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Interior-point methods and preconditioning for PDE-constrained optimization problems involving sparsity terms. (English) Zbl 07177902

Summary: Partial differential equation (PDE)-constrained optimization problems with control or state constraints are challenging from an analytical and numerical perspective. The combination of these constraints with a sparsity-promoting $L^1$ term within the objective function requires sophisticated optimization methods. We propose the use of an interior-point scheme applied to a smoothed reformulation of the discretized problem and illustrate that such a scheme exhibits robust performance with respect to parameter changes. To increase the potency of this method, we introduce fast and efficient preconditioners that enable us to solve problems from a number of PDE applications in low iteration numbers and CPU times, even when the parameters involved are altered dramatically.

MSC:
65F08 Preconditioners for iterative methods
65F10 Iterative numerical methods for linear systems
65K05 Numerical mathematical programming methods
76D55 Flow control and optimization for incompressible viscous fluids
90C20 Quadratic programming
93C20 Control/observation systems governed by partial differential equations

Keywords:
box constraints; interior-point methods; PDE-constrained optimization; preconditioning; saddle-point systems; sparsity

Full Text: DOI

References:
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