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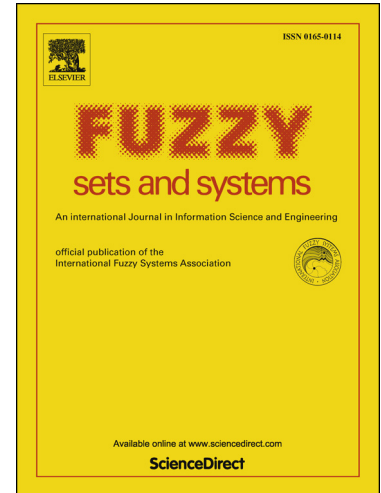
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# Fuzzy tracking adaptive control of discrete-time switched nonlinear systems

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## Abstract

This paper is concerned with the problem of fuzzy tracking adaptive control for a class of discrete-time switched uncertain nonlinear systems with arbitrary switching. Based on the common Lyapunov function method and by utilizing the fuzzy logic systems to approximate the unknown nonlinear functions, an adaptive fuzzy controller is firstly constructed for a class of uncertain nonlinear discrete-time switched systems. Meanwhile, the proposed adaptive control algorithm reduces the amount of online adjustable parameters. Based on the above techniques, the constructed fuzzy controllers and the adaptive law can guarantee that all the signals are bounded and the system output can converge to a small neighborhood of the reference signal in the closed-loop system. An illustrative example is provided to demonstrate the effectiveness of the proposed approaches.

**Key Words:** Adaptive fuzzy control, switched systems, nonlinear discrete-time systems, common Lyapunov function

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## 1. Introduction

Because the uncertainty is inherent in many practical systems, the control design capability for handling uncertainty has much actual needs. Meantime, it is also academically challenging in uncertain nonlinear control systems and it is a fact that the most of practical control systems have uncertain or nonlinear. Therefore, some researchers are interested in the problem of adaptive control for uncertain nonlinear systems and make a lot of achievements in the recent decades. For uncertain nonlinear continuous-time and discrete-time systems, there are many results on the adaptive tracking control by utilizing the function approximation tools such as fuzzy logic systems [1, 2, 6-10, 12-16, 21, 22, 24, 38-41, 45-49] and neural networks [3, 4, 17, 18, 20, 23, 25-37, 66-69]. There is no doubt that uncertain discrete-time nonlinear systems play an important role in nonlinear control systems. Recently, many people achieved some great works in uncertain discrete-time nonlinear systems. For example, the adaptive controllers of a class of MIMO discrete-time nonlinear systems with unknown functions are constructed in [5] by utilizing higher-order neural networks. The authors in [19] investigated a direct adaptive control approach for a class of discrete-time nonlinear systems with unknown backlash and the systems are transformed into n-step-ahead predictor systems to predict future states and the fuzzy logic systems are used to approximate unknown backlash, unknown functions, and unknown inversion.

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