Contribution to investigation of influence of geomagnetic storms on electrification system

Daniel Mayer

Abstract. The influence of variations of the geomagnetic field on electrification system is investigated with the aim to evaluate its negative effects on the operation of various electrical devices, such as systems for the transmission of electrical energy. An algorithm for calculating the currents that can be induced in the power lines and can lead to the violation of stability of the system is derived. The algorithm is demonstrated on an illustrative example.

Contents

Method of low-voltage electric network power processes control and their quality assurance on the basis of *p*-*q*-*r* theory

Mykhaylo Zagirnyak, Viacheslav Prus,
Alyona Nikitina

Abstract. A method of power processes quality estimation and compensation for poor quality in industrial low-voltage electric networks is substantiated. Calculation relations for spectral presentation of power components and quality indices of electric power are improved in accordance with *p*-*q*-*r* theory of instantaneous power. The structure of compensating device is grounded and a higher efficiency of nonlinear distortions compensation compared with the basic variant of *p*-*q*-*r* theory is confirmed.

Contents

Novel approaches to analysis of transition processes identification error by probability-statistical methods during sudden symmetric short-circuit tests of synchronous machines

Anatolii I. Sudakov, Evgenii A. Chabanov,
Nikolai V. Shulakov

Abstract. Probabilistic and statistical methods are developed for researching long transient processes in synchronous machines, occurring under the influence of various random factors. In particular, a new authentic method is explained. The method is oriented at minimizing the mean square error of approximation of the discrete statistical model of the transient component to the experimental data on a relatively long section of the discrete transition process. The model allows representing the found error in the form of a discrete surface in three dimensions.

Contents

Active control of flying capacitor currents in multilevel voltage-source inverters

Petr Kokeš, Radko Semerád

Abstract. Analyzed is an output voltage generation technique in multilevel voltage-source inverters with flying capacitors (FLC VSI) utilizing SVM modulation that enables the limitation of voltage ripple across flying capacitors for small modulation depths. This may reduce the capacitance of flying caps in applications where high current overloads are demanded at low AC output voltages, e.g. at motor start. For small modulation depths, the so called zero-voltage vectors must be used in the SVM. The method is based on varying the time distribution of these vectors. By the change of this time distribution, an active control of the currents flowing through the flying capacitors is possible to some extent. The principle of this adaptation is explained, its properties under steady and transient states are discussed and practical results with 4-level 4 kVA FLC VSI are presented.

Contents

Heat transfer analysis in boundary layer flow over a non-isothermal shrinking cylinder with wall mass suction

Krishnendu Bhattacharyya

Abstract. An analysis is made to study the heat transfer in boundary layer flow past a permeable shrinking cylinder with mass suction and variable surface temperature. The similarity transformations are used to obtain the nonlinear self-similar ordinary differential equations from the governing partial differential equations. Then numerical solutions are obtained by finite difference method using the quasilinearization technique. The analysis reveals some important aspects of heat transfer in non-isothermal cylindrical shrinking surface. Due to direct variation of temperature along the surface the heat transfer increases and for inverse variation the effect is opposite. Because of the curved shape of the cylinder the velocity boundary layer thickness and thermal boundary layer thickness increase. Also, for mass suction the heat transfer enhances.

Contents

Magnetohydrodynamic and radiation heat transfer boundary layer flow of a nanofluid past a stretching sheet with velocity slip and convective boundary conditions

M. Gnaneswara Reddy

Abstract. The problem of laminar fluid flow which results from a permeable stretching of a flat surface in a nanofluid with the effects of heat radiation, magnetic field, velocity slip and convective boundary conditions is investigated. The transport equations used in the analysis takes into account the effect of Brownian motion and thermophoresis parameters. Similarity transformation is used to convert the governing non-linear boundary-layer equations into coupled higher order non-linear ordinary differential equations. These equations are numerically solved using the fourth-order Runge–Kutta method along with shooting technique. An analysis is carried out to elucidate the effects of governing parameters corresponding to various physical conditions. Numerical results are obtained for distributions of velocity, temperature and concentration, as well as, for the skin friction, local Nusselt number and local Sherwood number for several values of governing parameters. It was found that the local concentration of nanoparticles increases as the radiation parameter and convection Biot number increases but decreases as the Lewis number increases. Also, the velocity decreases as the values of magnetic parameter and velocity slip parameter increase. A comparative study between the previous published and present results in a limiting sense is found in an excellent agreement.

Contents

Analysis and interpretation of compressible fluid interaction upon the vibration of a circular membrane

Daniel G. Gorman, Jaromír Horáček,
Anthony J. Mulholland, Maire N. Gorman

Abstract. The free vibration of a circular membrane in interaction with a fluid contained in a cylindrical boundary is analysed. The fluid is compressible and assumed inviscid. The resulting modal parameters are described by non-dimensionalised frequencies, mode shape coefficients and relative modal energy levels between that of the membrane and the fluid. A simplified "bar" model is introduced as a means of describing the characteristics of membrane/fluid strong interaction between axisymmetric modes of the membrane and axial modes of the fluid column only.

Contents