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PRINCIPLE OF MINIMAL NONLOCAL COMPLEMENTARY ENERGY FOR NONLINEAR BOND-BASED PERIDYNAMIC DIFFUSION AND THE ASSOCIATED OPTIMAL DESIGN PROBLEM

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We study an optimal design problem for a system governed by a nonlocal bond-based peridynamic analogue of a p-Laplacian operator [1] and its limit in the case of the vanishing nonlocal horizon. For optimal design problems of systems governed by elliptic PDEs, the dual variational principle (principle of minimal complementary energy) has proven to be an invaluable analytical tool [2]. Inspired by this fact, we study the principle of minimal complementary energy in the nonlocal case. For linear nonlocal diffusion with heterogeneous material coefficients such an approach has proved to be successful [3, 4], with the main challenge being the need for the proper mathematical tools relating the local, vectorial fluxes with their two-point nonlocal analogues [3]. Generalizing these tools to the nonlinear case turns out to be an interesting challenge [5]. Our results provide an alternative way of rigorously establishing the relation between the nonlocal optimal design problems and their local counterparts in the vanishing nonlocal horizon limit.

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