feeding (see, for instance [17]). There are important practical applications for