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STABILITY OF IMPULSIVE CELLULAR NEURAL NETWORKS WITH TIME DELAY

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Abstract. This paper focuses on the stability problem of impulsive cellular neural networks with time delay. Several criteria on asymptotic stability are established by means of Lyapunov function and Lyapunov functional. Two examples are also discussed to illustrate the theorems.

Keywords. Stability, impulsive, cellular neural networks, time delay, Lyapunov functional.

AMS (MOS) subject classification: 34A37, 92B20, 93D09

1 Introduction

In [1,2], Chua and Yang proposed a new class of networks called cellular neural networks (CNNs). A cellular neural network is a massively parallel computing architecture made of simple processing elements which are locally connected. CNNs have already been applied to signal processing problems such as filtering, edge detection, character recognition and object recognition, especially in processing static images. Such applications rely on the existence of an equilibrium point or a unique equilibrium point, and its stability. Existence or global asymptotic stability or global exponential stability of CNNs with delays has been studied to some special requests such as discrete-time, with time-varying delays and so on by [3-17]. But few people pay attention to global asymptotic stability of impulsive CNNs with time delay.

Impulsive control has attracted the interest of many researchers in recent years, see [18-27] and relevant references therein. Such control arises naturally in a wide variety of applications, such as orbital transfer of satellite [24], ecosystems management [22], and control of money supply in a financial market. There are many cases where impulsive control can give better performance than continuous control. Sometimes even only impulsive control can be used for control purpose. Impulsive control problems are well described by impulsive differential systems. Significant progress has been made in the theory of impulsive differential systems in recent years, see [21,23,26-27] and references therein.

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