International Journal of Innovative Computing, Information and Control
Volume **1**, Number **2**, June **2005**

ICIC International ©2005 ISSN 1349-4198
pp. 181–191

ROBUST H_∞ CONTROL FOR A CLASS OF UNCERTAIN NONLINEAR TWO-DIMENSIONAL SYSTEMS

Huiling Xu

Department of Applied Mathematics
Nanjing University of Science and Technology
Nanjing 210094, P. R. China
xuhl@nj165.com

Yun Zou and Shengyuan Xu

Department of Automation
Nanjing University of Science and Technology
Nanjing 210094, P. R. China.
zouyun@jlonline.com; syxu02@yahoo.com.cn

Received August 2004; revised February 2005

Abstract. *This paper considers the problem of robust H_∞ control for uncertain 2-D discrete systems in the Fornasini-Marchesini second local state-space model with a class of generalized Lipschitz nonlinearities. The parameter uncertainty is assumed to be norm-bounded. A state feedback controller is designed such that a prescribed H_∞ performance condition is satisfied and the stability of the resulting closed-loop system can be guaranteed for all admissible uncertainties. In terms of a linear matrix inequality (LMI), a sufficient condition for the solvability of the problem is given. A desired state feedback controller can be constructed by solving a certain LMI. A numerical example is given to demonstrate the application of the proposed method.*

Keywords: FM LSS model, Linear matrix inequality, Robust H_∞ control, State feedback, Two-dimensional systems, Uncertain systems

1. **Introduction.** During the past years, the problem of H_∞ control for linear systems has drawn considerable attention; many results on this topic have been reported in the literature [17, 12]. However, when parameter uncertainty appears in the plant modeling, the standard H_∞ theory is unable to offer guaranteed H_∞ performance or even the stability of the closed-loop system. This has motivated the study of robust H_∞ control problem and a great number of results on both continuous-time and discrete-time systems have been proposed [16].

Two-dimensional (2-D) discrete systems have received much attention over the past decades since 2-D systems have extensive applications in image processing, seismographic data processing, thermal processes [5], water stream heating, and other areas [10]. Many control problems such as stabilization, H_∞ control for 2-D systems have been investigated and various approaches to deal with these problems have been proposed in the literature, see for example, [5, 8, 9, 10]. With the development of the linear matrix inequality (LMI) approach to deal with control and filtering problems for 1-D systems, the LMI approach has recently been applied to study 2-D systems. For example, the problems of