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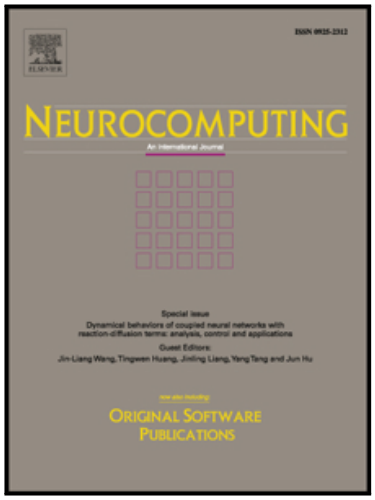

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Distributed event-based consensus control of multi-agent system with matching nonlinear uncertainties

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Abstract

Event-triggered scheme for multi-agent system is motivated by the network systems with limited communication and energy resources. In our paper, the event-triggered consensus problem of multi-agent system with heterogeneous matching uncertainties is considered. An event-based distributed adaptive controller and a novel event-triggered rule without continuous communication among agents are proposed, with which the consensus errors are uniformly bounded and all the agents could converge to an adjustable small bounded set exponentially. Meanwhile, the Zeno behavior is excluded with the designed control strategy. Finally, numerical examples are given to illustrate the effectiveness of the theoretical analysis.

Keywords: multi-agent system, consensus, event-based scheme, nonlinear uncertainties

1. Introduction

Nowadays, cooperative control research for multi-agent systems has become a hot topic and attracted much attention in varieties of research fields including physics, sociology, biology, artificial intelligence, sensor networks and control engineering due to its broad application. The common problems of cooperative control contain consensus [1]-[7], tracking [8], [9], containment control [10], [11] etc. Most of the existing work focus on designing control laws by local information so as to achieve an agreement for all agents on variables of common concern, which is known as consensus problem. Consensus is the essential research problem for multi-agent systems. In [1], a general framework on consensus research for multi-agent systems is proposed. Since then, the results about consensus have greatly sprung up from kinds of perspectives, such as communication topologies [1]-[5], time delays [1], output saturation [6], nonlinear dynamics [7] etc.

Continuous communication and continuous controller updates are needed in the results above. However, in practical systems, autonomous agents usually are equipped with digital microprocessors so that digital platforms are needed to coordinate the data acquisition, transmission and controller execution. To address this concern, one approach is sampled control such as [12], in which the controllers are updated periodically. But with this method the controller updates continue periodically with the same frequency even after the control goals have been achieved with sufficient enough accuracy. To overcome this shortcoming, it is preferable to introduce event-triggered schemes. The idea of event driven schemes is produced in computing, in which an event is an action or occurrence recognized by software that may be handled by the software. Computer events can be generated or triggered by the system, by the user or in other ways. Software that changes its behavior in response to events is said to be event-driven. Nowadays, there are many results based on event-triggered schemes for multi-agent systems such as [13]-[15]. In these results, controller updates depend on the prescribed events, which can reduce the number of controller updates greatly, avoid unnecessary bandwidth and energy consumption. Meanwhile, event-triggered scheme has been addressed in multi-agent systems due to its advantages.

The event-triggered controllers can be developed with continuous or dis-continuous communication

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