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GLOBAL ATTRACTORS FOR IMPULSIVE FRACTIONAL DELAY LATTICE SYSTEMS

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Abstract. The asymptotic behavior of an impulsive delay lattice system with a Caputo fractional time derivative is investigated. The existence of a compact global attractor is established. In addition, it is shown that the global attractor is a singleton set under Lipschitz conditions.

Keywords. Global attracting set; Impulsive; Delay; Lattice system; Caputo fractional substantial time derivative.

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1 Introduction

The Caputo fractional substantial derivative [8] is defined as

$$D_s^{\mu} f(x) = I_s^{\nu}[D_s^m f(x)], \quad \nu = m - \mu,$$

where

$$I_s^{\nu} f(x) = \frac{1}{\Gamma(\nu)} \int_a^x (x-\tau)^{\nu-1} e^{-\beta(x-\tau)} f(\tau) d\tau, \quad \nu > 0,$$

is the fractional substantial integral [9, 10], β is a constant (or a function independent of x, say $\beta(y)$), m is the smallest integer exceeds μ, and

$$\begin{aligned} D_s^m &= \left(\frac{\partial}{\partial x} + \beta\right)^m = \left(D + \beta\right)^m \\ &= \left(D + \beta\right)\left(D + \beta\right) \dots \left(D + \beta\right). \end{aligned}$$

In this paper, we consider the global existence and the long time behavior of solutions for an impulsive delay lattice system with a Caputo fractional