

Simulation Analysis and Control of the Temperature Field in an Induction Furnace Based on Various Parameters

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Abstract : Induction heating is extensively employed in industrial furnaces due to its swift response and high energy efficiency. Designing and optimising these furnaces necessitates the use of computer-aided simulations. This study aims to develop an accurate temperature field model for a rectangular steel billet in an induction furnace by leveraging various parameters in COMSOL Multiphysics software. The simulation analysis incorporated temperature dynamics, considering skin depth, temperature-dependent, and constant parameters of the steel billet. The resulting data-driven model was transformed into a state-space model using MATLAB's System Identification Toolbox for the purpose of designing a linear quadratic regulator (LQR). This controller was successfully implemented to regulate the core temperature of the billet from 1000°C to 1200°C, utilizing the distributed parameter system circuit.

Keywords : induction heating, LQR controller, skin depth, temperature field

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