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Robust Synchronization of Uncertain Fractional-Order Quaternion-Valued Memristive Neural Networks with Delays

Communication Info

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Abstract

This paper addresses the synchronization of uncertain fractional-order quaternion-valued memristive neural networks (FOQVMNNs) with time-varying delays. Fractional-order models are widely recognized for their ability to describe systems with memory and hereditary properties [1], which are essential in neural network dynamics [2]. To overcome structural mismatches and unknown perturbations, a nonlinear adaptive control law is first proposed to achieve robust complete synchronization [3]. Furthermore, to reduce communication overhead, an event-triggered control (ETC) mechanism is designed to realize quasi-synchronization [4]. Unlike traditional decomposition methods [5], the analysis is conducted directly in the quaternion domain to preserve the system's algebraic integrity and reduce computational complexity. Numerical simulations are provided to illustrate the effectiveness of the proposed results.

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References

- [1] D. Baleanu, *Fractional calculus: models and numerical methods*, World Scientific, Vol. 3, 2012.
- [2] Y. Sun, Y. Liu, L. Liu, Fixed-time synchronization for fractional-order cellular inertial fuzzy neural networks with mixed time-varying delays, *Fractal and Fractional*, 8, 2024, 97.
- [3] J. Yang, Y. Sheng, H.L. Li, J. Yang, S. Chen, X. Luo, J. Yang, Z. Li, H. Li, Adaptive synchronization of fractional-order uncertain complex-valued competitive neural networks under the non-decomposition method, *Fractal and Fractional*, 8, 2024, 449.
- [4] Z. Wang, W. Zhang, H. Zhang, D. Chen, J. Cao, M. Abdel-Aty, Event-triggered quasi-projective synchronization of fractional-order quaternion-valued neural networks with uncertain parameters and time-varying delays, Available at SSRN 5010904, 2024.
- [5] A. Pratap, R. Raja, J. Alzabut, J. Cao, G. Rajchakit, C. Huang, Mittag-Leffler stability and adaptive impulsive synchronization of fractional order neural networks in quaternion field, *Mathematical Methods in the Applied Sciences*, 43 (2020) 6223-6253.