

## Accepted Manuscript

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PII: S0925-2312(17)31228-6  
DOI: [10.1016/j.neucom.2017.06.077](https://doi.org/10.1016/j.neucom.2017.06.077)  
Reference: NEUCOM 18687

To appear in: *Neurocomputing*

Received date: 2 November 2016  
Revised date: 15 February 2017  
Accepted date: 30 June 2017

Please cite this article as: Changchun Hua, Kuo Li, Xiping Guan, Decentralized Event-triggered Control for Interconnected Time-delay Stochastic Nonlinear Systems Using Neural Networks, *Neurocomputing* (2017), doi: [10.1016/j.neucom.2017.06.077](https://doi.org/10.1016/j.neucom.2017.06.077)



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# Decentralized Event-triggered Control for Interconnected Time-delay Stochastic Nonlinear Systems Using Neural Networks

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## Abstract

This paper focuses on the problem of decentralized event-triggered control for a class of interconnected time delay stochastic nonlinear systems with unmodeled dynamics. In order to ensure that the output satisfies the prescribed performance, a funnel performance variable is introduced. By using neural network approximation theory and backstepping method, the controller and its event triggered mechanism are co-designed. Based on Lyapunov stability theory and changing supply functions idea, it is proved that all the signals of the overall closed-loop system with the designed controller are bounded in probability. Finally, a numerical simulation is presented to illustrate the effectiveness of the proposed method.

## Index Terms

Event-triggered control, prescribed performance, unmodeled dynamics, neural networks, interconnected time-delay stochastic systems.

## I. INTRODUCTION

It is well known that time delay and stochastic disturbance are two sources of the instability or performance degradation of control systems, see [1]-[3] and the references therein. Recently, the research on time delay stochastic nonlinear systems has received considerable attention. In [4], the homogeneous domination approach was introduced to solve the state feedback stabilization problem for high order stochastic nonlinear systems with time-varying delay. The work [5] considered the problem of observer-based adaptive neural network control for a class of single input single output strict feedback stochastic nonlinear systems with unknown time delays. The dynamic output feedback tracking control problem was studied in [6] for a class of interconnected time delay stochastic nonlinear systems with the prescribed performance requirement. The work [7] investigated issues of finite-time topological identification and stochastic synchronization for two complex networks with multiple time delays. Although some output or error prescribed constraint techniques were proposed and developed such as the barrier Lyapunov function technique[8],[9]; the performance transformation function technique[10],[11]; the funnel control technique [12]. However, few works have exploited the funnel control technique to address the prescribed performance control problem for the interconnected time-delay stochastic nonlinear systems. One knows that the unmodeled dynamics exist in many nonlinear systems due to the impossibility of establishing exact models or the complexity of establishing high

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