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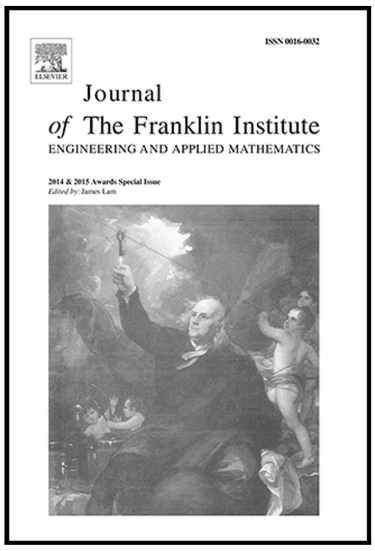

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Gang Chen, Ya Zhao

PII: S0016-0032(18)30425-3
DOI: 10.1016/j.jfranklin.2018.05.064
Reference: FI 3517

To appear in: *Journal of the Franklin Institute*

Received date: 23 August 2016
Revised date: 16 March 2018
Accepted date: 27 May 2018

Please cite this article as: Gang Chen, Ya Zhao, Distributed Adaptive Output-feedback Tracking Control of Non-affine Multi-agent Systems with Prescribed Performance, *Journal of the Franklin Institute* (2018), doi: 10.1016/j.jfranklin.2018.05.064

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ACCEPTED MANUSCRIPT

Distributed Adaptive Output-feedback Tracking Control of Non-affine Multi-agent Systems with Prescribed Performance ☆

Gang Chen[a,*], Ya Zhao[a]

[a] *The Key Laboratory of Dependable Service Computing in Cyber Physical Society, Ministry of Education; College of Automation, Chongqing University, Chongqing 400044, China*

Abstract

This paper addresses the distributed adaptive output-feedback tracking control problem of uncertain multi-agent systems in non-affine pure-feedback form under a directed communication topology. Since the control input is implicit for each non-affine agent, we introduce an auxiliary first-order dynamics to circumvent the difficulty in control protocol design and avoid the algebraic loop problem in control inputs and the unknown control gain problem. A decentralized input-driven observer is applied to reconstruct state information of each agent, which makes the design and synthesis extremely simplified. Based on the dynamic surface control technique and neural network approximators, a distributed output-feedback control protocol with prescribed tracking performance is derived. Compared with the existing results, the restrictive assumptions on the partial derivative of non-affine functions are removed. Moreover, it is proved that the output tracking errors always stay in a prescribed performance bound. The simulation results are provided to demonstrate the effectiveness of the proposed method.

Keywords: Multi-agent systems, Output feedback control, Transient performance, Adaptive control, Dynamic surface control.

1. Introduction

With the development of modern information technology, cyber physical systems are used more extensively in civilian, military, and commercial applications. To improve the reliability, robustness, and scalability of cyber physical systems, the distributed control strategy becomes a prospective choice. Generally, the cyber physical systems can be modeled as networks of agents (or dynamic systems). Therefore, the distributed control of multi-agent systems has witnessed a compelling interest in recent years. Especially, as the states of agents are measurable, the distributed state-feedback control problems of nonlinear multi-agent systems have been extensively investigated(see, for example, [1, 2, 3, 4, 5, 6, 7]).

☆This work was supported by National Natural Science Foundation of China(61673077, 61273108), Basic and Advanced Research Project of Chongqing (CSTC 2016jcyjA0361) and the Fundamental Research Funds for the Central Universities(106112017CDJQJ178827).

*Tel.:+86 65112173.

Email addresses: chengang@cqu.edu.cn (Gang Chen), zhaoya_cq@163.com (Ya Zhao)

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