Nonlinear Consensus Protocol Modified from Doubly Stochastic Quadratic Operators in Networks of Dynamic Agents

By: Abdulghafor, R (Abdulghafor, Rawad)[1]; Almotairi, S (Almotairi, Sultan)[2]; Almohamedh, H (Almohamedh, Hamad)[3]; Turaev, S (Turaev, Sherzod)[4]; Almutairi, B (Almutairi, Badr)[5,6]

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Abstract

This article explores nonlinear convergence to limit the effects of the consensus problem that usually occurs in multi-agent systems. Most of the existing research essentially considers the outline of linear protocols, using complex mathematical equations in various orders. In this work, however, we designed and developed an alternative nonlinear protocol based on simple and effective mathematical approaches. The designed protocol in this sense was modified from the Doubly Stochastic Quadratic Operators (DSQO) and was aimed at resolving consensus problems. Therefore, we called it Modified Doubly Stochastic Quadratic Operators (MDSQO). The protocol was derived in the context of coordinated systems to overcome the consensus issue related to multi-agent systems. In the process, we proved that by using the proposed nonlinear protocol, the consensus could be reached via a common agreement among the agents (average consensus) in a fast and easy fashion without losing any initial status. Moreover, the investigated nonlinear protocol of MDSQO realized the reaching consensus always as well as DSQO in some cases, which could not reach consensus. Finally, simulation results were given to prove the validity of the theoretical analysis.

Keywords

Author Keywords: nonlinear protocol; consensus problem; multi-agent systems; doubly stochastic quadratic operators; average consensus

KeyWords Plus: FINITE-TIME CONSENSUS; 2ND-ORDER MULTIAGENT SYSTEMS; DISTRIBUTED CONSENSUS; SUFFICIENT CONDITIONS; SWITCHING TOPOLOGY; STABILITY; CONVERGENCE; ALGORITHMS

Author Information

Reprint Address: Abdulghafor, R (reprint author)

+ Int Islamic Univ Malaysia, Fac Informat & Commun Technol, Kuala Lumpur 53100, Malaysia.

Reprint Address: Almotairi, S (reprint author)

+ Majmaah Univ, Community Coll, Dept Nat & Appl Sci, Majmaah 11952, Saudi Arabia.

Addresses:

+ [1] Int Islamic Univ Malaysia, Fac Informat & Commun Technol, Kuala Lumpur 53100, Malaysia
+ [2] Majmaah Univ, Community Coll, Dept Nat & Appl Sci, Majmaah 11952, Saudi Arabia

[3] KACST, Riyadh 12354, Saudi Arabia

+ [4] United Arab Emirates Univ, Coll Informat Technol, POB 15551, Abu Dhabi, U Arab Emirates
+ [5] Majmaah Univ, Dept Informat Technol, Coll Comp Sci, Majmaah 11952, Saudi Arabia
+ [6] Majmaah Univ, Informat Technol Coll, Majmaah 11952, Saudi Arabia

E-mail Addresses: rawad@iium.edu.my; almotairi@mu.edu.sa; halmohamedh@kacst.edu.sa; sherzod@uaeu.ac.ae; b.algoian@mu.edu.sa

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