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Boundary Value Problem for Fractional q-Difference Equations

N. Allouch [1], S. Hamani [1*] and J. Henderson [2]

[1] *Laboratory of Pure and Applied Mathematics, Faculty of SEI, University of Mostaganem, B.P. 227, 27000, Mostaganem, Algeria.*
[2] *Department of Mathematics, Baylor University, Waco, Texas. 76798-7328, USA.*

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Abstract: In this paper, we study the existence of solutions for a class of boundary value problems for fractional q-difference equations involving the Caputo fractional q-difference derivative. Our results are given by applying some standard fixed point theorems. Furthermore, an example is presented to illustrate one of the main results.

Keywords: *fractional q-difference equations; Caputo fractional q-derivative; existence; fixed point; Leray-Schauder nonlinear alternative.*

Mathematics Subject Classification (2010): 26A33, 34A37, 70K05, 70K20.

1 Introduction

Fractional calculus is an important branch in mathematical analysis, currently being addressed by many researchers in various fields of science and engineering such as physics, chemistry, biology, economics, control theory, and biophysics, etc. For more details, see [15, 19, 22, 23, 27]. Recently, considerable attention has been given to the existence of solutions to the boundary value problems for fractional differential equations. See for example, the papers of Benchohra *et al.* [4, 10, 11] and references therein.

In 1910, Jackson [16, 17], the first researcher to develop q-difference calculus or quantum calculus in a systematic way, introduced the notions of the q-integral and some classical concepts.

Combining fractional calculus and q-calculus, we obtain fractional q-difference calculus. This generalizes q-calculus by defining the q-derivatives and q-integrals in an arbitrary order. The fractional q-difference calculus had its origin in the end of the

* Corresponding author: mailto:hamani_samira@yahoo.fr