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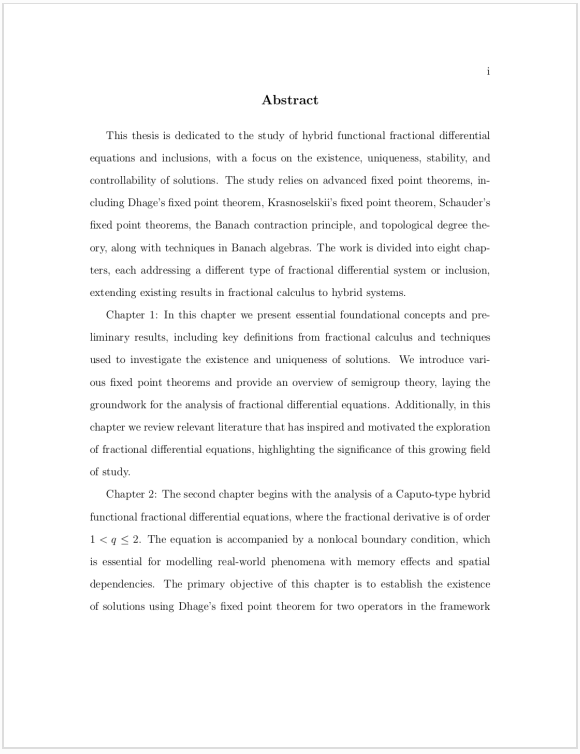

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Abstract

This thesis is dedicated to the study of hybrid functional fractional differential equations and inclusions, with a focus on the existence, uniqueness, stability, and controllability of solutions. The study relies on advanced fixed point theorems, including Dhage's fixed point theorem, Krasnoselskii's fixed point theorem, Schauder's fixed point theorems, the Banach contraction principle, and topological degree theory, along with techniques in Banach algebras. The work is divided into eight chapters, each addressing a different type of fractional differential system or inclusion, extending existing results in fractional calculus to hybrid systems.

Chapter 1: In this chapter we present essential foundational concepts and preliminary results, including key definitions from fractional calculus and techniques used to investigate the existence and uniqueness of solutions. We introduce various fixed point theorems and provide an overview of semigroup theory, laying the groundwork for the analysis of fractional differential equations. Additionally, in this chapter we review relevant literature that has inspired and motivated the exploration of fractional differential equations, highlighting the significance of this growing field of study.

Chapter 2: The second chapter begins with the analysis of a Caputo-type hybrid functional fractional differential equations, where the fractional derivative is of order $1 < q \leq 2$. The equation is accompanied by a nonlocal boundary condition, which is essential for modelling real-world phenomena with memory effects and spatial dependencies. The primary objective of this chapter is to establish the existence of solutions using Dhage's fixed point theorem for two operators in the framework

A qualitative study on different classes of fractional order hybrid differential equations

by Darshana Devi

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