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NECESSARY AND SUFFICIENT CONDITION FOR THE ABSOLUTE EXPONENTIAL STABILITY OF A CLASS OF NEURAL NETWORKS WITH FINITE DELAY

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Abstract. In this paper, we establish the necessary and sufficient condition for the absolute stability of a class of time-varying delayed neural networks with connection matrix and delayed feedback matrix having non-negative elements. In other words, we identify the largest class of typical types of time-varying delayed neural networks with absolute stability.

Keywords. neural networks, unbounded delay, time-varying delay, absolute stability, necessary and sufficient condition, M-matrix.

AMS (MOS) subject classification: 34A34

1 Introduction

Research on dynamic behaviors of neural networks dates back to the early days of neural network science. In recent years, stability problem of neural networks without time delay or with time delays has been widely studied because of theoretical interest and application considerations.

Stability includes global and local stability. In practice, the topic of global stability is of more importance than that of the local stability. The global stability of symmetrically connected networks is relatively straightforward to analyze, and by now most of the results have been well established. Moreover, another very important concept on stability is absolute stability which is one of the three main features: neural networks should possess proposed by Forti et al [8]. Thus, it is very important to know what conditions can guarantee the neural networks absolutely stable. Many researchers have tried to look for less restrictive conditions to guarantee neural networks absolutely stable. Some have identified the weakest conditions, in other words, necessary and sufficient condition for absolute stability of some classes of neural networks.

Forti et al [7] first identified that when the connection matrix is symmetric, the sufficient and necessary condition for absolute stability of neural networks without delay is connection matrix negative semi-definite. Recently, however, T. Chu et al [6] extended these results to cases when connection matrix is normal. While X.B. Liang et al [15] considered another class of