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STABILITY ANALYSIS OF BAM FUZZY NEURAL NETWORKS WITH DISTRIBUTED DELAYS AND REACTION-DIFFUSION TERMS

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Abstract. In this paper, global exponential stability of bi-directional associative memory (BAM) fuzzy neural networks with distributed delays and reaction-diffusion terms is investigated. Two sufficient conditions, which ensure the existence, uniqueness and global exponential stability of equilibrium point for this neural network, are obtained by using the topological degree theory, properties of M-matrix, Lyapunov functional and analysis technique. Exponential convergence rate which depends on the delay kernel functions and system parameters is estimated. Two examples are given to show the effectiveness of the obtained results. It is believed that these results are significant and useful for the design and applications of BAM fuzzy neural networks.

Keywords. Bi-directional associative memory; fuzzy neural networks; reaction-diffusion; distributed delays; global exponential stability

AMS (MOS) subject classification: 92B20, 34K20, 34K13

1 Introduction

The bi-directional associative memory (BAM) neural network was first introduced by Kosto [1]. It is an important model with the ability of information memory and information association, which is crucial for application in pattern recognition, solving optimization problems and automatic control engineering [2-4]. In such applications, it is of prime importance to ensure that the designed neural network is stable. It is well known, in both biological and artificial neural networks, the delays arise because of the processing of information [5]. Time delays may lead to oscillation, divergence, or instability which may be harmful to a system [5,6]. Therefore, study of neural dynamics with consideration of the delayed problem becomes extremely important to manufacture high quality neural networks. To date, most researches on delayed BAM neural networks have been restricted to the cases of constant or time-varying delays, for example, see [3-13] and references therein. The circuits diagram and connection pattern implementing for the delayed neural networks can be found in [10]. However, as pointed out in [14,15], neural