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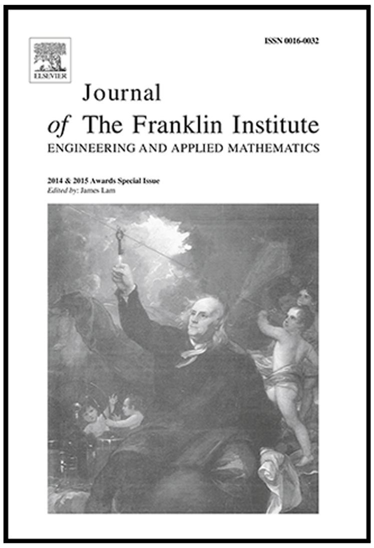

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Event-based consensus for second-order multi-agent systems with actuator saturation under fixed and Markovian switching topologies

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Abstract

This paper studies the event-based consensus problem of second-order multi-agent systems with actuator saturation under fixed topology and Markovian switching topologies. By a model transformation, the consensus problem is first converted into the stability problem of the error system. Using discontinuous Lyapunov functional approach, two sufficient conditions on the consensus are derived for second-order multi-agent systems with fixed topology and Markovian switching topologies, respectively. The discontinuous Lyapunov functions take full account of the characteristics of the sawtooth delay, and thus lead to a less conservative consensus criterion. It is shown that the consensus condition depends on the parameters of sampling period, Laplacian matrix, and event-triggered parameter. In addition, this paper provides an effective method to co-design both the consensus controller and the event-triggered parameter. Finally, two numerical examples are provided to illustrate the effectiveness and feasibility of the proposed algorithm.

1. Introduction

The study of consensus problems has a long history in computer science, especially in distributed computation and automata theory. During the past two decades, consensus as a typical collective behavior in the multi-agent systems has received considerable attention [1, 2], due to its broad applications in sensor networks, unmanned air vehicle formations, underwater vehicles, etc. In the context of multi-agent systems, consensus refers to reaching an agreement among a group of autonomous agents, which is one of the most important and fundamental issues in the coordination control. Until now, the consensus problem for multi-agent systems with first-order dynamics has been extensively studied and many important results have been obtained[3, 4]. Then, these results have been used to develop consensus theory for multi-agent systems with second-order dynamics and general linear dynamics [5-7], which greatly promote the development of cooperative control theory.

Although many efforts have been made towards solving consensus problems for multi-agent systems with various dynamics, most of the existing results do not take actuator saturation into account. As a matter of fact, actuator saturation is very common in practical applications due to physical, safety or technological constraints. Ignoring actuator saturation in the control protocol design will degrade the system performances and may even cause instability of the closed-loop system. Recently, many researchers have recognized the importance of the consensus problem with actuator saturation, and some work in this area has been conducted. For example, the consensus problem for the first-order mul-

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