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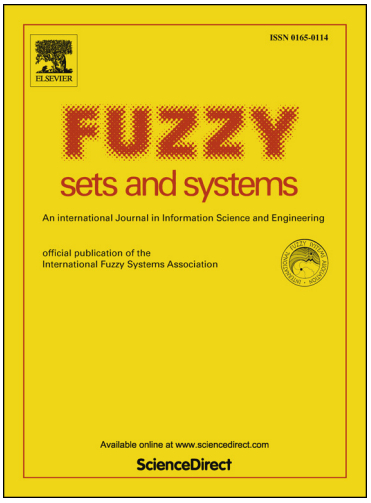

Introducing validity into self-organizing fuzzy neural network applied to impedance force control

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Introducing Validity into Self-Organizing Fuzzy Neural Network Applied to Impedance Force Control

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Abstract: In this paper, a novel self-organizing fuzzy neural network is proposed that constructed by an input-output mapping and monitored by a hierarchy of validity degrees. We define new operators called validification and devalidification to propagate validity into the six layers of proposed architecture. Self-organizing in structure learning is accomplished through a new measure that depends on error, the number of rules, and validity degrees. Additionally, a parameter learning condition is derived through studying the stability of proposed approach. To evaluate the proposed approach, an impedance controller is designed facing three challenges: different kinds of uncertainty, partial truth, and real-time realization. In the proposed controller, considering the challenge of partial truth, we assume that the manipulator's inertia is known according to first-principle knowledge while other parts are uncertain. Simulation results show the effectiveness of the proposed approach in the presence of disturbance. The proposed approach emerges as a promising approach by involving self-organizing property and possibility (fuzzy) and validity aspects of information.

Keywords: Fuzzy Neural Network, Impedance Force Control, Robot Manipulator, Validity, Uncertainty.

1 Introduction

Uncertainty is inherently fast and large, but it is assumed to be bounded and slow for accomplishing rigorous model-based conventional analysis. Fuzzy Logic [29] has described as a