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ASYMPTOTIC STABILITY AND EXPONENTIAL STABILITY FOR A CLASS OF IMPULSIVE NEUTRAL DIFFERENTIAL EQUATIONS WITH DISCRETE AND DISTRIBUTED DELAYS

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Abstract. In this paper, we present sufficient conditions for asymptotic stability and exponential stability of a class of impulsive neutral differential equations with discrete and distributed delays. Our approaches are based on the method using fixed point theory, which do not resort to any Lyapunov functions or Lyapunov functionals. Our conditions do not require the differentiability of delays, nor do they ask for a fixed sign on the coefficient functions. Our results improve some previous ones in the literature. Examples are given to illustrate our main results.

Keywords. Fixed point theory, Asymptotic stability, Exponential stability, Impulsive neutral differential equations, Delays

AMS (MOS) subject classification: 34K20, 34K45, 47H10.

1 Introduction

Many real world problems in science and engineering can be modelled by neutral delay differential equations, such as delayed cellular neural network models[1, 2] and heat conduction in materials with decay memory[3]. The existence, uniqueness and stability problems of the neutral delay differential equations have been investigated by many authors, for example, Afonso et al.[4], Jin and Luo[5], Mesmouli[6], and Raffoul[7, 8], etc.

Lyapunov's direct method has been very effective in establishing stability results for a wide variety of differential equations. The success of Lyapunov's direct method depends on finding a suitable Lyapunov function or Lyapunov functional. However, it may be difficult to look for a good Lyapunov functional for some classes of delay differential equations. Therefore, an alternative may be explored to overcome some difficulties. It was proposed by Burton[9] and his co-workers to use fixed point methods to study the stability problems for deterministic systems. Afterwards, a great number of classes of delay differential equations are studied by this method, see, for example,