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DELAY-INDEPENDENT AND DELAY-DEPENDENT STABILITY OF A NOVEL DELAYED NEURAL NETWORK

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Abstract. This paper is devoted to stability analysis of a novel delayed neural network, whose neurons are connected with each other through both neurons' feedback connection strength matrix and direct connection strength matrix. Both delay-independent and delay-dependent stability criteria are obtained by integrating LMI approach and Lyapunov-Krasovskii functional method. By introducing some slack matrix variables, the criteria are less conservative. It is the most efficient for systems with time delay. The criteria are in form of LMI with more slack matrix variables, which may enlarge the range in selecting neural networks' parameters including the upper bound of delay for guaranteeing asymptotic stability of the system.

Keywords. Delayed neural networks, Global asymptotical stability, Lyapunov-Krasovskii functional, Linear Matrix Inequality.

1 Introduction

In the past two decades, neural networks have been extensively studied because of its great potential in theory and applications. For example, it has been successfully applied in signal and image processing, pattern recognitions, associative memories, and so on. It is well-known that such kinds of engineering applications of neural networks rely crucially on qualitative properties of stability and dynamic behaviors of the networks. The existence and convergence of a unique equilibrium point are of importance for a neural network. For example, when in applications to parallel computation and signal processing involving the solution of optimization problems, it is required that there be a well-defined computable solution for all possible initial states. This means that the network should have a unique global attractive equilibrium point, where uniqueness of the equilibrium point is required to avoid the risk of spurious response or the common problem of local minima and hence ensure global optimization. Therefore, stability analysis of neural networks