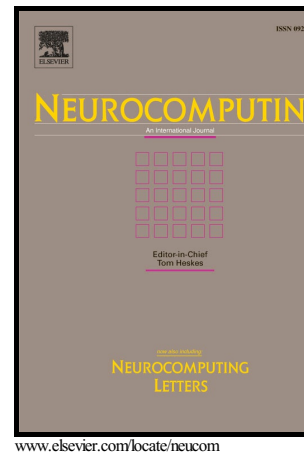


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Adaptive Neural Control for a Class of Pure-Feedback Nonlinear Time-Delay Systems with Asymmetric Saturation Actuators

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Abstract

This paper addresses the problem of adaptive tracking control for a class of uncertain pure-feedback nonlinear time-delay systems with unknown asymmetric saturation actuators. The considered problem is challenging due to the existence of unknown distributed time-varying delays and asymmetric saturation actuator. In particular, the difficulties from distributed time-varying delays and unknown asymmetric saturation nonlinearity are processed by using the mean value theorem for integrals and a Gaussian error function-based continuous differentiable model, respectively. Then, based on a novel combination of mean value theorem, Razumikhin functional method, variable separation technique and Neural Network (NN) parameterization, an adaptive neural controller which involves only one parameter to be updated is presented for such systems via Dynamic Surface Control (DSC) technique. Moreover, the DSC technique can overcome the problem of ‘explosion of complexity’ in the traditional backstepping design. All signals in the closed-loop system remain semi-globally uniformly ultimately bounded (SGUUB), and the tracking error converges to a small neighborhood of the origin. Finally, simulation results are given to verify the effectiveness of the proposed design.

Keywords:

Nonlinear system, neural network, time-varying delay, asymmetric saturation actuator, Razumikhin lemma

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