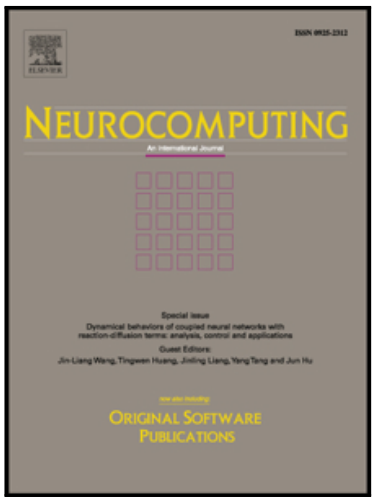

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Tao Li, Zhipeng Li, Shaobo Shen, Shumin Fei

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Extended adaptive event-triggered formation tracking control of a class of multi-agent systems with time-varying delay

Tao Li [a,*], Zhipeng Li [a], Shaobo Shen [b], Shumin Fei [c]

[a] *School of Automation Engineering, Nanjing University of Aeronautics and Astronautics, Nanjing 210016, PR China;*

[b] *School of Instrument Science & Engineering, Southeast University, Nanjing 210096, PR China;*

[c] *School of Automation, Southeast University, Nanjing 210096, PR China.*

Abstract

This paper considers the adaptive event-triggered formation tracking control of a class of second-order multi-agent systems (MASs) with time-varying delay. Firstly, a distributed control protocol is constructed and some extended adaptive event-triggered schemes are presented, where the triggering thresholds rely on the real-time variation of the MASs but not not pre-selected constants. Then by choosing an augmented Lyapunov-Krasovskii functional (LKF), two delay-dependent criteria are formulated in terms of linear matrix inequalities (LMIs). Especially, during estimating the upper bound on LKF's derivative, since some novel integral inequalities and a new convex technique are utilized, the conservatism can be greatly reduced. Finally, two numerical examples with some simulations are provided to illustrate our methods.

Key words: Multi-agent systems (MASs); Second-order; Formation tracking control; Time-varying delay; Adaptive event-triggered scheme

1 Introduction

In past decade, motivated by flocking behaviors and technological developments of computer, automation, and communication, the concept on multi-agent systems (MASs) was put forward and since then, increasing attention has been paid to the research on cooperative control of MASs [1-16,23-30]. It is worth noting that, as a typical case, formation control of MASs includes multiple/one leader(s) and followers, and its objective is to guarantee the states of the followers to form a certain predefined shape, which is significant and applied to many practical fields, such as formation of unmanned aerial vehicles, multiple mobile robots, attitude control of satellites, and cooperative navigation of autonomous underwater vehicles. Therefore, recently, many scholars have attached much importance to the formation control of the MASs and a large amount of results have been reported [6-16,26-30].

Meanwhile, formation tracking control will be more meaningful since it requires the followers not only to form a desired formation but also to realize tracking the leaders. Therefore, the research on formation tracking of MASs has received much attention [9–16,28–30]. Based on switching topologies, the tracking control for second-order MASs was studied with its application to quadrotors' flight [9]. In Ref. [10], the formation tracking control for time-delay MASs was studied and in [11], the second-order average tracking with directed topologies was discussed. Based on finite-time control, in [12], the formation tracking of multiple manipulators was addressed and in [13], the adaptive tracking of unknown nonlinear MASs was analyzed. Especially, in Ref. [14], the distributed tracking was combined

* Corresponding author at: School of Automation Engineering, Nanjing University of Aeronautics and Astronautics, Nanjing 210016, PR China. Tel.: +86 25 84892301 5076.

Email address: autolitao@nuaa.edu.cn (Tao Li).