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OPTIMAL CONTROL OF A NONLINEAR COUPLED ELECTROMAGNETIC INDUCTION HEATING SYSTEM WITH POINTWISE STATE CONSTRAINTS*

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Abstract

An optimal control problem arising in the context of 3D electromagnetic induction heating is investigated. The state equation is given by a quasilinear stationary heat equation coupled with a semilinear time-harmonic eddy current equation. The temperature-dependent electrical conductivity and the presence of pointwise inequality state-constraints represent the main challenge of the paper. In the first part of the paper, the existence and regularity of the state are addressed. The second part of the paper deals with the analysis of the corresponding linearized equation. Some sufficient conditions are presented which guarantee the solvability of the linearized system. The final part of the paper is concerned with the optimal control. The aim of the optimization is to find the optimal voltage such that a desired temperature can be achieved optimally. The corresponding first-order necessary optimality condition is presented.

MSC: 49J20, 35B37, 78A25, 35J60, 90C48.

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