International Journal of Innovative Computing, Information and Control
Volume **2**, Number **2**, April **2006**

ICIC International ©2006 ISSN 1349-4198
pp. **293–303**

MEMORY STATE FEEDBACK GUARANTEED COST CONTROL FOR NEUTRAL DELAY SYSTEMS

Bing Chen

Institute of Complexity Science
Qingdao University
Qingdao, Shandong 266071, P. R. China
bing1958@eyou.com

James Lam and Shengyuan Xu

Department of Mechanical Engineering
University of Hong Kong
Pokfulam Road, Hong Kong

Received July 2004; revised March 2005

Abstract. *This paper studies the problem of guaranteed cost control for a class of uncertain neutral delay systems. Unlike the commonly used quadratic cost function involving the state, a cost function involving the delayed state is considered. This naturally leads to a memory state feedback such that the resulting closed-loop system is not only asymptotically stable but also guarantees an adequate level of performance even with an admissible class of uncertainties. A sufficient condition for the existence of a guaranteed cost controller is given in terms of the feasibility condition of a linear matrix inequality. Finally, a numerical example is used to demonstrate the effectiveness of the approach proposed in this paper.*

Keywords: Guaranteed cost control, Memory state feedback, Neutral delay system, Uncertain system

1. **Introduction.** Dynamic systems often encounter the effects of delays in the processing state, input or related variables. Considerable attention has been paid to the research on the control and stabilization of time-delay systems as time-delay often degrades performance or even becomes a source of instability in many engineering systems. Recently, a lot of research results of robust stability analysis and controller synthesis have been reported in the literatures, see [1-3] and the reference therein. In a control system, other than the requirement of stability, there are various performance objectives to be considered when designing a controller, such as H_∞-norm minimization, quadratic cost minimization, pole placement, etc. One recent development is the guaranteed cost control which aims at designing a stabilizing controller with ensures an adequate level of quadratic cost performance. In the past years, results on guaranteed cost controls for time-delay systems have been proposed. In [4-6], the problem of guaranteed cost control of uncertain linear systems with state-delay are considered and a design scheme of guaranteed cost controllers is developed based on the linear matrix inequality (LMI) approach. More recently, a sufficient condition of the existence of delay-dependent guaranteed cost controllers is developed also in terms of matrix inequality [7].