Relaxed control for a class of strongly nonlinear impulsive evolution equations*

Pairote Sattayatham
School of Mathematics, Suranaree University of Technology,
Nakhon Ratchasima 30000, Thailand
E-mail address: sattayatham@yahoo.com.

Abstract

Relaxed control for a class of strongly nonlinear impulsive evolution equations are investigated. Existence of solutions of strongly nonlinear impulsive evolution equations is proved and properties of original and relaxed trajectories are discussed. The existence of optimal relaxed control and relaxation results are also presented. For illustration, one example is given.

Keywords: Impulsive system, Banach space, nonlinear monotone operator, evolution triple, relaxation.

1. Introduction

In this paper, we present sufficient conditions of optimality for optimal relaxed control problems arising in systems governed by strongly nonlinear impulsive evolution equations on Banach spaces. The general descriptions of such systems were proposed in [1] as given below.

$$\begin{aligned} \dot{x}(t)+A(t,x(t)) &= g(t,x(t),u(t)) \;\; t \in I \setminus D, \\ x(0) &= x_0, \\ \Delta x(t_i) &= F_i(x(t_i)),\; i=1,2,...,n, \end{aligned} \tag{1}$$

where $I \equiv (0,T)$ is a bounded open interval of the real line and let the set $D \equiv \{t_1, t_2, ..., t_n\}$ be a partition on $(0,T)$ such that $0 < t_1 < t_2 < ... < t_n < T$. In general, the operator A is a nonlinear monotone operator, g is a nonlinear nonmonotone perturbation, $\Delta x(t) \equiv x(t_i^+)-x(t_i^-) \equiv x(t_i^+)-x(t_i)$, $i=1,2,...,n$, and $F_i's$ are nonlinear operators. This model includes all the standard models used by many authors in the field (see [2],[3]). The objective functional is given by $J(x,u) = \int_0^T L(t,x(t),u(t))dt$.

*This work was supported by Thailand Research Fund. Grant No. BRG 48 2005.