Existence of countably many symmetric positive solutions for system of even order time scale boundary value problems in Banach spaces

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ABSTRACT

This paper establishes the existence and uniqueness of the solutions to the system of even order differential equations on time scales,

\[ (-1)^{n}u_{1}(\Delta^{n})^{i} (t) = \omega_{1}(t)f_{1}(u_{1}(t), u_{2}(t)), \quad t \in [0, T]_{\mathbb{T}}, \quad n \in \mathbb{Z}^{+}, \]

\[ (-1)^{m}u_{2}(\Delta^{m})^{j} (t) = \omega_{2}(t)f_{2}(u_{1}(t), u_{2}(t)), \quad t \in [0, T]_{\mathbb{T}}, \quad m \in \mathbb{Z}^{+}, \]

satisfying two-point Sturm-Liouville integral boundary conditions

\[ a_{i+1}u_{1}(\Delta^{i})^{j}(0) - \beta_{i+1}u_{1}(\Delta^{i})^{j}(T) = \int_{0}^{T} a_{i+1}(s)\Delta^{j}(u_{1}(s))\Delta s, \quad 0 \leq i \leq n - 1, \]

\[ a_{i+1}u_{2}(\Delta^{i})^{j}(0) - \beta_{i+1}u_{2}(\Delta^{i})^{j}(T) = \int_{0}^{T} a_{i+1}(s)\Delta^{j}(u_{2}(s))\Delta s, \quad 0 \leq i \leq n - 1, \]

by utilizing Schauder fixed point theorem. We also establish the existence of countably many symmetric positive solutions for the above problem by applying Hölder’s inequality and Krasnoselskii’s fixed point theorem.

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