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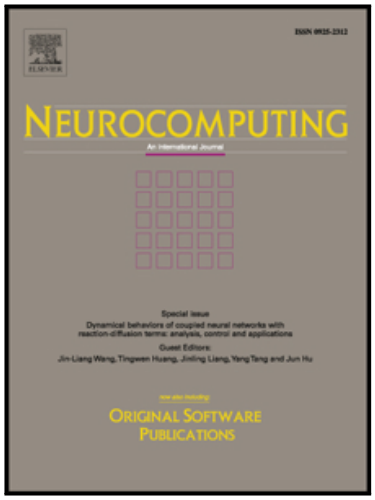

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Fixed-time event-triggered consensus control for multi-agent systems with nonlinear uncertainties

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Abstract

This paper investigates the fixed-time event-triggered consensus control problem for multi-agent systems with nonlinear uncertainties. The fixed-time consensus protocols are presented based on event-triggered strategies which can significantly reduce energy consumption and the frequency of the controller updates. Both the centralized and the distributed consensus control strategies are considered. It is proved that under the proposed event-triggered consensus control strategies the Zeno behavior is avoided. Compared with the finite-time consensus, the fixed-time consensus can be achieved within a fixed settling time with arbitrary initial states of the agents. Finally, two examples are presented to show the effectiveness of the fixed-time event-triggered consensus protocols.

Keywords: fixed-time, event-triggered, consensus, multi-agent systems, nonlinear uncertainties

1. Introduction

Recent years, cooperative control of multi-agent systems received considerable attention and led to lots of significant results such as formation control [1, 2], flocking [3, 4], data fusion [5] and so on. As a basic problem of cooperative control, consensus is a typical collective behavior which requires all the agents to converge to a common value or an agreement by communicating with their neighbours [6].

Noticeably, most of the existing works about consensus problem of the multi-agent systems were asymptotic consensus results which meant that the consensus can only be achieved within infinite time[7, 8, 9, 10, 11]. In [7], the distributed consensus algorithm was considered for linear multi-agent systems with noise and delays. The consensus problems for the networks topologies with fixed and switching topologies were researched in [8], and the random interconnection failure was considered in [9]. For the system model with external disturbances and input delays, the consensus control algorithm for multi-agent systems had been researched in [10, 11]. However, convergence rate is an important property for the consensus of multi-agent systems. This naturally leads to the analysis and construction of the control protocols for consensus convergence rate.

Compared with the convergence rate of asymptotic results, the finite-time consensus results have better dynamic property. Motivated by the advantages of finite-time control protocols, for instance, higher accuracy and faster convergence rate [12], finite-time consensus control of multi-agent systems has attracted much attention in recent years [12, 13, 14]. The distributed finite-time consensus control protocols by continuous state feedback were proposed for networks of dynamic agents in [13]. By adding a power integrator method, the continuous finite-time consensus protocols were proposed for leaderless and leader-follower multi-agent systems [14]. In these researches, the settling time of finite-time consensus is depend on the initial states of all the agents. Hence, the settling time can be sufficiently large if the initial states are very large.

To deal with these constraints, new works based on the notion of fixed-time stability [15] have been studied, which can ensure the settling time regardless of the initial states of the agents. In [16], the fixed-time consensus protocols

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