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Perturbed Partial Fractional Order Functional Differential Equations with Infinite Delay in Fréchet Spaces

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Abstract: In this paper we investigate the existence of solutions of perturbed partial hyperbolic differential equations of fractional order with infinite delay and Caputo's fractional derivative by using a nonlinear alternative of Avramescu on Fréchet spaces.

Keywords: *partial functional differential equation; fractional order; solution; left-sided mixed Riemann-Liouville integral; Caputo fractional-order derivative; infinite delay; Fréchet space; fixed point.*

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1 Introduction

In this paper we are concerned with the existence of solutions to fractional order initial value problem (IVP for short), for the system

$$({}^cD_0^r u)(t,x) = f(t,x,u_{(t,x)}) + g(t,x,u_{(t,x)}), \text{ if } (t,x) \in J, \tag{1}$$

$$u(t,x) = \phi(t,x), \text{ if } (t,x) \in \tilde{J}, \tag{2}$$

$$u(t,0) = \varphi(t), \; u(0,x) = \psi(x), \; (t,x) \in J, \tag{3}$$

where $\varphi(0) = \psi(0)$, $J := [0,\infty) \times [0,\infty)$, $\tilde{J} := (-\infty,+\infty) \times (-\infty,+\infty) \backslash [0,\infty) \times [0,\infty)$, ${}^cD_0^r$ is the standard Caputo's fractional derivative of order $r = (r_1, r_2) \in$

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