Reach a nonlinear consensus for MAS via doubly stochastic quadratic operators

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Abstract

This technical note addresses the new nonlinear protocol class of doubly stochastic quadratic operators (DSQOs) for coordination of consensus problem in multi-agent systems (MAS). We derive the conditions for ensuring that every agent reaches consensus on a desired rate of the group's decision where the group decision value in its agent's initial statuses varies. Besides that, we investigate a nonlinear protocol sub-class of extreme DSQO (EDSQO) to reach a consensus for MAS to a common value with nonlinear low-complexity rules and fast time convergence if the interactions for each agent are not selfish. In addition, to extend the results to reach a consensus and to avoid the selfish case we specify a general class of DSQO for reaching a consensus under any given case of initial states. The case that MAS reach a consensus by DSQO is if each member of the agent group has positive interactions of DSQO (PDSQO) with the others. The convergence of both EDSQO and PDSQO classes is found to be directed towards the centre point. Finally, experimental simulations are given to support the analysis from theoretical aspect.

Keywords

Author Keywords: Consensus problem; multi-agent systems; doubly stochastic quadratic operators; extreme doubly stochastic quadratic operators

KeyWords Plus: 2ND-ORDER MULTIAGENT SYSTEMS; FINITE-TIME CONSENSUS; DISTRIBUTED CONSENSUS; DIRECTED NETWORKS; DYNAMIC AGENTS; PROTOCOLS; ALGORITHMS; COMMUNICATION; STABILITY; COORDINATION

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