Distributed Model Predictive Control Framework for Consensus of Multi-Agent System

Lifeng Zheng
College of Electronic and lnformation Engineering
Southwest University
Chongqing, China
zlf_swu@163.com

Huaqing Li
College of Electronic and lnformation Engineering
Southwest University
Chongqing, China
huaqingli@swu.edu.cn

***Abstract*—Given that mere cooperation or competition may not adequately describe the interaction patterns of large-scale networked systems, we investigate the multi-cluster aggregative games characterized by mixed relationships. In this context, each cluster is regarded as a virtual player whose task is to make decisions within the coupled feasible set to minimize its own cost, while agents within the same cluster collaborate to achieve this objective. To correctly estimate the aggregation of global decisions in a distributed way, a dynamic tracking variable is introduced for each agent, and tracking errors are eliminated by an orthogonal component of a consensus subspace. Additionally, a distributed generalized Nash equilibrium seeking algorithm based on the preconditioning operator splitting method is designed. If there is only one cluster in the system, the algorithm will degenerate into a distributed optimization algorithm. It is proved that the algorithm converges when the uncoordinated step sizes are smaller than given upper bounds. This work proposes a generalized solution for distributed optimization and games.**

Keywords—multi-agent system, game theory, distributed algorithm, operator splitting, decision-making