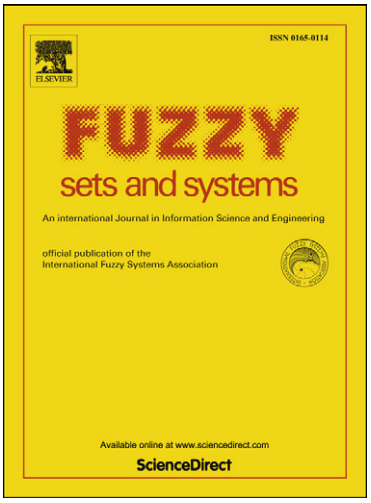
Accepted Manuscript



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Jun-Wei Wang, Han-Xiong Li, Huai-Ning Wu

PII: S0165-0114(15)00487-X
DOI: http://dx.doi.org/10.1016/j.fss.2015.09.027
Reference: FSS 6922

To appear in: *Fuzzy Sets and Systems*

Received date: 27 March 2014
Revised date: 31 July 2015
Accepted date: 29 September 2015

Please cite this article in press as: J.-W. Wang et al., Fuzzy guaranteed cost sampled-data control of nonlinear systems coupled with a scalar reaction-diffusion process, *Fuzzy Sets and Systems* (2015), http://dx.doi.org/10.1016/j.fss.2015.09.027

Fuzzy Guaranteed Cost Sampled-Data Control of Nonlinear Systems Coupled with a Scalar Reaction-Diffusion Process

Jun-Wei Wang[†], Han-Xiong Li[‡, §] and Huai-Ning Wu[*, ¶]

[†]*School of Automation and Electrical Engineering*
University of Science and Technology Beijing
Beijing 100083, P. R. China

[‡]*Department of Systems Engineering and Engineering Management*
City University of Hong Kong
Tat Chee Avenue, Kowloon, Hong Kong SAR.

[§]*State Key Laboratory of High Performance Complex Manufacturing,*
Central South University, Changsha 410083, Hunan, P. R. China

[¶]*Science and Technology on Aircraft Control Laboratory*
School of Automation Science and Electrical Engineering
Beihang University (*Beijing University of Aeronautics and Astronautics*)
Beijing 100191, P. R. China

Abstract

A fuzzy guaranteed cost sampled-data control problem is addressed in this paper for a class of nonlinear coupled systems of an *n*-dimensional lumped parameter system modeled by ordinary differential equation (ODE) with a scalar reaction-diffusion process represented by parabolic partial differential equation (PDE). A Takagi-Sugeno (T-S) fuzzy coupled ODE-PDE model is initially proposed to accurately represent the nonlinear coupled ODE-PDE system. Based on the T-S fuzzy coupled ODE-PDE model, a fuzzy sampled-data controller is subsequently developed via the Lyapunov's direct method to not only locally exponentially stabilize the nonlinear coupled system, but also provide an upper bound of the given cost function. Moreover, a suboptimal fuzzy sampled-data control design is also addressed in the sense of minimizing an upper bound of the cost function. The main contribution of this study lies in that a new parameterized linear matrix inequality (LMI) technique is proposed to reduce the conservativeness of the method, and an LMI-based fuzzy suboptimal sampled-data control design is developed for the nonlinear coupled ODE-PDE system based on this parameterized LMI technique. Simulation results on the sampled-data control of hypersonic rocket car are provided to illustrate the effectiveness and merit of the design method.

Key words: Fuzzy control; Sampled-data control; Lumped parameter system; Distributed parameter system; Linear matrix inequalities (LMIs).

[*] Corresponding author. E-mail: whn@buaa.edu.cn