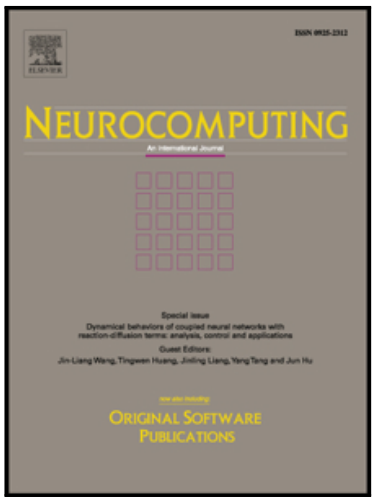

Consensus of multi-agent systems with time delay based on periodic sample and event hybrid control

Kaien Liu, Zhijian Ji

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Consensus of multi-agent systems with time delay based on periodic sample and event hybrid control

Kaien Liu[a,b,c], Zhijian Ji[b,*]

[a]School of Mathematics and Statistics, Qingdao University, Qingdao, Shandong 266071, China
[b]College of Automation and Electrical Engineering, Qingdao University, Qingdao, Shandong 266071, China
[c]Institute of Applied Mathematics of Shandong Province, Qingdao University, Qingdao, Shandong 266071, China

Abstract

The consensus problem of first-order multi-agent systems with time delay is investigated. The periodic sample and event hybrid control method is applied. Specifically, each agent samples its own states periodically and decides when to transmit its sampled states to its neighbors based on certain event. The agents' distributed consensus algorithms are based on these hybrid sampled and event-triggered state measurements, which can significantly decrease the number of the controllers' updates. The Zeno behavior which is discussed in most works considering event-based consensus of multi-agent systems is excluded automatically since the span between two contiguous event-triggering time instants is not less than the sampling period. The cases of directed and undirected topologies are both considered. The obtained results improve the existing ones in the literature. A numerical simulation is provided to illustrate the effectiveness of the obtained theoretical results.

Keywords: Consensus; Multi-agent systems; Delay; Periodic sample control; Event control; Digraph.

1. Introduction

Cooperative control problems in networks of multi-agent systems have drawn much attention from different research communities due to their wide applications in different fields. One of the important problems is consensus which means that all agents reach an agreement on certain quantities of interest by using local interaction, see [1, 2, 3] and the references therein. However, most of the existing works rely on continuous availability of information, which leads to inefficient implementations in terms of energy consumption and network congestion for communication bandwidth. In order to overcome this drawback, the sampled-data approach is applied. In [4] and [5], by using periodic sampling and zero-order hold devices, Xie et al. presented the conditions on consensus of first-order multi-agent systems without or with delay. The case of second-order multi-agent systems was addressed in [6, 7, 8]. The asynchronous sampling-based consensus algorithms were proposed in [9, 10], where different agents updated their control inputs at different time instants. It should be pointed out that all the above mentioned algorithms were scheduled at some specific time instants.

*Corresponding author.
Email address: jizhijian@pku.org.cn (Zhijian Ji)