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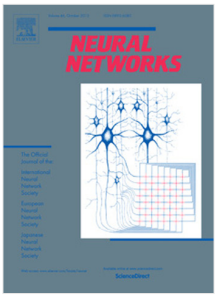

Mittag-Leffler synchronization of fractional neural networks with time-varying delays and reaction–diffusion terms using impulsive and linear controllers

Ivanka Stamova, Gani Stamov

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*Title Page (With all author details listed)

Mittag-Leffler synchronization of fractional neural networks with time-varying delays and reaction-diffusion terms using impulsive and linear controllers

Ivanka Stamova[a,*], Gani Stamov[b]

[a]Department of Mathematics, University of Texas at San Antonio,
San Antonio, Texas 78249, USA
[b]Department of Mathematics, Technical University of Sofia,
8800 Sliven, Bulgaria
*Corresponding author at: Department of Mathematics, University of Texas at San Antonio,
San Antonio, Texas 78249, USA.
E-mail: ivanka.stamova@utsa.edu

Abstract. In this paper, we propose a fractional-order neural network system with time-varying delays and reaction-diffusion terms. We first develop a new Mittag-Leffler synchronization strategy for the controlled nodes via impulsive controllers. Using the fractional Lyapunov method sufficient conditions are given. We also study the global Mittag-Leffler synchronization of two identical fractional impulsive reaction-diffusion neural networks using linear controllers, which was an open problem even for integer-order models. Since the Mittag-Leffler stability notion is a generalization of the exponential stability concept for fractional-order systems, our results extend and improve the exponential impulsive control theory of neural network system with time-varying delays and reaction-diffusion terms to the fractional-order case. The fractional-order derivatives allow us to model the long-term memory in the neural networks, and thus the present research provides with a conceptually straightforward mathematical representation of rather complex processes. Illustrative examples are presented to show the validity of the obtained results. We show that by means of appropriate impulsive controllers we can realize the stability goal and to control the qualitative behavior of the states. An image encryption scheme is extended using fractional derivatives.

Keywords: *Neural networks, Time delays, Reaction-diffusion terms, Impulsive control, Fractional derivatives, Mittag-Leffler synchronization*