Dissertation peer review

Author of the doctoral thesis: Debela Geneti Denisa

Topic: Analysis of Thermal Stresses in Steel Workpiece Heated by Induction

Promoters: Assoc. Prof. Albert Smalcerz, Ph.D. DSc.

AssocProf. Václav Kotlan, Ph.D.

Reviewer: Assoc. Prof. Dr. Ing. Jan Kyncl

The dissertation is appropriately structured, after the introduction, the author focuses on research gaps, presents the theoretical foundations of induction heating, heat transfer, stresses in material. The author also deals with mathematical modeling of relevant phenomena, temperature measurement during induction heating and optimization.

It is commendable that the author gives the material properties, model parameters and correlation used for convection heat transfer so that the results can be verified.

The author lists the sources and literature used in detail, based on the latest current knowledge.

From his own results, the author draws conclusions that can be considered correct and outlines perspectives for the further development of the issue.

I consider the author's publication activity to be more than sufficient for obtaining the title of Ph.D.

The dissertation thesis itself deserves a more thorough final revision, and the list of quantities used should also include units or physical dimensions of the quantities, moreover, this list is incomplete.

I have the following comments and questions about the work:

- In equation (2.1) should be gamma and not lambda.
- Equations (2.1), (2.3) and many others apply only in the sinusoidal steady state, but the dependence of the magnetic induction on the intensity of the magnetic field according to Figure 5.6 is not a homogeneous linear function, so it cannot be a sinusoidal steady state.
- It is commendable that the author consistently cites sources, but the formula for the penetration depth of electromagnetic waves in a conductive medium (eqn. (2.4)) has been known for at least 150 years and the citation (Lupi et. al. 2015) is not appropriate.
- For the rate of temperature change, the unit K/s is more appropriate than °C/s (Figure 2.3).
- The author uses cylindrical and Cartesian coordinates in various places, and even cylindrical in dimensionless form, which can be quite difficult for a less experienced reader (pages 20, 21, 35...).
- The list of used symbols is incomplete.

- The left side of equation (3.7) is obviously a vector and the right side is a scalar according to the notation, similarly in equation (3.6) D is written as a scalar and it is a vector and so on.
- In equations (3.19) and (5.6), C is the emissivity only in the case of a small body enclosed in a significantly larger cavity.
- Explain the equation (4.1), state the units of its terms. Was this equation used in the modeling?
- I'm afraid the correlation from page 140 doesn't match the situation of Figure 4.7: spraying a cylinder with nozzles is not the same as having a fluid flow around the cylinder. How sensitive is the model to changes in the convection heat transfer coefficient?
- The author uses nabla notation on page 42 and curl on page 79. On page 79, he distinguishes phasor quantities from time domain quantities by underlining, on page 42 he does not. Similarly, the volume sources of heat in equation (3.10) and in equation (5.5) are denoted differently, the author also uses a different symbol for the heat transfer coefficient in equation (6.23) and equation (4.23), and similarly denotes the thermal conductivity coefficient k (4.23) and lambda (6.24).I would consider it appropriate to unify the markings.

The previous comments are of a formal nature and do not reduce the high quality of the research's own conclusions.

So I can state that the author has fulfilled the conditions (first author of publication in peer revieved scientific journal with an Impact Factor, high substantive value of the dissertation and my review is higly positive) and I recommend the dissertation for the defence.

Doctoral dissertation by M.Sc. Eng. Debela Desisa titled "Analysis of Thermal Stresses in Steel Workpiece Heated by Induction" is in accordance with the requirements of the Article 190, paragraph 2 of the Act of July 20, 2018 - Law on Higher Education and Science (consolidated text: Journal of Laws of 2023, item 742, as amended).

Praha, 16. 10. 2024