A wavelet-based approach for the optimal control of non-local operator equations

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

ID 4648209
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Year 2022
Title A wavelet-based approach for the optimal control of non-local operator equations
Journal SIAM journal on scientific computing
Volume 44
Number 4
Pages / **Article-Number** A2691–A2708
Keywords wavelets, PDE-constrained optimization, nonlocal operators, semismooth Newton, fractional Laplacian, bound constraints
The optimal control of partial differential equations (PDEs) driven by nonlocal operators presents many numerical challenges. In contrast to the existing methods available in the literature, we propose a wavelet-based approach. This allows us to directly treat the nonlocal operators without the need to extend the underlying PDE into a higher spatial dimension. Due to their possessing vanishing moments, wavelets offer efficient compression strategies that lead to O(A)-algorithms for the forward equation, where A is the number of degrees of freedom. While wavelet schemes have been used very succesfully in the context of boundary element methods, their potential for the simulation of forward problems on domains involving nonlocal operators has yet to be fully exploited. These computational advantages carry over to the solution of the class of control problems under consideration. The latter are equivalent to a coupled system of nonsmooth operator equations with nonlocal operators.

ISSN/ISBN 1064-8275