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University of Sri Jayewardenepura

Faculty of Graduate Studies

Department of Mathematics

An Analysis of

Direct Resistance Heating of a Circular Sheet Metal

Using Finite Difference Techniques

A Thesis

by

PASDUNKORALE ARACHCHIGE JAYANTHA

Submitted in Partial Fulfillment of the requirements for the Degree of

Master of Science
in
Industrial Mathematics

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(P. A. Jayantha)

31.03.98

Abstract

This report presents results of a numerical study on direct resistance heating of a circular metal sheet of uniform thickness. It is shown that the electrical current density of the plane sheet satisfies the continuity equation while the electrical potential satisfies the Laplace equation if there is no variation of physical properties of the material. The power balance equation which describes the temperature of the circular plate is obtained.

Initially, we obtain numerical results of the above equations when a circular sheet blank is heated by passing an electrical current through a diameter. The results show that the electrical current density, heat generation and temperature near the diameter are higher than those of the other points of the plate.

Assuming that the circular sheet blank is heated by passing the electrical current through several diameters in a staggered pattern, we find the numerical solution of the above equations. These results show that the final temperature distribution has a pattern and the temperature near the center is higher than other points when the temperature at the boundary is maintained at room temperature.

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