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# ROBUST STABILITY OF RECURRENT NEURAL NETWORKS WITH TIME-VARYING DELAYS

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**Abstract:** In this paper, global stability of recurrent neural networks with time-varying delays is considered. The uncertainity is considered in all the parameters of the concerned neural networks. A novel LMI-based stability criterion is obtained by using Lyapunov functional theory to guarantee the asymptotic stability of recurrent neural networks with time-varying delays. Finally, numerical example is given to demonstrate the correctness of the theoretical results.

**Key Words:** Lyapunov functional, Linear matrix inequality, Recurrent neural networks, Time-varying delays.

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## 1 Introduction

A recurrent neural network, which naturally involves dynamic elements in the form of feedback connections used as internal memories. Unlike the feedforward neural network whose output is a function of its current inputs only and is limited to static mapping, recurrent neural network perform dynamic mapping. Recurrent networks are needed for problems where there exist at least one system state variable which cannot be observed. Most of the existing recurrent neural networks are obtained by adding trainable temporal elements to feedforward neural networks (like multilayer perceptron networks [10] and radial basis function networks [6]) to make the output history sensitive. Like feedforward neural networks, these network functions as block boxes and the meaning of each weight in these nodes are not known. They play an important role in applications such as classification of patterns, associate memories and optimization etc. ( see [6], [10] and the references

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