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CONTROLLER DESIGN ANALYSIS TO SYNCHRONIZE COMPETITIVE SYSTEMS OF NEURAL NETWORKS

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Abstract. This article provides an investigation on fixed-time synchronization analysis for a novel class of time-delayed competitive neural networks. Chosen neural networks are nonlinear reaction-diffusion refinements of the Cohen-Grossberg artificial neural networks. The competitive nature of considered neural systems turns to the interaction between short-term and long-term history of neural messages transition. In this investigation the drive-response neural networks are introduced to derive the corresponding error neural systems. Proving the asymptotic stability of the error neural system is equivalent to synchronization of the corresponding drive-response neural system. Our strategy is to design some appropriate controllers that avoid undesired behaviour. The fixed-time synchronization analysis is relied on the Lyapunov functionals method and theoretical findings will be justified with some numerical prototypes to show validity of the proposed method.

Keywords. Reaction-Diffusion model, Neural Network, Fixed-time synchronization, Lyapunov functional, Time Delays, Competitive systems.

AMS (MOS) subject classification: 34K24, 34K40, 35Bxx, 68T07, 93D30.

1 Introduction

Trying to better understanding the concept of synchronization leads us to the second half of the twenteeth century, where some famous scientists such as Huygens, Rayleigh, Van der pol and some others were investigating on the subsystems of oscillation generators such as pendulums, acoustically coupled organ pipes, electronic generators, different modes in laser cavity, junctions forming in array and so on, respectively. See [1] and bibliography therein for more details. In this investigations, one of the most important case studies was the closeness of frequencies or phases of these subsystems. Nowadays,