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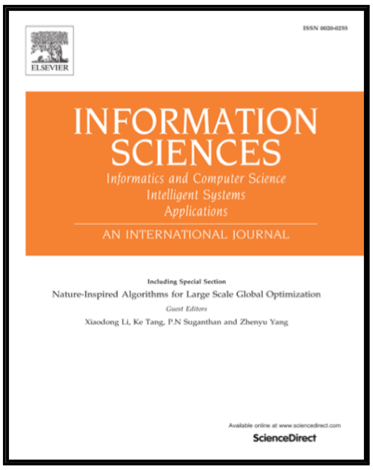

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Event-Triggered Consensus for Linear Continuous-time Multi-agent Systems Based on a Predictor

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Abstract

In this paper, the problem of an event-triggered consensus for a linear continuous-time multi-agent system is investigated. A new event-triggered consensus protocol based on a predictor is proposed to achieve consensus while not requiring continuous communication among agents. The predictor utilizes an artificial closed-loop system to predict the future state of each agent. With the proposed consensus protocol, each agent only needs to monitor its own states to determine its event-triggered instants. When an event of an agent is triggered, the agent immediately updates its consensus protocol and sends its state information to its neighbors. When an agent receives state information from its neighbors, the agent immediately updates its consensus protocol and predictor. A necessary and sufficient condition that solves the consensus problem is derived. Moreover, it is proved that Zeno behaviors are excluded. Finally, some numerical examples are given to illustrate that, with the proposed protocol, a multi-agent system can achieve consensus while greatly reducing event-triggered times.

Keywords: Multi-agent system, Event-triggered control, Consensus, Predictor

1. Introduction

In the 1970s, the definition of an agent was proposed in the field of intelligence [25]. Since then, increasing numbers of researchers have paid attention to multi-agents, and many results have been obtained. To mention a few, the consensus problem of multi-agent systems with a directed communication topology was investigated in [27], and a theoretical framework for this problem was built. The consensus problem of multi-agent systems with first-order integrator dynamics, active leaders and variable interconnection topologies was considered in [18]. For multi-agent systems with second-order integrator dynamics, a necessary and sufficient condition for the consensus was proposed in [33]. The leader-following consensus problem of second-order nonlinear multi-agent systems with general topologies was studied without assuming that the interaction diagraph was strongly connected or contained a directed spanning tree in [31], while the leader-following consensus for a general multi-agent system was addressed in [6]. For multi-agent systems with high-order integrator dynamics, a necessary and sufficient condition was proposed for the consensus problem in [17]. The consensus for high-order linear multi-agent systems with time delays in both the communication channels and control inputs was investigated in [42]. The consensus problem of multi-agent systems with fixed/switching communication topology was investigated in [20], using the Lyapunov method. The existence of consensus protocols for linear continuous-time/discrete-time multi-agent systems with fixed communication topology was proved in [24] and [14]. A leader-following consensus problem for multi-agent systems subject to unknown-but-bounded process and measurement noises was developed in [11]. The recent advances in distributed cooperative control under a sampled-data setting were presented in [10]. Some other results concerning multi-agent systems can be seen in [2, 12, 13, 26] and references therein.

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