International Journal of Innovative
Computing, Information and Control
Volume **5**, Number **10(A)**, October **2009**

ICIC International ©2009 ISSN 1349-4198
pp. 3179–3187

NON-FRAGILE ROBUST H_∞ CONTROL FOR UNCERTAIN 2-D DELAYED SYSTEMS DESCRIBED BY THE GENERAL MODEL

Huiling Xu[1], Yun Zou[2] and Shengyuan Xu[2]

[1]Department of Mathematics
[2]School of Automation
Nanjing University of Science and Technology
Nanjing 210094, P. R. China
xuhuiling_2005@yahoo.com.cn; zouyun@vip.163.com; syxu02@yahoo.com.cn

Received April 2008; revised September 2008

Abstract. *This paper considers the problem of robust H_∞ control for uncertain 2-D discrete delayed systems in the general model via non-fragile state feedback controllers. The parameter uncertainty is assumed to be norm-bounded. The problem to be addressed is the design of state feedback controllers such that the stability of the resulting closed-loop system is guaranteed and a prescribed H_∞ performance level is ensured for all admissible uncertainties. In terms of a linear matrix inequality (LMI), a sufficient condition for the solvability of the problem is obtained. A desired non-fragile state feedback controller can be constructed by solving a certain LMI. A simulation example is provided to demonstrate the application of the proposed method.*

1. **Introduction.** Control of time-delay systems is a research topic of recurring interest, which is both practical and theoretical importance since time delays are frequently encountered in practical applications. A great number of control results concerning time-delay systems have been reported [1, 2, 17]. The problem of H_∞ control for linear time-delay systems has drawn considerable attention; many results have been reported in the literature; see, e.g., [4, 7, 14, 20], and the references therein. Recently, there has been an increasing interest in the study of non-fragile control problems, which are concerned with how to design controllers that are non-fragile in the sense that satisfactory performance level of the closed-loop system can be preserved in face of controller uncertainties [28].

During the past decades, two-dimensional (2-D) systems have received much attention [13, 12, 22] since 2-D systems have extensive applications in image processing, seismographic data processing, thermal processes, water stream heating, modelling of partial differential equations and other areas [8, 11, 15]. Different kinds of 2-D models, such as 2-D Roesser models [19], 2-D Fornasini-Marchesini models [6], 2-D general state space models (2-D GM) [10, 25] etc., have been proposed. These models have also been extended to multidimensional systems; see, e.g., [15, 26]. A great number of fundamental notions and results of one-dimensional (1-D) discrete systems were generalized to 2-D discrete systems [9, 27].

Very recently, the problem of robust H_∞ control for 2-D systems described by Roesser models, Fornasini-Marchesini model and general state space models has been studied; see, e.g., [5, 21, 23], and the references therein. These results were also extended to 2-D discrete delayed systems described by Roesser models, Fornasini-Marchesini model in [18, 24]. However, the problem of non-fragile robust H_∞ control for 2-D discrete delayed systems described by general models has not been investigated up to date.