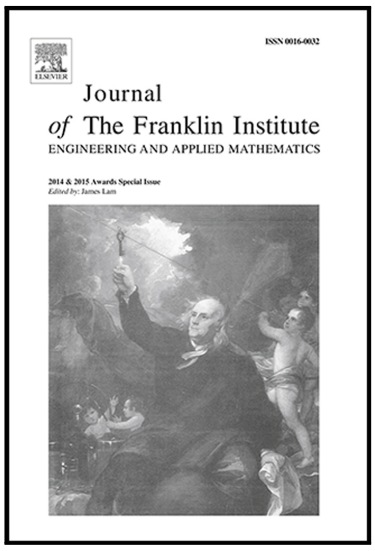

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Event-triggered tracking control for couple-group multi-agent systems

Chuan Yan[1], Mei Yu[1], Cheng Li[2] *

Abstract: This paper mainly investigates the event-triggered tracking control for couple-group multi-agent systems in a disturbance environment, where the topology of the agents is switching. Consensus protocol is designed for the case that some agents reach a consistent value, while the other agents reach another consistent value. Then, event-triggered control laws are designed to reduce the frequency of individual actuation updating for discrete-time agent dynamics. Moreover, by applying the Lyapunov function method, a sufficient condition of couple-group consensus is established in terms of a matrix inequality when the communication topology is switching. Finally, simulation examples are given to demonstrate the effectiveness of the proposed methods.

Keywords: couple-group consensus; multi-agent systems; switching topology; event-triggered.

1 Introduction

In recent years, there has been an increasing research in coordination control of multi-agent systems. Information consensus has attracted more and more attentions from many engineering application fields, such as formation control, flocking, artificial intelligence, automatic control, and so on [1]-[5].

Generally speaking, consensus means that a group of agents converge to a consistent quantity of interest under some control protocols, which has attracted great attention [6]-[8]. In [6], the authors pointed out that the second smallest eigenvalue of its Laplacian matrix was a measure to solve consensus problems. From [7], we knew that the convergence was achieved by finding the optimal weight associated with each communication link, where the global structure of the network must be known beforehand. In [8], the authors presented randomized gossip algorithm on an arbitrary connected network and showed its performance precisely in terms of the second largest eigenvalue of an appropriate stochastic matrix. The above literatures all tried to seek a suitable topology communication to achieve a suitable convergence.

The literature mentioned above was mainly considered under the traditional time-triggered control actuation schemes. However, since the microprocessor or controller equipped in each agent may have limited resources or energies in practical applications, it is better for the agents to update their control actuation as little as possible. In [9]-[10], the authors presented preliminary results of control synthesis for systems with event-based schemes, where the controllers were designed to ensure stability of the closed-loop systems with respect to measurement errors. Many established results referring to event-triggered schemes were in the framework of continuous-time systems, and some of the results had been extended to discrete-time systems [11]-[12].

To our best knowledge, all the aforementioned references have focused on the single group multi-agent systems, where all the agents are assumed to converge to the same consensus value. Group consensus, which included the aforementioned consensus as a special case, was first introduced in [13] to represent such consensus where the states of all agents in the same sub-network reached the same consistent value while there was no agreement among different sub-networks. In [14], the group consensus problem of multi-agent systems with switching topologies

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