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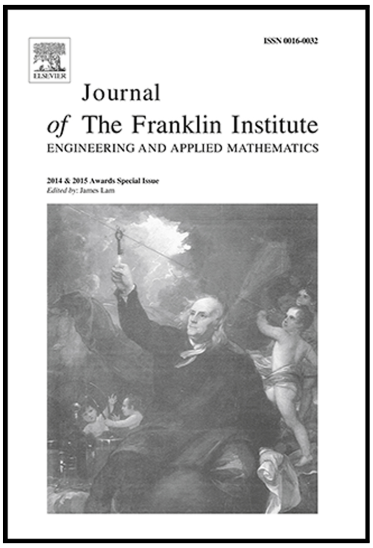

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Guoying Miao, Jinde Cao, Ahmed Alsaedi, Fuad E. Alsaadi

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Event-triggered Containment Control for Multi-agent Systems with Constant Time Delays

Guoying Miao[†‡], Jinde Cao[†*], Ahmed Alsaedi[§], Fuad E. Alsaadi[¶]

Abstract

The paper investigates containment control for the first-order and second-order multi-agent systems with constant time delays under event-triggered conditions, respectively. By applying existing sum of square method to stability analysis of containment control for multi-agent systems, sufficient containment conditions for multi-agent systems are obtained. Firstly, we discussed the case of containment control for multi-agent system with single time delay, and event-triggered conditions are proposed. Then, we extend the results of containment control for multi-agent systems with single time delay to the case with multiple time delays. Finally, simulation examples are given to illustrate the effectiveness of our theoretical results.

Keywords: containment control, time delays, sum-of-squares, event-triggered.

1 Introduction

In recent years, containment control problems for multi-agent systems [1]- [6] have attracted increasing attentions, owing to widely practical applications such as formation control for unmanned aircrafts, entertainment of robots, formation control for underwater vehicles and so on. Moreover, if there are multiple leaders and multiple followers in multi-agent systems, under designed control algorithms, followers asymptotically enter the convex hull of leaders, which is called containment control problem of multi-agent systems.

Since there widely exist time delays in practical systems, it is meaningful to study stability of systems with time delays [7]- [15]. Based on a quadratic Lyapunov-Krasovskii functional and integral inequality techniques, stability of uncertain systems with time delays was studied in [7]. And results in [7] was extended to the case of coupled differential-functional equations in [8], where the interval of time delay was divided into small sections represented as l. When l was increasing, it was asymptotically approaching to the analytic solution of time delays. By applying Abel lemma and combining with different bounding techniques, the larger upper boundary of time delays for linear systems was given in [9] and [10], respectively. Furthermore, another method to investigate time delays is Sum-of-Squares (SOS) [11]- [15]. For instance, by using polynomials to parameterize a quadratic Lyapunov-Krasovskii functional in [7], stability

[*]Corresponding author. *Email addresses:* jdcao@seu.edu.cn

[†]School of Automation, Southeast University, Nanjing 210096, Jiangsu, P.R. China.

[‡]School of Information and Control, Nanjing University of Information Science and Technology, Nanjing 210044, PR China.

[§]Nonlinear Analysis and Applied Mathematics (NAAM) Research Group, Department of Mathematics, King Abdulaziz University, Jeddah 21589, Saudi Arabia.

[¶]Department of Electrical and Computer Engineering, Faculty of Engineering, King Abdulaziz University, Jeddah 21589, Saudi Arabia.