Utilization of induction heating in the line of continuous casting–continuous rolling of steel

Viktor B. Demidovich, Fedor V. Chmilenko, Irina I. Rastvorova

Abstract. Technical and economic aspects of induction heating applied in process of continuous casting–continuous rolling of steel are discussed and evaluated. Continuous processing of steel includes many in-line heating technologies. The primary types of furnaces used for heating in these continuous lines are gas fired and induction furnaces. The prospect of casting slabs which can be passed directly to the hot strip mill finishing train is attracting world-wide interest and offers new opportunities for induction heating. The economics of induction heating depend as much on factors such as plant layout and subsequent rolling practice as on relative energy cost and thermal efficiencies. An induction heater following a gas-fired continuous furnace cannot only correct temperature deficiencies caused by fluctuating rolling schedule, but also allows the furnace to operate at a lower temperature, increasing its overall thermal efficiency and reducing the formation of surface scale. A Windows application code was developed that allows simulation of 2D thermal processes including continuous casting, cooling, holding and reheating of slabs in gas-fired and induction furnaces. Complex models of these processes allow designers to make informed choices between gas-fired and induction furnaces and to develop flexible and efficient steel processing line technologies.

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Development and application of induction and resistive electrical heating systems for industrial pipelines

Alexander Kuvaldin, Maxim Fedin,
Mikhail Strupinskiy, Nikolay Khrenkov

Abstract. The problems of calculation of heating units for ferromagnetic steel in weak electromagnetic fields are analyzed. Comparison of possibilities of induction, electrical contact and combined methods of pipe heating are provided. Special problems—heating system options—are considered: use of bimetallic outer conductors; use of increased frequency; effect of a lengthwise cut (clearance) of a steel pipe. Possibilities of the survey results utilization are investigated, as well as engineering and techno-economic problems.

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Use of detailed equivalent circuit method for investigation of electromagnetic, thermal and hydrodynamic processes in induction electric engineering units

Fedor N. Sarapulov, Sergey F. Sarapulov, Vasiliy E. Frizen

Abstract. Basic simulation principles of electromagnetic, thermal and hydrodynamic processes in induction electric engineering units are presented.

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Analysis of induction machines with combined stator windings

Luděk Schreier, Jiří Bendl, Miroslav Chomát

Abstract. The properties of the induction machine with the combined stator winding are analysed regarding the influence of the angular displacement and the number of turns of the delta and star connected windings on the currents, the torque and the efficiency of the machine. Equations of the machine that are valid for an arbitrary angle of the displacement and an arbitrary ratio of turns of these windings are derived. The theoretical conclusions are verified by experiments.

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Modeling techniques for
tires based on $\varphi-s$ diagram

Ekaterina V. Balakina, Nikolai M. Zotov,
Aleksei P. Fedin, Roman K. Borodin

Abstract. A new technique for computer modeling of $\varphi-s$ diagrams (dependences of a braking coefficient of friction on a longitudinal sliding coefficient) is presented. The technique was developed by summarizing the outcomes of foreign experiments and the resulting analytical representation of the diagrams is suitable for computer modeling.

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MHD slip flow over a stretching sheet with convective boundary condition

Gopi Chand, R. N. Jat, Dinesh Rajotia1pt

Abstract. The boundary layer flow and heat transfer of an incompressible viscous fluid in the presence of uniform transverse magnetic field over a stretching sheet with viscous dissipation and partial slip is investigated numerically. Using a similarity transformation, the governing partial differential equations are reduced into a set of nonlinear ordinary differential equations and then solved numerically by shooting method. Numerical solution of boundary value problem in the case when the sheet stretches with a velocity varying linearly with the distance is carried out. The velocity and temperature distributions are obtained for different parameters and presented through figures.

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Coupled pendulums—consequences of an experiment inconsistent with the theory

Tomáš Stejskal

Abstract. Special properties of coupled pendulums are investigated, which have an impact on the whole theory of oscillatory processes. Firstly, the contradiction between the theoretical characteristics of coupled pendulums and the actual measured data is pointed out. Also, this paper points out that the traditional calculation methods are inadequate to describe the observed phenomenon of coupled pendulums oscillation.

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