

Dirichlet systems with relativistic operator: differences vs differential

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Abstract

We discuss the solvability of some Dirichlet systems with discrete relativistic operator

$$u \mapsto \Delta \left[\frac{\Delta u(n-1)}{\sqrt{1 - |\Delta u(n-1)|^2}} \right] \quad (n \in \{1, \dots, T\}).$$

Here, for $u : \{0, \dots, T+1\} \rightarrow \mathbb{R}^N$, we denote by Δu the usual forward difference operator. Besides an "universal" existence result for a system with a general nonlinearity, we obtain multiplicity of solutions for potential systems with parameterized nonlinearities. Comparisons with similar results for the relativistic differential operator, as well as for the mean curvature operator in Minkowski space are provided. Our approach relies on Brouwer degree arguments and critical point theory for convex, lower semicontinuous perturbations of C^1 -functionals.

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