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Existence Results of Mild Solutions for Second Order Neutral Functional Perturbed Evolution Equations with Finite State-Dependent Delay

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Abstract

In this paper, we give sufficient conditions in a real Banach space $(E, |.|)$ to get the existence of mild solutions for the following second order neutral functional perturbed evolution equations with finite state-dependent delay, involving Avramescu nonlinear alternative for sum of compact operators and contractions maps in Fréchet spaces, combined with semigroup theory.

$$\frac{d}{dt}\left[y'(t) + Q(t, y_\rho(t, y_t))\right] = A(t)y(t) + f\left(t, y_{\rho(t,y_t)}\right) + g\left(t, y_{\rho(t,y_t)}\right), \quad \text{a.e.} \quad t \in J := [0, +\infty), \tag{0.1}$$

$$y(t) = \varphi(t), \qquad t \in H := [-r, 0], \tag{0.2}$$

$$y'(0) = y_1. \tag{0.3}$$

where $f, g, Q : J \times C(H; E) \to E$, $\varphi \in C(H; E)$, $\rho : J \times C(H; E) \to \mathbb{R}$ are given functions, $y_1 \in E$ and $\{A(t)\}_{t \geq 0}$ is a family of linear closed (not necessarily bounded) operators from E into E that generates an unique evolution system of operators $\{U(t, s)\}_{(t,s) \in J \times J}$ for $s \leq t$.

For any continuous function y and any $t \in J$, we denote by y_t the element of $C(H; E)$ defined by $y_t(\theta) = y(t+\theta)$ for $\theta \leq 0$. Here $y_t(\cdot)$ represents the history of the state from time $t \leq 0$ up to the present time t.

Keywords : Second order perturbed evolution equations, neutral problems, mild solutions, state dependent delay.

Mathematics Subject Classification : 34G20, 34Kxx, 47H20, 74H20.

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