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GLOBAL EXPONENTIAL STABILITY AND EXISTENCE OF PERIODIC OSCILLATORY SOLUTIONS FOR REACTION-DIFFUSION GENERALIZED NEURAL NETWORKS WITH TIME-VARYING DELAYS

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Abstract. By using generalized Halanay inequality and M-matrix, both the global exponential stability and periodic oscillatory solutions are discussed for a class of reaction-diffusion generalized neural networks with time-varying delays. Several new sufficient conditions are obtained to ensure existence, uniqueness of the equilibrium point, and its global exponential stability of the equilibrium point and the existence of periodic oscillatory solutions of reaction-diffusion generalized neural networks with time-varying delays. The results extend and improve the earlier publications. In addition, this condition requires neither the activation functions to be differentiable, bounded, and the weight-connected matrices to be symmetric, nor time-varying delays and generalized terms to be differentiable. Moreover, an example is given to show the effectiveness of the obtained results.

Keywords. global exponential stability, periodic oscillatory solution, reaction-diffusion, generalized neural networks, time-varying delays, nonsingular M-matrix.

AMS (MOS) subject classification: 34K20, 34K60, 94C05

1 Introduction

The dynamics of recurrent neural networks such as cellular neural networks (CNNs) and delayed cellular neural networks (DCNNs) have been deeply investigated in recent year due to its applicability in solving some image processing, signal processing and pattern recognition problems. Several important results have been obtained in [1-4,9,12,15,18,20-25,27,29]. Such applications heavily depend on the dynamical behavior of the networks. If the dynamical behavior of the recurrent neural networks depends only on the time, at this time the model is an ordinary differential equation; if the behavior not only depends on the time but also contains the time delays, the model is a functional equation. However, strictly speaking, diffusion effects cannot be avoided in the neural networks model when electrons are moving in asymmetric electromagnetic field, so we must consider the space is varying