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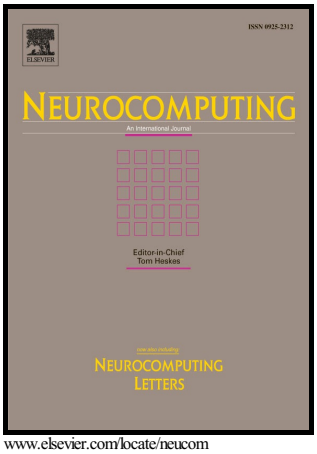

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PII: S0925-2312(16)31085-2
DOI: http://dx.doi.org/10.1016/j.neucom.2016.09.050
Reference: NEUCOM17579

To appear in: *Neurocomputing*

Received date: 1 November 2015
Revised date: 3 August 2016
Accepted date: 22 September 2016

Cite this article as: Heng Liu, Shenggang Li, Jinde Cao, Guanjun Li, Ahmed Alsaedi and Fuad E. Alsaadi, Adaptive fuzzy prescribed performance controller design for a class of uncertain fractional-order nonlinear systems with external disturbances, *Neurocomputing,* http://dx.doi.org/10.1016/j.neucom.2016.09.050

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ACCEPTED MANUSCRIPT

Adaptive Fuzzy Prescribed Performance Controller Design for a Class of Uncertain Fractional-Order Nonlinear Systems with External Disturbances

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Accepted manuscript

Abstract

A fractional-order adaptive fuzzy controller, capable of guaranteeing prescribed performance, is designed for a class of uncertain fractional-order nonlinear systems with external disturbances in this paper. With respect to the prescribed performance control, we mean that the system variables converge to an arbitrary small region of the origin with convergence rate no less than a certain prescribed function. Fuzzy logic system is utilized to approximate an unknown nonlinear function which contains fractional-order terms. Based on the Lyapunov stability criterion, a fractional-order adaptive fuzzy sliding mode controller, which can guarantee the stability of the closed-loop system as well as the prescribed performance, is constructed. Finally, simulation results are given to confirm our results.

Keywords: Adaptive fuzzy control, fractional-order nonlinear system, prescribed performance control, fractional-order controller.

1. Introduction

Recently, fractional-order systems have received more and more interests from physicists and engineers due to their several interesting properties and potential applications [1, 2, 3, 4]. In reality, lots of actual systems show fractional-order differential dynamical behavior because of special materials and chemical

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