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STABILITY ANALYSIS OF DELAY NEURAL NETWORKS WITH IMPULSIVE EFFECTS

Zhichun Yang and Daoyi Xu

Institute of Mathematics, Sichuan University
Chengdu, P. R. China, 610064

Abstract. In this paper, we consider a generalized model of impulsive delay neural networks described by measure differential equations. By introducing an M-cone and delay differential inequalities with impulsive initial conditions, some sufficient conditions ensuring uniform stability, global asymptotical stability and global exponential stability of the impulsive delay neural networks are obtained. The results may extend and improve the earlier publications. An example is given for illustration of the theoretical results.

Keywords. Neural network, Impulse, Delay, Stability.

AMS (MOS) subject classification: 34k45, 34K20, 34A37, 92B20.

1 Introduction

Stability analysis of delay neural networks has attracted considerable attention in both theoretical research and engineering applications to optimization, pattern recognition, signal processing and associative memories and so on since delay effects can not be avoided in various neural networks([1]-[8]). On the other hand, impulsive effects widely exist in many dynamical systems involving such areas as population dynamics, drug administration, automatic control, neural networks etc..([9]-[15]). Especially in the process of implementation of artificial electronic networks, its state is often subject to instantaneous perturbations and experience abrupt change at certain instants, that is, do exhibit impulsive effects. Furthermore, both delays and impulses can affect the dynamical behaviors of the system by creating oscillatory and unstable characteristics. Therefore, it is necessary to investigate impulse and delay effects on the stability of neural networks. It should also have a theoretical significance in the design and applications of neural networks with delay and impulsive effects.

A large number of the criteria on the stability of delay neural networks without impulse have been derived in the literature, e.g., Refs.[2]-[8]. The main approach is Lyapunov's direct method for investigating the stability of non-impulsive neural networks and most of the mentioned results are involved with the properties of M-matrix since M-matrix may be easily verified and widely used in engineering. Correspondingly, there is not much work devoted to investigate impulsive effects on the stability of neural networks. Recently,