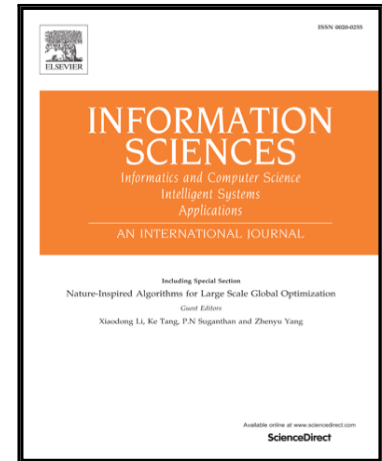


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Chong-Xiao Shi, Guang-Hong Yang

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Hierarchical constrained consensus algorithm over multi-cluster networks

Chong-Xiao Shi^a, Guang-Hong Yang^{a,b,*}

^aCollege of Information Science and Engineering, Northeastern University, Shenyang, 110819, China

^bState Key Laboratory of Synthetical Automation of Process Industries, Northeastern University, Shenyang, Liaoning, 110819, China

Abstract

This paper considers the constrained consensus problem over multi-cluster networks. It is assumed that the agents' states are constrained by different sets, where each constraint set is privately known by the corresponding agent. Within this framework, a hierarchical projection-based consensus algorithm is presented to solve the considered problem. Technically, the consensus analysis of the proposed algorithm consists of the following three aspects: First, by using the property of the projection operator, the limiting behaviors of the agents' states generated by the algorithm are investigated. Then, based on the limiting behaviors, it is proven that the agents' states in the whole network achieve a constrained consensus. Furthermore, by introducing an important auxiliary variable that relates to the agents' states, the linear convergence of the proposed algorithm is proved. Compared with the existing results, this paper generalizes the constrained consensus methods under single-cluster networks to the multi-cluster ones. Finally, simulations are given to verify the theoretical results.

Keywords: Multi-cluster networks, consensus control, constrained sets, projection-based algorithm, linear convergence rate

1. Introduction

In recent years, the study on networked systems has attracted much attention due to the rapid developments of smart grids [6, 8], large-scaled interconnected systems [15, 16], distributed optimization [4, 25, 32, 36], aerospace engineering [10, 23], circuit systems [11, 12], and so on. Especially, increasing studies have focused on the consensus control problem over multi-agent networks. The so-called consensus control means that all the agents reach an agreement via an appropriate distributed control law.

*Corresponding author

Email addresses: s254705600@sina.com (Chong-Xiao Shi), yangguanghong@ise.neu.edu.cn (Guang-Hong Yang)

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