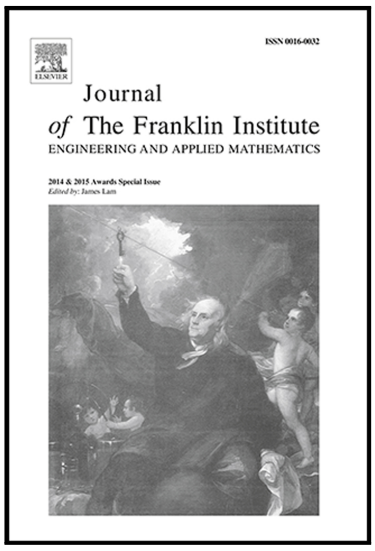

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Containment Control of Singular Heterogeneous Multi-agent Systems

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Abstract

In this paper, we first consider the containment control problem of singular heterogeneous multi-agent systems, where all the followers converge to the convex hull spanned by the leaders. To solve this problem, we propose two distributed control laws: one is based on the state feedback control framework, which is suitable for the case that the full state information of each follower is accessible; and the other is based on the output regulation framework, where each follower only can access to its output. Furthermore, the distributed observers are designed for every follower to estimate the convex combination of the leader states which is determined by the communication graph. It should be noted that our results can also regard the non-singular multi-agent systems' containment control problem as a special case. Finally, simulation results corroborate the effectiveness of our analytical results.

Keywords: Containment control, singular system, distributed observer, output regulation, heterogeneous multi-agent systems

1. Introduction

In recent years, large amounts of cooperative problems of multi-agent systems have been extensively studied (see [1]-[25]). These studies can be classified into leaderless consensus problem (e.g., [8, 9, 13]), leader-following consensus problem (e.g., [6, 22, 23]), and containment control problem (e.g., [7, 25]). Unlike the leaderless/leader-following consensus problem that all the agents/followers achieve a common state, the containment control problem requires all the followers converge to a convex hull formed by multiple leaders. Also, we can regard the leader-following consensus problem as a special case of the containment control problem, since the convex hull of one leader's state is exactly the state itself.

Because of the multiple leaders' setting, studying the containment control problem becomes more difficult which attracts more recent attentions than the leader-following consensus problem. Reference [26] investigated the problem of distributed containment control of a group of mobile autonomous agents with multiple stationary or dynamic leaders under both fixed and switching directed network topologies. In [27],

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