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Synchronization in the presence of unknown, nonuniform and arbitrarily large communication delay

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Abstract

This paper studies both output and state synchronization problems for multi-agent systems with agents that are identical and coupled through a network with unknown, nonuniform and arbitrarily large communication delay. We assume that agents are non-introspective (i.e. agents have no access to any of their own states) in the output synchronization problem. The network can be either undirected or directed. In the case of undirected network, exact knowledge of the network is not required and only a specific lower bound is needed. The objective is to design a decentralized protocol such that the multi-agent system achieves output synchronization or state synchronization for any unknown, nonuniform and arbitrarily large communication delay.

Key words: Multi-agent systems, Communication delay, Distributed control

1. Introduction

In the past few decades, synchronization problems for multi-agent systems have received substantial attention, where the objective is to achieve asymptotic agreement on a common state (*state synchronization*) or output trajectory (*output synchronization*) among agents of the network through decentralized control protocols. Some early results can be found in, e.g., [1], [2], [3], [4], for state synchronization problems of

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