Analysis of fluid flow and heat transfer over a symmetric porous wedge

Prativa R. De, Swati Mukhopadhyay, G. C. Layek

Abstract. The flow over a symmetric porous wedge and the heat transfer in presence of a heat source/sink is studied. With the increase of heat source parameter the temperature increases. It is noted that the steady flow separation occurs at the critical value of wedge angle and this separation region is controlled using suction (injection) applied at the porous wedge wall. With the increasing value of Falkner–Skan exponent, the horizontal velocity is found to increase. Fluid velocity is found to increase with increasing values of suction parameter. The thermal boundary layer thickness decreases (increases) with suction (injection). The rate of heat transfer and the flow near the wedge with different suction/blowing speeds and wedge angles are presented in presence of a heat source/sink.

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Numerical investigation on pulsatile flow through asymmetric double constrictions

Mani Shankar Mandal, G. C. Layek

Abstract. The pulsatile laminar flow through a two-dimensional channel with asymmetric double constrictions is investigated in the present study. The governing equations of motion are written based on stream function–vorticity and solved numerically using a finite-difference scheme by exploiting appropriate physically realistic prescribed conditions. An extensive qualitative analysis is performed through numerical computations in order to estimate the effects of Reynolds number and the flow pulsation parameter in terms of Strouhal number on the flow velocity and the wall shear stress. The study reveals that the geometry of the constriction has a considerable effect on the flow field. Special emphasis is put on comparing the present results of wall shear stress in constricted regions with the existing results where primitive variable approach popularly known as Marker-and-Cell (MAC) method was used for the numerical solution of unsteady Navier–Stokes equations; a good agreement between them is achieved.

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Velocimetry and accelerometry of particles injected in thermal plasma jet

Jiří Šonský

Abstract. Three-dimensional variant of the particle tracking velocimetry and accelerometry is developed, able to measure velocities and accelerations of particles in hot core of the thermal plasma jet, as well as in surrounding areas such as particle injection zone. Positions of particles are captured during the light pulse by two perpendicular multi-exposure CCD cameras equipped with shared rotating mirror yielding sequence of images separated by time intervals 3–20 μs. Software processing of the captured images yields the velocities and accelerations of captured particles, and the processing of an image series yields the approximated fields of the velocities and accelerations of the particles.

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Approximating hysteresis curves for study of ferroresonance in iron cored transformers

Jan Kyncl, Pavel Matyska,
Adithya Hariram, Lubomír Musálek

Abstract. The hysteresis curves produced in the iron cores of a transformer are investigated. The methodology is based on full- scale laboratory measurements. A mathematical model describing their shapes is realized by the code Mathematica®. Regression and method of least squares are used for a better understanding of the phenomenon.

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Electromagnetic damping system with three permanent magnets

Vladimír Křivka

Abstract. Dynamic interaction in a system containing two fixed and one free permanent magnet is studied. The movement of the free magnet is one-dimensional. The paper presents the complete mathematical model of the problem consisting of a nonlinear partial differential equation describing the distribution of magnetic field in the system and another ordinary nonlinear differential equation for the movement of the free magnet. Its numerical solution is realized by the combination of fully adaptive codes Agros2D and Hermes2D based on the finite element method of a higher order of accuracy. The methodology is illustrated by a typical example.

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Accuracy verification of new fault location method for medium voltage distribution networks

Peter Braciník, Marek Höger, Miroslav Kováč,
Juraj Altus, Marek Roch, Alena Otčenášová

Abstract. A new method for fault location in distribution networks is described and results obtained during its verification are presented. The basic principle of the tested method is introduced at the beginning. Then the scale model of 22 kV power line used for verification together with verification measurements and fault calculation are described. After that the fault location calculation based on the simulation results is presented. Both results are compared and evaluated. The final part of the paper describes how the wave propagation speed could be calculated and how its value affects the accuracy of the method.

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Wind power plant energy prediction simulator

Zdeněk Hradílek, Tomáš Šumbera

Abstract. Important issues of wind power plants (WPP) are investigated, especially their reliability within the power transmission system. First, attention is paid to the effects of fluctuation experienced in electric power production at wind power plants with regard to the control field deviation and possibility of controlling WPP with the use of supporting services. Then, estimation of power produced by the WPP and probability of wind speed occurrence are evaluated. The key part of the paper describes the software for simulation of the wind power plants with optional prediction of up to 54 hours in advance. The software for prediction of electric power produced by wind power plants utilises the ALADIN prediction model. The essential input data for the calculations includes the output curve obtained at a specific WPP site or from details supplied by the manufacturer. The output of this code is the graphic presentation of the time evolution of power delivered by the pre-defined wind power plants. The results improve the reliability of prediction of power delivered by WPP to power networks.

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