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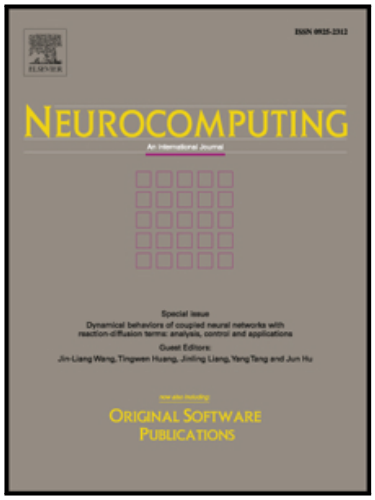

Output-Feedback Tracking Control for Interval Type-2 Polynomial Fuzzy-Model-Based Control Systems

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Output-Feedback Tracking Control for Interval Type-2 Polynomial Fuzzy-Model-Based Control Systems

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Abstract

In this paper, the output tracking control issues of polynomial-fuzzy-model-based (PFMB) systems equipped with mismatched interval type-2 (IT2) membership functions are investigated. The output-feedback IT2 polynomial fuzzy controller connected with the nonlinear plant in a closed loop drives the system states of the nonlinear plant to track those of a stable reference model. The system stability is investigated based on the Lyapunov stability theory under the sum-of-squares (SOS)-based analysis approach and the SOS-based stability conditions are derived subjecting to an H_∞ performance. In addition, the fuzzy controller does not need to share the same membership functions with the plant. Moreover, the information of membership functions is included in the analysis to facilitate the analysis and relax the stability conditions. Numerical and experimental examples are presented to verify the effectiveness of the proposed tracking control approach.

Keywords: Fuzzy tracking control, Interval type-2 fuzzy logic, Polynomial fuzzy-model-based (PFMB) control systems, Stability analysis, Sum of squares (SOS).

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