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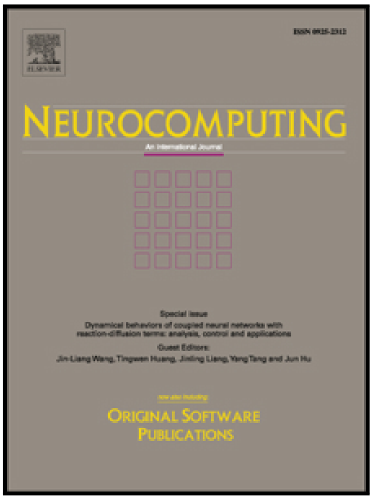

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Resilient control design for consensus of nonlinear multi-agent systems with switching topology and randomly varying communication delays

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Abstract

This paper examines the robust consensus problem of nonlinear multi-agent systems via a resilient controller subject to switching topology, wherein the effect of uncertainty in the form of additive perturbations and a randomly varying communication delay is considered in the control design. In particular, a directed graph is used to describe the interaction topology of the addressed multi-agent system and a stochastic variable obeying the Bernoulli distributed white sequences is incorporated to represent the randomness of delay. By utilizing the Lyapunov's direct method and some matrix operations, a sufficient condition for mean-square asymptotic consensus of the addressed system is derived. Subsequently, the explicit characterization of the resilient control gain is obtained by means of linear matrix inequalities that can be effectively solved by using the ideas of convex optimization. An academic example is eventually presented to illustrate the significance and potency of the proposed control design strategy.

Keywords: Multi-agent systems; Consensus; Resilient control; Randomly varying communication delays.

1. Introduction

In the past three decades, multi-agent systems have stirred considerable research attention since they are successfully applied in various branches of science and engineering, including intelligent transportation management systems, distributed sensor networks, mobile robotics, surveillance systems and so forth [1]. Generally speaking, a multi-agent system consists of a large number of interacting intelligent agents whose dynamics are expressed in the framework of differential/difference equations. In such system, the so-called Laplacian matrix is used to represent the connectivity between agents, which can be obtained with aid of the adjacency and degree matrices. It is to be noted that the prime concern in the study of multi-agent systems is consensus issue, which means that a group of interacting agents attains a collective goal regarding the state of all agents [2, 3]. Due to its clear engineering insights, so far in the literature, a multitude of research

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