Consensus Convergence of Multi-Agent Systems Controlled via Geometric Quadratic Stochastic Operators

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Karim, Siti Nurlaili [a] ; Roslan, Nur Syahirah [a] ; Sani, Sarah Afifah Abdullah [b] ; Lah, Nur Syadhila Che [c] ; Hamzah, Nur Zatul Akmar [d]

[a] Department of Computer Science, Faculty of Information and Communication Technology, Universiti Tunku Abdul Rahman, Jalan Universiti, Bandar Barat, Perak, Kampar, 31900, Malaysia

Abstract

Consensus control in multi-agent systems has emerged as a key domain of research, owing to its broad implementations in numerous fields. However, achieving consensus, where all agents agree on a common value, presents a key challenge in the study of multi-agent coordination. To address this, consensus models are formulated and developed specifically to solve such problems. Previous empirical and theoretical studies have shown that nonlinear models outperform linear models in tackling consensus challenges. Limited studies of the nonlinear consensus models promote the idea of a potential nonlinear model utilising Geometric quadratic stochastic operators (QSOs). This paper proposed Geometric QSOs for solving consensus problems in the systems of multi-agent. For consensus convergence, the suggested method makes advantage of a nonlinear class of family of QSOs with geometric distribution. The foundation of the nonlinear protocols for Geometric QSOs is

probability and measure theory. The study uses geometric QSOs to examine how the multi-agent systems converge to the ideal value. An investigation was conducted in comparison between the DeGroot model and current nonlinear models. Our results suggest that the suggested nonlinear consensus model can be used to solve a more sophisticated consensus problem. © 2026 Author(s)

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Corresponding authors

Corresponding author	S.N. Karim
Affiliation	Department of Computer Science, Faculty of Information and Communication Technology, Universiti Tunku Abdul Rahman, Jalan Universiti, Bandar Barat, Perak, Kampar, 31900, Malaysia
Email address	nurlaili.karim@utp.edu.my

Abstract

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Corresponding authors

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