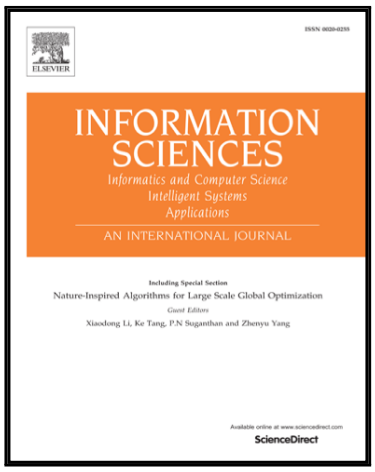

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Global Leader-Following Consensus of a Group of Discrete-Time Neutrally Stable Linear Systems by Event-Triggered Bounded Controls *

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Abstract

This paper studies the global leader-following consensus problem for a group of discrete-time neutrally stable linear systems subject to actuator saturation. An event-triggered linear feedback law, either of the state feedback type or the output feedback type, is constructed for each follower agent and an event-triggering strategy is designed for updating these control laws. These event-triggered control laws are shown to achieve global leader-following consensus when the communication topology among the follower agents is strongly connected and detailed balanced and the leader is a neighbor of at least one follower agent. Simulation results illustrate the theoretical validity.

Keywords: Multi-agent systems, event-triggered control, discrete-time, actuator saturation, global leader-following consensus.

1 Introduction

In the past decades, much attention has been paid to distributed cooperative control of multi-agent systems and many fundamental results have been obtained (see, for example, [7, 17, 18]). Among the many distributed cooperative control problems, the consensus problem has been most extensively studied due to its many applications in, for example, autonomous underwater vehicles, unmanned air vehicles, mobile robots, and distributed sensor networks (see, for example, [1, 2, 3, 14]). Consensus of a multi-agent system entails all agents achieving an agreement on their states by using the information of their neighbors obtained through a communication network.

In cooperative control of multi-agent systems, the requirement of frequent updates of control input poses a great challenge in controller implementation for systems with limited resources. To reduce the unnecessary control updates, event-triggered control has been applied to solve the consensus problem of multi-agent systems. In event-triggered control, control input is updated according to an event-triggering strategy. For example, a control input is updated only when a sampled error exceeding a threshold value. Many results have been obtained on solving the consensus problem using event-triggered control (see, for example, [4, 5, 8, 9, 11, 24, 27]).

As one of the most common physical constraints in practical control systems, actuator saturation has been taken into consideration in solving the consensus problem in both the continuous-time and the discrete-time settings. Global consensus in the presence of actuator saturation can be achieved by linear feedback for the agents described by double-integrator systems or neutrally stable linear systems under a strongly connected and detailed balanced communication topology [16]. A neutrally stable linear system is one whose open-loop poles are in the closed

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