EXACT CONTROLLABILITY OF A RETARDED FRACTIONAL DIFFERENTIAL EQUATION WITH NON-INSTANTANEOUS IMPULSES

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Abstract. In this paper, we consider a nonlinear retarded fractional differential equation with non-instantaneous impulses in the Banach space X. We used the analytic semigroup theory and the Banach fixed point theorem to study the exact controllability outcomes for the proposed system. Finally, an example is given to illustrate the applications of our main results.

Keywords. Retarded fractional differential equation, Exact controllability, Fixed point theorem, Non-instantaneous impulses, Analytic semigroup theory.

AMS (MOS) subject classification: 34A08, 93B05, 34A37, 47D06.

1 Introduction

The theory of fractional differential equations and fractional calculus has gained importance and popularity due to its applications in numerous fields such as control theory, medical domains, viscoelasticity, physics, optics and signal processing. Several authors investigated the existence of the mild solutions for the fractional differential equations by using the semigroup theory and fixed point theorems. For more details on fractional differential equations, see [1, 2, 3].

The fundamental concept of controllability was introduced by Kalman [4] in 1960. The significance of exact controllability lies in the fact that it can steer the state of the system from any initial data to any target by choosing a suitable control. The controllability problem for the fractional differential equations as well as integro-differential equations has been studied extensively by [5, 6, 7, 8]. Balachandran et. al. [8] investigated the exact controllability for the fractional integro-differential equation in the Banach space.

The impulsive differential equations are drawn the attention of many researchers due to its applications in various fields such as economics, physics and medicine. In the real world there are many phenomena and processes