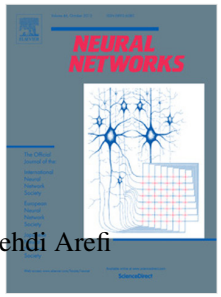
Accepted Manuscript



Adaptive neural output-feedback control for nonstrict-feedback time-delay fractional-order systems with output constraints and actuator nonlinearities

Farouk Zouari, Asier Ibeas, Abdesselem Boulkroune, Jinde Cao, Mohammad Mehdi Arefi

PII: S0893-6080(18)30176-X
DOI: https://doi.org/10.1016/j.neunet.2018.05.014
Reference: NN 3960

To appear in: *Neural Networks*

Received date : 1 November 2017
Revised date : 5 March 2018
Accepted date : 21 May 2018

Please cite this article as: Zouari, F., Ibeas, A., Boulkroune, A., Cao, J., Arefi, M.M., Adaptive neural output-feedback control for nonstrict-feedback time-delay fractional-order systems with output constraints and actuator nonlinearities. *Neural Networks* (2018), https://doi.org/10.1016/j.neunet.2018.05.014

Adaptive Neural output-feedback control for Nonstrict-Feedback time-delay fractional-order systems with Output Constraints and Actuator Nonlinearities

Farouk ZOUARI[1], Asier IBEAS[2,3] , Abdesselem Boulkroune[4], Jinde Cao[5,6], Mohammad MEHDI AREFI[7]

[1*] Laboratoire de Recherche en Automatique (LARA), École Nationale d'Ingénieurs de Tunis (ENIT), Université de Tunis El Manar, BP. 37, Le Belvédère, 1002 Tunis, Tunisie.
Email:zouari.farouk@gmail.com*

[2] Department of Telecommunications and Systems Engineering, Universitat Autònoma de Barcelona, 08193- Bellaterra, Barcelona, Spain.
[3] Departamento de Ingeniería, Facultad de Ciencias Naturales e Ingeniería, Universidad de Bogotá Jorge Tadeo Lozano, 22 Street, No. 4-96, Mod. 7A, Bogotá, D.C. 110311, Colombia
Email: asier.ibeas@uab.cat

[4]LAJ, University of Jijel, BP. 98, Ouled-Aissa, 18000 Jijel, Algeria
Email: boulkroune2002@yahoo.fr

[5]School of Mathematics, and Research Center for Complex Systems and Network Sciences, Southeast University, Nanjing 210096, China
[6]School of Electrical Engineering, Nantong University, Nantong 226000, China
Email : *jdcao@seu.edu.cn*, , *jdcaoseu@gmail.com*

[7]Department of Power and Control Engineering, School of Electrical and Computer Engineering, Shiraz University, 71348-51154 Shiraz, Iran.
Email: arefi.shirazu@gmail.com

Abstract. This study addresses the issue of the adaptive output tracking control for a category of uncertain nonstrict-feedback delayed incommensurate fractional-order systems in the presence of nonaffine structures, unmeasured pseudo-states, unknown control directions, unknown actuator nonlinearities and output constraints. Firstly, the mean value theorem and the Gaussian error function are introduced to eliminate the difficulties that arise from the nonaffine structures and the unknown actuator nonlinearities, respectively. Secondly, the immeasurable tracking error variables are suitably estimated by constructing a fractional-order linear observer. Thirdly, the neural network, the Razumikhin Lemma, the variable separation approach, and the smooth Nussbaum-type function are used to deal with the uncertain nonlinear dynamics, the unknown time-varying delays, the nonstrict feedback and the unknown control directions, respectively. Fourthly, asymmetric barrier Lyapunov functions are employed to overcome the violation of the output constraints and to tune online the