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STABILITY ANALYSIS FOR NEURAL NETWORKS WITH DISCONTINUOUS NEURON ACTIVATIONS AND IMPULSES

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Abstract. *In this paper, by using the fixed point theorem of differential inclusion theory and constructing suitable Lyapunov functions, we study the existence, uniqueness and global exponential stability of periodic solution for neural networks with discontinuous neuron activations and impulses. The results show that the Forti's conjecture is true when neural networks are affected by impulses. Further, a numerical example is given to demonstrate the effectiveness of the results obtained in this paper.*
Keywords: Neural networks, Global exponential stability, Impulse, Differential inclusions.

1. **Introduction.** In recent years, various neural networks models such as Hopfield neural networks, Cellular neural networks, Lagrange neural networks and Bi-directional associative memory networks have been extensively investigated and successfully applied to signal processing, pattern recognition, associative memory and optimization problems [1-4]. In the application of neural networks either as associative memories or as optimization solvers, the stability of networks is prerequisite. Particularly, when neural networks are employed as associative memories, the equilibrium points represent the stored patterns, and, the stability of each equilibrium point means that each stored pattern can be retrieved even in the presence of noise. When employed as an optimization solver, the equilibrium points of neural networks correspond to possible optimal solutions, and the stability of networks then ensures the convergence to optimal solutions. Also, stability of neural networks is fundamental for network designs. Due to these, stability analysis of neural networks has received extensive attentions in the literature so far. In Refs. [5-7], the authors discussed the problem of stability for neural networks with discontinuous neuron activations, but without impulses. It is well known that studies on neural networks not only involve discussions of stability properties, but also involve investigations of other dynamics behaviors such as periodic oscillation, bifurcation and chaos. In many applications, the property of periodic oscillatory solutions are of great interest. For example, the