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PERIODIC OSCILLATORY SOLUTION OF CONTINUOUS-TIME AND DISCRETE-TIME RECURRENT NEURAL NETWORKS WITH RECENT-HISTORY DISTRIBUTED DELAYS

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Abstract. In this paper, the continuous-time and discrete-time recurrent neural networks with recent-history distributed delays are considered. By constructing suitable Lyapunov functional, applying M-matrix theory and inequality technique, several sufficient conditions ensuring existence and uniqueness of periodic oscillatory solution of the recurrent neural networks are obtained under more general assumption about activation functions. The results extend and improve the previously known results. An example is provided to demonstrate the usefulness of the proposed results.

Keywords. Recurrent neural networks; recent-history distributed delays; global exponential stability; periodic oscillatory solution; Lyapunov functional.

AMS (MOS) subject classification: 34C25; 39A11; 93D05

1 Introduction

In recent years, the stability of delayed recurrent neural networks have been widely studied due to their applications in various areas such as pattern recognition, associative memory, parallel computation [1-11].

It is well known that the studies on neural dynamical systems not only involve a discussion of stability properties, but also involve many dynamic behaviors such as periodic oscillatory behavior, bifurcation, and chaos [12]. In theory and applications, the global exponential periodicity is an important dynamic property of recurrent neural networks, and the global exponential stability at an equilibrium point can be viewed as a special case of the global exponential periodicity due to an equilibrium point can be viewed as a special periodic solution of neural networks with arbitrary period. Therefore, the analysis of periodic solutions of neural networks may be considered to be more general than that of equilibrium point [12-17].

On the other hand, in numerical simulation and practical implementation of the continuous-time neural networks, it is essential to formulate a discrete-time system that is an analogue of the continuous-time system. Therefore, it is of both theoretical and practical importance to study the dynamics of discrete-time neural networks [18], and some authors have studied the