

Poincare Journal of Analysis & Applications Vol. 10, No. 1 (2023), 175-192 ©Poincare Publishers DOI: 10.46753/pjaa.2023.v010i01.013

EXISTENCE AND HYERS-ULAM STABILITY OF THE SOLUTIONS TO THE IMPLICIT SECOND-ORDER DIFFERENTIAL EQUATION

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Date of Receiving	:	05.	07.	2022
Date of Revision	:	09.	10.	2022
Date of Acceptance	:	21.	06.	2023

Abstract. The main objective of this research is to investigate the existence and stability of solutions for implicit second order differential equations with fractionalorders integral boundary conditions. Our studies have relied on Krasnoselskii's fixed point theorem and Banach contraction principle. We provide examples to clarify the achieved conclusions.

1. Introduction

Mathematicians effectively used the tools of fractional calculus to describe reallife problems requiring highly accurate mathematical modeling. It is observed that the proposed models are more appropriate to be represented by fractional-order differential equations that yield more precise outcomes. Recently, fractional-order derivatives have been increasingly used in a diversity of scientific fields. Such as electromagnetics, electrochemistry, fluid mechanics, quantum mechanics, viscoelasticity, ecological systems, optics, and signal processing. Therefore, it is a mathematical challenge to develop and implement new methods for solving fractional-order differential equations, see [8, 10, 12, 13, 14, 15, 16, 23].

On the other hand, the stability analysis of the fractional order differential equations is critical in many applications and essential in the Ulam-Hyers-Rassias stability types and their generalizations, see [7, 18, 20].

- *Key words and phrases.* Caputo fractional derivative, Ordinary second-order fractional-order differential equation, Existence results, Boundary value problems.
- Communicated by. P. Găvruța and Haydar Akça

²⁰¹⁰ Mathematics Subject Classification. 26A33, 34K45, 47G10.

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