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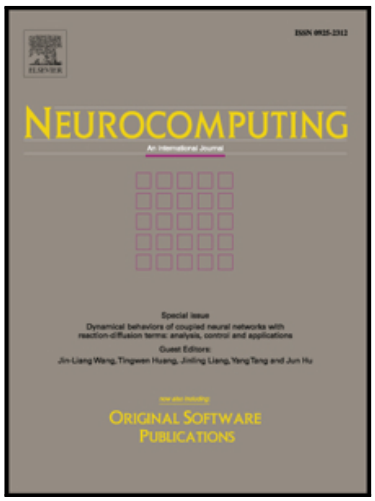

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Adaptive Tracking Control for Switched Strict-Feedback Nonlinear Systems with Time-Varying Delays and Asymmetric Saturation Actuators

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Abstract

This paper focuses on the problem of adaptive tracking control for a class of switched strict-feedback nonlinear systems with unknown time-varying delays and asymmetric saturation actuators under arbitrary switching. Especially, the considered time-varying delays absolutely depend on the subsystem number. The main technical difficulties lie in finding an appropriate common Lyapunov function (CLF) for all subsystems and designing a common adaptive control scheme in the presence of unknown time-varying delays and asymmetric saturation nonlinearities. Based on a novel combination of Lyapunov-Razumikhin method, dynamic surface control (DSC) technique, variable separation approach and neural network (NN) approximation, a simple quadratical CLF is constructed and a common adaptive control scheme involving only one adaptive parameter is developed. The proposed controller guarantees that all signals of closed-loop system are semi-globally uniformly ultimately bounded (SGUUB) while the tracking error converges to an adjustable neighborhood of the origin. Finally, the effectiveness of the design methodology is illustrated with two simulation examples.

Keywords: Switched nonlinear system; Time delay; Asymmetric saturation actuator; Adaptive control; Lyapunov-Razumikhin method

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