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Research Article

Boundary Value Problems for q-Difference Inclusions

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We investigate the existence of solutions for a class of second-order q-difference inclusions with nonseparated boundary conditions. By using suitable fixed-point theorems, we study the cases when the right-hand side of the inclusions has convex as well as nonconvex values.

1. Introduction

The discretization of the ordinary differential equations is an important and necessary step towards finding their numerical solutions. Instead of the standard discretization based on the arithmetic progression, one can use an equally efficient q-discretization related to geometric progression. This alternative method leads to q-difference equations, which in the limit $q \to 1$ correspond to the classical differential equations. q-difference equations are found to be quite useful in the theory of quantum groups [1]. For historical notes and development of the subject, we refer the reader to [2, 3] while some recent results on q-difference equations can be found in [4–6]. However, the theory of boundary value problems for nonlinear q-difference equations is still in the initial stages, and many aspects of this theory need to be explored.

Differential inclusions arise in the mathematical modelling of certain problems in economics, optimal control, stochastic analysis, and so forth and are widely studied by many authors; see [7–13] and the references therein. For some works concerning difference inclusions and dynamic inclusions on time scales, we refer the reader to the papers [14–17].