Fully nonlinear model of a hydraulic circuit

Ivan Straškraba

Abstract. Two-phase flow in a typical hydraulic system is introduced. The purpose is a rigorous mathematical analysis of the corresponding fully nonlinear system. The linearized problem near a fixed steady state have already been explicitly described. The problem is transformed to a single fixed point equation making thus possible to find at least "small" solutions with hope to be continued by some more general cases.

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Comparison of electrorheological characteristics obtained for two geometries: parallel plates and concentric cylinders

Petra Peer, Petr Filip,
Martin Stenicka, Vladimir Pavlinek

Abstract. Rheological characteristics obtained for a concrete material are not always reproducible if different rheometers or their geometrical arrangements are used. However, this point has hitherto been discussed rather rarely. This situation seems to be more challenging since the introduction and application of so-called smart materials. The aim of this contribution is to compare the electrorheological characteristics of suspensions (5, 10, and 15 wt. %) of PANI powders suspended in silicone oil measured by a rotational rheometer Physica MCR 501 (Anton Paar Co.) equipped with two different geometrical arrangements—parallel plates and concentric cylinders. The coincidences or differences in the results of the individual measured parameters are discussed.

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Mixed convection flow of nanofluids past a permeable vertical surface under convective boundary condition

Suri Venkata Subhashini, Nancy Samuel

Abstract. The effect of thermal diffusion on mixed convection flow of nanofluids over a permeable vertical flat surface with convective boundary condition has been studied numerically by considering Brownian diffusion parameter and thermophoresis diffusion parameter. The non-linear coupled partial differential equations governing the flow, thermal and concentration fields are first transformed into a set of non-linear coupled ordinary differential equations by using a set of suitable similarity transformations. The resulting system of non-linear coupled ordinary differential equations is solved numerically using an implicit finite difference scheme in combination with the quasi-linearization technique. Results indicate that the increase in Lewis number causes a decrease in concentration boundary layer thickness and therefore, mass transfer rate at the wall increases. Further, increase in Brownian motion parameter causes increase in the surface temperature of the plate. The increase in thermophoresis parameter causes to increase in both thermal and concentration boundary layer thicknesses.

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Analysis of physiologically pulsating flow with variable blood viscosity in a doubly constricted vascular tube

Mani Shankar Mandal, G. C. Layek

Abstract. The incompressible pulsatile laminar blood flow in the neighborhood of a doubly constricted rigid tube (modeled as stenosed artery) is considered. The flowing blood viscosity is supposed to be non-uniform. The variation of blood viscosity is mainly the result of concentration of red blood cells in total blood volume (haematocrit). The governing nonlinear equations of motion by considering the anomaly of blood viscosity are framed with the help of stream function–vorticity method and are solved numerically by using finite-difference technique. The alternating direction implicit scheme is used for vorticity transport equation. Important flow quantities, such as wall shear stress and velocity components, are estimated properly in the neighborhood of constrictions. The length of the recirculating region formed between the two constrictions is diminished with the increasing values of the haematocrit parameter. It is noticed that the increase in the haematocrit parameter results in the progressive flattening of axial velocity component. The wall shear stress distributions are also shown graphically and discussed for both steady and physiological pulsating flow conditions.

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Dual-frequency power supply system and inductors for heating of rotating disks in an electromagnetic field

Aleksandr B. Kuvaldin,
Aleksandr R. Lepeshkin, Stepan A. Lepeshkin

Abstract. Three-dimensional models for calculation of electric and thermal parameters and electromagnetic fields at induction heating of rotating disks in program package ANSYS are developed. The results of investigations of induction heating of rotating disks of variable thickness and different inductors are presented. The influence of rotation frequency on the power of internal heat sources in a rotating disk using various inductors is described. The dual-frequency power supply system and special inductors are developed for heating of rotating disks in electromagnetic field.

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Advanced induction heating of thin plate products

Victor B. Demidovich, Irina I. Rastvorova,
Petr A. Sitko

Abstract. Various 2D and 3D models are developed for investigation and design of the induction coils for heating steel slabs and strip. New concept of universal induction coils that allow using combination of longitudinal and transverse flux for heating plate products is discussed.

Contents

Measuring low impedance and skin effect with a gain-phase meter

Malcolm S. Raven

Abstract. A technique is described for measuring impedance with frequency which uses a modified gain-phase meter. This employs novel software routines to extract the complex components of the impedance from the signal amplitude and phase. The paper presents an analysis of the technique followed by details of the de-embedding procedure. A separate alternative circuit analysis is presented for the measurement of capacitive impedance. The results of the experimental measurements show that the technique is sufficiently sensitive to measure the skin effect in a short copper rod at audio frequencies to about 10 MHz. These results are found to compare well with theoretical analysis using Bessel functions including the possible detection of the internal inductance of the rod which is significantly less than the external inductance.

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