Nonlinear Dynamics and Systems Theory, **22** (2) (2022) 155–168

Existence and Uniqueness of Solutions for a Semilinear Functional Dynamic Equation with Infinite Delay and Impulses

C. Duque [1], H. Leiva [2] and A. Tridane [3*]

[1] *Department of Mathematics, Faculty of Sciences, Los Andes University, Mérida, Venezuela.*
[2] *School of Mathematical and Computational Science, Yachay Tech. University, San Miguel de Urcuqui, Imbabura, Ecuador.*
[3] *Department of Mathematical Sciences, United Arab Emirates University, Al Ain, UAE.*

Received: November 15, 2021; Revised: March 20, 2022

Abstract: This work is devoted to the prove of the existence of solutions for a semilinear retarded differential equation with infinite delay and impulses on time-scales, which is done by using a version of the Arzela-Ascoli theorem on time-scales, and applying the Leray-Schauder alternative. After that, the uniqueness of solutions is proved by applying a version of Gronwall's inequality for impulsive differential equations, and finally, the continuation of solutions is proved.

Keywords: *semilinear functional dynamic equations; infinite delay; infinite impulses; Leray-Schauder alternative; existence; uniqueness; continuation; time-scales.*

Mathematics Subject Classification (2010): 93C10, 93C23, 34N05, 34K45.

1 Introduction

In the last decades, the theory of time scales has occupied an important space within the mathematical community, attracting the interest of many researchers since it is a powerful tool for continuous and discrete analysis from a unified point of view (see, for instance, [1–3] and references therein).

The time scales theory has made possible to create models in population dynamics, physics, chemical technology, economics, control theory, among others, that allow the study of certain phenomena and processes where the temporal variable can vary both continuously and discretely (see [3, 6–9] and references therein). However, there exists

* Corresponding author: mailto:a-tridane@uaeu.ac.ae