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Solutions of a Class of Discrete Fourth Order Boundary Value Problems

We study the discrete fourth order boundary value problem

$$\begin{cases} \Delta^4 u(t-2) - \alpha \Delta^2 u(t-1) + \beta u(t) = f(t, u(t)), & t \in [1, N]_{\mathbb{Z}}, \\ u(-1) = \Delta u(-1) = 0, & u(N+1) = \Delta^2 u(N) = 0, \end{cases}$$

where $N \geq 1$ is an integer, $\alpha, \beta \geq 0$, and $f: [1, N]_{\mathbb{Z}} \times \mathbb{R} \rightarrow \mathbb{R}$ is continuous in the second argument. We obtain several criteria for the existence of one and multiple solutions of the problem. Our analysis is mainly based on the variational method and critical point theory. Examples are presented to illustrate our results.

Keywords: Discrete boundary value problem, fourth order, solutions, variational methods, local linking, critical points.

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