Nonlinear Analysis 74 (2011) 6747–6757

Contents lists available at ScienceDirect

Nonlinear Analysis

journal homepage: www.elsevier.com/locate/na

Existence of global solutions for second order impulsive abstract partial differential equations

S. Sivasankaran [a], M. Mallika Arjunan [b], V. Vijayakumar [c,*]

[a] Department of Mathematics, University College, Sungkyunkwan University, Suwon 440-746, South Korea
[b] Department of Mathematics, Karunya University, Karunya Nagar, Coimbatore - 641 114, Tamil Nadu, India
[c] Department of Mathematics, Info Institute of Engineering, Kovilpalayam, Coimbatore - 641 107, Tamil Nadu, India

ARTICLE INFO

Article history:
Received 21 December 2010
Accepted 30 June 2011
Communicated by Ravi Agarwal

MSC:
34A37
34K30
35R10
35R12
47D06
49K25

Keywords:
Second order abstract Cauchy problem
Cosine function of operators
Impulsive systems
Global solutions

ABSTRACT

In this paper, we study the existence of global solutions for a class of second order impulsive abstract functional differential equations. The results are obtained by using Leray–Schauder's Alternative fixed point theorem. An application is provided to illustrate the theory.

1. Introduction

Impulsive differential equations, that is, differential equations involving an impulse effect, appear as a natural description of observed evolution phenomena of several real-world problems. It is known that many biological phenomena involving thresholds, bursting rhythm models in medicine and biology, optimal control models in economics, pharmacokinetics and frequency modulation systems, do exhibit impulse effects; see the monographs of Samoilenko and Perestyuk [1] and Lakshmikantham et al. [2], and the references cited therein.

It is to be noted that the recent progress in the development of the qualitative theory of impulsive differential equations has been stimulated primarily by a number of interesting applied problems [3–7]. A natural generalization of impulsive ordinary differential equations is abstract impulsive differential equations in Banach space. For general aspects of impulsive differential equations, monographs [8–10] are recommended.

Recently, in [11], the authors studied the existence of global solutions for an impulsive abstract functional differential equation of the form

$$\begin{cases} u'(t) = Au(t) + f(t, u(t), u(\rho(t))), \quad t \in I = [0, a] \text{ or } [0, \infty), \\ u(0) = u_0, \\ \Delta u(t_i) = J_i(u(t_i)), \quad i \in \mathbb{F} \subset \mathbb{N}, \end{cases}$$

by using Leray–Schauder's alternative theorem.

* Corresponding author.
E-mail addresses: sdsiva@gmail.com (S. Sivasankaran), arjunphd07@yahoo.co.in (M. Mallika Arjunan), vijaysarovel@gmail.com (V. Vijayakumar).

0362-546X/$ – see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.na.2011.06.054