METHOD OF CALCULATING TOTAL EDDY CURRENTS INDUCED IN SCREENS OF A SYMMETRICAL THREE-PHASE SINGLE-POLE GAS-INSULATED TRANSMISSION LINE

Zygmunt Piątek

Abstract. The problems of eddy currents induced in screens of a symmetrical three-phase single-pole gas-insulated transmission line (GIL) are discussed. The solution starts from determining the eddy currents induced in the tubular screen by the magnetic field of self-current of the phase conductor. Then the magnetic field in the external parallel phase conductor is presented by means of the magnetic vector potential as a Fourier series. In the non-conducting external and internal areas of the screen the Laplace equation is used for the magnetic field strength taking into account the reverse reaction of the eddy currents induced in the screen. The domain of the conducting screen is described by the Helmholtz equation for the eddy currents density supplemented with the classical boundary conditions. The solutions obtained are used to determine the total eddy currents induced in all the screens of the GIL under consideration.

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STRESS ANALYSIS OF MAGNETOELASTICALLY VIBRATING DISC

Piotr Jankowski, Stanislaw Rymkiewicz

Abstract. Observations made during the experiment with a physical model of an inductive dynamic drive show that in some extreme cases the disc is deformed fundamentally, what is proved by its vibrations. For the investigation of the state of stress, the mathematical model of the magneto-elastic vibrations for a circulation plate is used. Presented results which show the distributions of stresses for the parameters of an inductive-dynamic drive employed in an ultra rapid hybrid circuit breaker can be useful for constructors.

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NOVEL TRANSFORMATION OF MATERIAL PARAMETERS FOR BETTER DISCRETIZATION OF VERY THIN SKIN DEPTH AND ITS APPLICATIONS

Ladislav Musil

Abstract. A new method for an easier discretization of thin surface layers with eddy currents in electrically conductive materials is presented. The basic idea of how to carry out better discretization of a very thin layer is to increase its width by transformation of the material parameters. The suggested transformation increases the skin depth but does not affect the basic integral parameters of the solution, such as the total Joule losses. The accuracy of the method is tested on very simple analytically solvable arrangements and also on two particular examples of industrial induction heating technologies.

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APPLICATION OF POWER SYSTEM STABILIZERS PSS3B TO ELECTROMECHANICAL SWING DAMPING IN MULTI-MACHINE POWER SYSTEM

Stefan Paszek, Andrzej Pawłowski

Abstract. Presented are the results of parameter optimisation of dual input power system stabilizers of type PSS3B designed for damping rotor swings of synchronous generators in the power system of a non-linear mathematical model. It is assumed that the power system consists of generator and receiving nodes, all interconnected by the power system network. The generator with its excitation system and the power system stabilizer operate within the generator nodes. The generator is powered by a driving turbine with a governor system. The parameters of the system stabilizers were determined by minimising the generalised quality factor in the multi-machine power system. The quality factor was calculated from the deviations of the active power, rotational speed and generator voltage in individual generator nodes for transient symmetrical short-circuits in the system transmission lines. The exemplary optimisation computations were carried out for a CIGRE 7-machine power system. The presented computations were performed for the systems with and without stabilizers.

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INTEGRODIFFERENTIAL APPROACH TO MODELLING OF CONTINUAL INDUCTION HEATING OF NONMAGNETIC CYLINDRICAL BODIES

Pavel Karban, Ivo Doležel, Martina Donátová

Abstract.

Continual induction heating, from the viewpoint of the mathematical and computer modelling, represents a relatively complicated problem described by two coupled partial differential equations for electromagnetic and temperature fields characterised by time-varying boundary conditions. Application of classical finite element method (FEM) requires remeshing of the definition area at every time level, which may significantly decelerate the process of solution, particularly calculation of the electromagnetic field. For linear problems of this kind the paper offers another approach based on the direct computation of spatial and temporal distributions of eddy currents and Joule losses in the heated body. The algorithm is illustrated by an example whose results are validated by a professional FEM-based code.

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ANALYTICAL APPROACH TO ELECTROMAGNETIC TORQUE FOR SPHERICAL INDUCTION MOTOR WITH ANISOTROPIC AND CONDUCTIVE ROTOR

Dariusz Spałek, Krzysztof Waleczek

Abstract. An analytical approach to electromagnetic field analysis for spherical electromechanical converters is performed taking into account their magnetic anisotropy. The electromagnetic field is evaluated analytically using the variable separation method proposed for the magnetic vector potential. Subsequently, electromagnetic torque and power losses are calculated analytically for an exemplary spherical induction motor.

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