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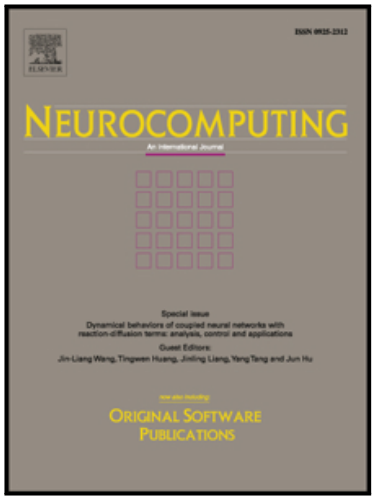

Observer-Based H_∞ Fuzzy Control for Modified Repetitive Control Systems

Yingchun Wang, Rui Wang, Xiangpeng Xie, Huaguang Zhang

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Observer-Based H_∞ Fuzzy Control for Modified Repetitive Control Systems

Yingchun Wang, Rui Wang, Xiangpeng Xie and Huaguang Zhang

Abstract: In this paper, the periodic tracking control problem is considered for nonlinear systems with some parameters uncertainties and disturbances. First, a T-S fuzzy approach is employed to model nonlinear systems. Second, considering the partly state unmeasured and periodic tracking reference signal, fuzzy state observer and fuzzy modified repetitive controller (FMRCr) are designed based on the modified repetitive control (MRC) approach. To achieve signal tracking and H_∞ disturbance attenuation performance, a two-dimensional model approach and singular-value decomposition technique of system output matrix are developed. Then, by the Lyapunov stability theory, some sufficient conditions are obtained for FMRC closed-loop system with stabilization and H_∞ disturbance attenuation performance in linear matrix inequality (LMI) form. Correspondingly, the controller gains and observer gains are solved by LMI toolbox. Two numerical examples are provided to illustrate the validity of the method.

Keywords: Modified repetitive-control, fuzzy control, tracking control, linear matrix inequality (LMI), fuzzy observer.

I. Introduction

In decades, the problems of period tracking control have attracted widely attentions and research activities in control field due to those problems appearing in most of practical systems [1]–[6]. Repetitive control (RC), based on the internal model theory, can effectively track or reject periodic signals for linear systems [7] or time-varying uncertain system [8]. In [9], a modified repetitive control (MRC) approach was first proposed to improve the repetitive control system performance by introducing a low-pass filter

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Y. Wang, R. Wang and H. Zhang are with the School of Information Science and Engineering, Northeastern University, Shenyang 110819, China (e-mail: drwangyc@gmail.com; wangrui134526@163.com; zhanghuaguang@ise.neu.edu.cn).

X. Xie is with the Institute of Advanced Technology, Nanjing University of Posts and Telecommunications, Nanjing 210003, PR China (e-mail: xiexiangpeng1953@163.com).