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# DELAY-DEPENDENT ROBUST STABILITY FOR UNCERTAIN STOCHASTIC NEURAL NETWORKS WITH INTERVAL TIME-VARYING DELAY

Jie Fu, Huaguang Zhang and Tiedong Ma

School of Information Science and Engineering
Northeastern University, Shenyang, Liaoning 110004, P. R. China

**Abstract.** This paper studies the robust stability problem for a class of uncertain stochastic neural networks(SNNs) with interval time-varying delay. Based on Lyapunov-Krasovskii functional and stochastic analysis approach, a new delay-dependent sufficient condition is obtained in the linear matrix inequality(LMI) format such that for all admissible uncertainties delayed SNNs are globally asymptotically stable in the mean-square sense. No restriction on the derivative of the time-varying delay is required, which allows the time-delay to be a fast time-varying function. The effectiveness of the proposed method is demonstrated by a numerical example.

**Keywords.** stochastic neural networks(SNNs), interval time-varying delay, globally asymptotically stable, linear matrix inequality(LMI).

## 1 Introduction

In the past decade, neural networks(NNs) have attracted considerable attention for their applications such as pattern recognition, image processing, associative memory, etc[1]. In the process of information storage and transmission in NNs, since time delays may cause undesirable dynamic network behaviors such as oscillation and instability, the stability analysis problems for NNs have received considerable research attention[2-8], where the delay type can be constant, time-varying or distributed. Recently, a special type of time delay in practical engineering systems, i.e., interval time-varying delay, is identified and investigated [8-12]. Interval time-varying delay is a time delay that varies in an interval in which the lower bound is not restricted to be zero. In [10, 12] the derivative bound of the interval time-varying delay is needed, but in [9, 11] the restriction to the derivative of the interval time-varying delay is removed by model transformation approaches at the cost of conservatism.

On the other hand, it has been known that NNs can be stabilized or destabilized by certain stochastic input. In addition, in hardware implementation of NNs, the network parameters of the neural system may be subjected to some changes due to the tolerances of electronic components employed in