H∞ OUTPUT FEEDBACK CONTROL FOR
TWO-DIMENSIONAL CONTINUOUS SYSTEMS

Shengyuan Xu1, James Lam2, Yun Zou1, Zhiping Lin3 and Krzysztof Galkowski4

1School of Automation
Nanjing University of Science and Technology
Nanjing 210094, P. R. China

2Department of Mechanical Engineering
University of Hong Kong, Hong Kong

3School of Electrical and Electronic Engineering
Nanyang Technological University
Nanyang Avenue, 639798 Singapore

4Institute of Control and Computation Engineering
University of Zielona Góra, Zielona Góra, Poland

Abstract. This paper is concerned with the problem of H∞ control for two-dimensional (2-D) continuous systems described by the Roesser state space model. Attention is focused on the design of full-order dynamic output feedback controllers which not only stabilize the given 2-D continuous system, but also reduce the H∞ norm of the closed-loop transfer function, from the disturbance to the controlled output, to a prescribed level. A version of the bounded realness of 2-D continuous systems is established. Based on this, a sufficient condition for the solvability of the H∞ control problem is obtained in terms of a set of linear matrix inequalities (LMIs). Then, a desired dynamic output feedback controller can be constructed by solving these LMIs. Finally, an illustrative example is provided to demonstrate the applicability of the proposed method.

Keywords. Bounded realness, H∞ control, linear matrix inequality, output feedback, two-dimensional continuous systems.

1 Introduction

The problem of H∞ control for one-dimensional (1-D) systems has received much attention during the past years [4, 20]. The purpose is to design controllers such that the resulting closed-loop system is asymptotically stable and its H∞ norm is below a prespecified level. It is shown in [4] that a solution to this problem involves solving a set of Riccati equations, while in [7] a linear matrix inequality (LMI) approach was developed and necessary and