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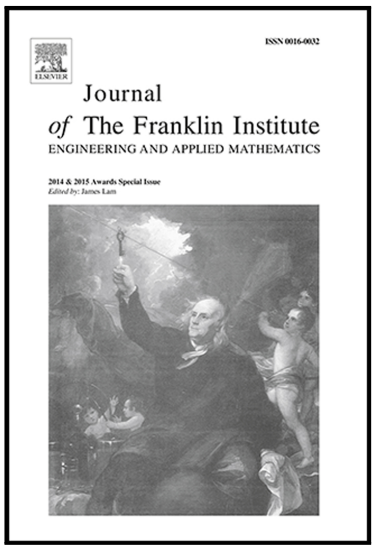

Time-varying formation tracking for high-order multi-agent systems with switching topologies and a leader of bounded unknown input

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Time-varying formation tracking for high-order multi-agent systems with switching topologies and a leader of bounded unknown input☆

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Abstract

Time-varying formation tracking problems for high-order multi-agent systems with switching topologies are investigated. Different from the previous work, the states of the followers form a predefined time-varying formation while tracking the state of the leader with bounded unknown control input. Besides, the communication topology can be switching, and the dynamics of each agent can have nonlinearities. Firstly, a nonlinear time-varying formation tracking control protocol is presented which is constructed using only local neighboring information. Secondly, an algorithm with four steps is proposed to design the time-varying formation tracking protocol, where the time-varying formation tracking feasibility condition is introduced. Thirdly, by using the Lyapunov theory, the stability of the proposed algorithm is proven. It is proved that the high-order multi-agent system with switching topologies achieves the time-varying formation tracking if the feasibility condition holds and the dwell time is larger than a positive constant. Finally, a numerical example with six followers and one leader is given to demonstrate the effectiveness of the obtained results.

Key words: Time-varying formation tracking, high-order multi-agent systems, nonlinearity, switching topologies, unknown control input

1. Introduction

Over the recent years, the cooperative control issues for multi-agent systems (MASs) have been extensively studied and tremendous achievements have been scored [1]-[5]. Based on the cooperative control theory, many derivative theories, such as consensus control [9], containment control [10] and formation control [11] have been developed. In these areas, formation control is the basic one and has become a focus recently [6]-[8]. The for-

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