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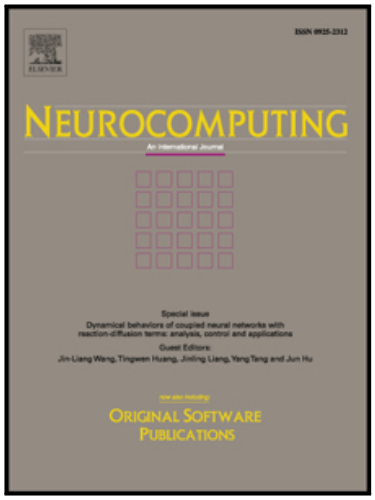

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ACCEPTED MANUSCRIPT

Existence and global exponential stability of periodic solutions for quaternion-valued cellular neural networks with time-varying delays*

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Abstract

In this paper, a class of quaternion-valued cellular neural networks (QVCNNs) with time-varying delays is considered. By using the continuation theorem of Mawhin's coincidence degree theory, the existence of periodic solutions for QVCNNs is obtained. By constructing a suitable Lyapunov function, some sufficient conditions are derived to guarantee the global exponential stability of periodic solutions for QVCNNs. Finally, two examples are given to illustrate the effectiveness of the obtained results.

Keywords: Cellular neural networks; Quaternion; Global exponential stability; Periodic solution; Time-varying delays.

1 Introduction

Due to the fact that cellular neural networks (CNNs) can be applied to signal processing, patten recognition, optimization and associative memories, especially in image processing and solving nonlinear algebraic equations, they have been widely studied both in theory and applications [1-3]. Moreover, as we know that time delays are unavoidable and may cause or destroy oscillation [4, 5], instability and bifurcation to networks [4, 6]. So, in order to analyze the dynamical behaviours to neural networks, incorporating time delays into them is a nature and necessary step ([7-11]).

On the one hand, complex-valued neural networks (CVNNs) as an extension of real-valued neural networks (RVNNs) are particularly suitable describing the neural processing for the

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