Robust Control for a Class of Dynamical Systems with Uncertainties

Xinkai Chen¹ and Guisheng Zhai²

¹Department of Electronic & Information Systems, Faculty of Systems Engineering, Shibaura Institute of Technology, Minuma-ku, Saitama-city, Saitama 337-8570, Japan
²Graduate School of Engineering, Osaka Prefecture University, 1-1 Gakuen-Cho, Sakai, Osaka 599-8531, Japan

Received: April 22, 2003; Revised: February 18, 2004

Abstract: In this paper, a new robust control is proposed for a class of dynamical systems with uncertainties. The considered dynamical systems may be nonminimum phase systems. The designed controller requires only input output measurement of the system. First, by using least square approximation technique, nonminimum phase systems are approximated by minimum phase systems. Then, the uncertainty is approximately estimated. Finally, based on the approximate minimum phase system and the estimate of the uncertainty, the robust control input is synthesized. Example and simulation results are presented to show the effectiveness of the proposed algorithm.

Keywords: Robust control; nonminimum phase systems; uncertainties; approximate inverse systems; least square method.

Mathematics Subject Classification (2000): 93C15, 93C80, 93D09, 93E10, 93E12.

1 Introduction

In recent years, the robust control for uncertain dynamical systems has been a topic of considerable interest. It is well known that all the practical control systems are subjected to uncertainties. Various robust design methodologies have been proposed for minimum phase dynamical systems until now [7, 10, 11]. For the systems with uncertainties, robust controllers are proposed in [3 – 5, 9, 13] recently. The overall systems can be ensured to be globally uniformly ultimately bounded (GUUB) which can be made arbitrarily close to exponential stability if the control energy permits. However, these approaches cannot be extended to the robust control for nonminimum phase dynamical systems with uncertainties.