



# Mild Solutions for Multi-Term Time-Fractional Impulsive Differential Systems

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**Abstract:** In this paper, we study the existence and uniqueness of mild solutions for multi-term time-fractional differential systems with non-instantaneous impulses and finite delay. We use the tools of the Banach fixed point theorem and condensing map along with generalization of the semigroup theory for linear operators and fractional calculus to come up with a new set of sufficient conditions for the existence and uniqueness of the mild solutions. An illustration is provided to demonstrate the established results.

**Keywords:** *fractional calculus, generalized semigroup theory, multi-term time-fractional differential system,  $(\beta, \gamma_j)$ -resolvent family, non-instantaneous impulses.*

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## 1 Introduction

During the last few decades, the fractional differential equations (FDEs) including Riemann-Liouville and Caputo derivatives have attracted the interest of many researchers, motivated by demonstrated applications in widespread areas of science and engineering such as models of medicine (modeling of human tissue under mechanical loads), electrical engineering (transmission of ultrasound waves), biochemistry (modeling of proteins and polymers) etc. In addition, due to the memory and hereditary properties of the materials and processes, in some areas of science such as identification systems, signal processing, robotics or control theory, the fractional differential operators

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