

Optimization with respect to order in a fractional diffusion model: analysis, approximation and algorithmic aspects*

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Abstract

We consider an identification problem, where the state u is governed by a fractional elliptic equation and the unknown variable corresponds to the order $s \in (0, 1)$ of the underlying operator. We study the existence of an optimal pair $(\bar{s}, \bar{u})$ and provide sufficient conditions for its local uniqueness. We develop semi-discrete and fully discrete algorithms to approximate the solutions to our identification problem and provide a convergence analysis. We present numerical illustrations that confirm and extend our theory.

Key words: optimal control problems, identification problems, fractional diffusion, bisection algorithm, finite elements, stability, fully-discrete methods, convergence.

Mathematics subject classifications (1991): 26A33, 35J70, 49J20, 49K21, 49M25, 65M12, 65M15, 65M60.

*EO has been supported in part by CONICYT through FONDECYT project 3160201.

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