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NOVEL STABILITY CONDITIONS FOR INTERVAL DELAYED NEURAL NETWORKS WITH MULTIPLE TIME-VARYING DELAYS

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Abstract. *In this paper, the global exponential stability and global asymptotic stability for a class of interval delayed neural networks (IDNNs) with multiple time-varying delays are considered. Delay-dependent and delay-independent criteria are proposed to guarantee the robust stability of IDNNs via linear matrix inequality (LMI) approach. Some numerical examples are illustrated to show the effectiveness of our results. From the illustrative examples, significant improvement over the recent results can be demonstrated.*
Keywords: Interval delayed neural network, Global exponential stability, Delay-dependent criterion, Delay-independent criterion, Linear matrix inequality

1. **Introduction.** In recent years, neural networks have been used in many mathematical and practical applications, such as optimization, recognition, prediction, diagnosis, decision, association, approximation, and generalization. Various neural networks have been investigated, such as bidirectional associative memory neural networks [1], cellular neural networks [2], Cohen-Grossberg neural networks [3], and Hopfield neural networks [4]. The existence of time delays is often a source of oscillation and instability of a neural networks. Hence the stability of delayed neural networks (DNNs) are important and significant in practical applications. The DNNs may be applied in many areas including the moving images processing, pattern classification, and automatic control engineering [1-4]. For many applications, artificial neural networks are usually implemented by integrated circuits [1-4]. In the implementation of artificial neural networks, time delay is produced from finite switching and finite propagation speed of electronic signals. During the implementation on very large scale integrated chips, parameter perturbations and transmitting time delays will destory the stability of DNNs [4-13]. In the analysis for uncertain DNNs, it is reasonable to assume that the parameters are varying in some prescribed intervals. Such DNNs are called the interval delayed neural networks (IDNNs) [4-7,9,13]. Hence some less conservative stability conditions for IDNNs will be proposed in this paper.

Depending on whether the stability criterion itself contains the size of delay, criteria for IDNN can be classified into two categories, namely delay-independent criteria [5,7,9] and delay-dependent criteria [4,6-8,10-12]. Usually the latter is less conservative when the value of delay is small. In the Lyapunov-based delay-dependent results, the slow-varying