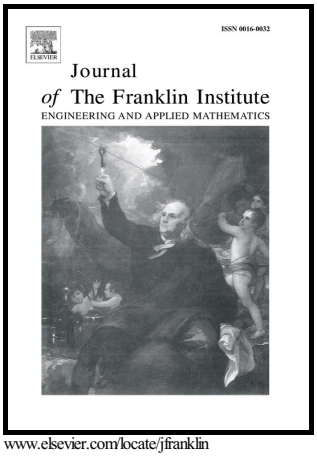

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Adaptive finite-time fault-tolerant consensus protocols for multiple mechanical systems

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Abstract

This paper investigates the problem of finite-time fault-tolerant consensus protocols for a class of uncertain multiple mechanical systems. On the basis of the recursive design method and finite-time control theory, distributed consensus protocols and adaptive laws are developed by using locally available information. Fuzzy logic systems are employed to approximate the unknown functions. It is proved that if the designed parameters and functions in the protocols and adaptive laws are suitably chosen, the position errors and the velocity errors between any two mechanical systems will converge to a small neighborhood of zero in finite time. Finally, an example is given to demonstrate the effectiveness of the proposed method.

Keywords: Multi-agent systems, finite-time consensus, fault-tolerant, adaptive control, mechanical systems.

1. Introduction

The consensus problem for multi-agent systems has attracted more and more attention in the past decades due to the broad applications of multi-agent systems in many areas, such as formation control [1, 2], attitude alignment [3], containment control [4], flocking [5], congestion control [6] and so on. The objective of consensus is to design distributed control algorithms such that a group of agents reach an agreement on some state of interest [18]. Fruitful results have been reported on the consensus problem [7–10].

In the research of consensus problem, convergence rate is a very important performance indicator for the proposed consensus protocols. Recently, finite-time consensus becomes one particular area of interest for its faster convergence and high performances, such as better disturbance rejection and robustness against uncertainties [11, 12]. There are three main methods to deal with the finite-time consensus problems of second-order multi-agent systems: homogeneous method [13], terminal sliding mode technique [14] and adding a power

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