MHD boundary layer flow along a stretching cylinder

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Abstract. An analysis is presented for the axi-symmetric laminar boundary layer flow of a viscous incompressible fluid and heat transfer towards a stretching cylinder under the influence of a uniform magnetic field. The partial differential equations corresponding to the momentum and heat equations are converted into highly non-linear ordinary differential equations using similarity transformations. Numerical solutions of these equations are obtained by shooting method. It is found that the velocity of the flow decreases with increasing magnetic parameter. The skin friction as well as the heat transfer rate at the surface is larger for a cylinder compared to a flat plate.

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Boundary layer flow and heat transfer over a permeable shrinking cylinder with mass suction

Krishnendu Bhattacharyya

Abstract. An axisymmetric boundary layer flow and heat transfer past a permeable shrinking cylinder subject to mass suction are studied. Similarity transformations are adopted to convert the governing partial differential equations for the flow and heat transfer into nonlinear self-similar ordinary differential equations. These equations are then solved by the finite difference method using the quasilinearization technique. From the investigation it is found that the velocity in the boundary layer region decreases with the curvature parameter and increases with the mass suction. Moreover, with the increase of the curvature parameter, suction parameter and Prandtl number the heat transfer is enhanced.

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Effects of Soret coefficient on thermohaline convection in a rotating fluid

Rajib Basu, G. C. Layek

Abstract. A theoretical analysis is made to investigate the influences of Soret coefficient on the onset of thermohaline convection at the marginal state in a horizontal layer of rotating fluid heated and salted from below. Both linear and nonlinear stability analyses are carried out. The marginally steady and oscillatory convections are discussed. The onset of instability is manifested by the oscillatory convection at the threshold of convection. The critical value of the Rayleigh number increases with increasing values of the rotation parameter, Taylor number, and decreases with increasing Soret number. The Taylor number stabilizes the system while the Soret number has a destabilizing influence on the system. Using finite amplitude disturbances over the steady convection, the subcritical instability is obtained. The Rayleigh number at the subcritical state increases with the increasing values of the Soret number, resulting possibility of steady supercritical state of instability of the double-diffusive system.

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Effect of non-homogeneity on thermally induced vibration of orthotropic visco-elastic rectangular plate of linearly varying thickness

Arun K. Gupta, Pooja Singhal

Abstract. The effect of non-homogeneity on thermally induced vibration of orthotropic visco-elastic rectangular plate of linearly varying thickness is presented. The plate is characterized by the clamped boundary conditions on all the four edges. For visco-elastic materials, basic elastic and viscous elements are combined. We have assumed the Kelvin model for visco-elasticity, which is a combination of elastic and viscous elements connected in parallel. For non–homogeneity of the plate material, density is assumed to vary parabolically. Using the separation of variables method, the governing differential equation has been solved for vibration of non-homogeneous orthotropic visco-elastic rectangular plate. An approximate frequency equation is derived by using Rayleigh–Ritz technique with a two-term deflection function. Results are calculated for time period and deflection at different points, for the first two modes of vibration, for various values of temperature gradients, non-homogeneity constant, taper constant and aspect ratio and shown by graphs.

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Combined effects of heat and mass transfer by MHD free-convective flow of micropolar and Newtonian fluids through porous medium in a vertical channel in the presence of thermal radiation

Navin Kumar, Sandeep Gupta, Tanu Jain

Abstract. The Study of fully developed free-convective flow of an electrically conducting fluid and mass transfer in a vertical channel occupied by porous medium under influence of transverse magnetic field and thermal radiation is considered in the present paper. The interior territory of the channel consist of two regions; one of them is filled with micropolar fluid and the other with a Newtonian fluid, or both the regions are filled with a Newtonian fluid. Parametric studies of the physical parameters involved in the problem are performed to illustrate the influence of these parameters on the fluid flow and heat transfer aspects of the problem. Analytical results for the details of the velocity, micro-rotation velocity and temperature field are obtained and shown through graphs. In addition, the non-dimensional shearing stress in terms of the skin friction coefficient and the rate of heat transfer in terms of Nusselt number at both the walls derived and their numerical values are offered through tables.

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Radiographic observation and semi-analytical reconstruction of fracture process zone in silicate composite specimen

Daniel Vavřík, Ivan Jandejsek,
Tomáš Fíla, Václav Veselý

Abstract. Tensile failure in quasi-brittle materials is connected with formation and evolution of the Fracture Process Zone (FPZ) at the tip of a propagating crack. Not only the existence of the material damage area but also its descriptive parameters (volume, shape and energy dissipation distribution) have to be identified in order to validate approaches on both numerical modelling of quasi-brittle behaviour and experimental determination of the corresponding fracture properties. Radiographic techniques and Digital Image Correlation method are used in the presented research as very appropriate for experimental analysing of the FPZ evolution during loading of a notched test specimen. The experimental results are accompanied/compared with predictions of the FPZ's size and shape via a special semi-analytical technique serving as a part of the method developed for evaluation of the real fracture-mechanical characteristics of quasi-brittle materials from records of loading tests on laboratory-sized specimens.

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Low voltage low power quadrature voltage controlled ring oscillator for 2.4 GHz WLAN applications

Jie Jin, Shu Li

Abstract. A new CMOS low voltage low power quadrature voltage controlled ring oscillator (QVCRO) based on Chartered 0.18 μm RF CMOS technology for 2.4 GHz IEEE 802.11b WLAN applications is presented. The proposed QVCRO consists of only one resistor, two capacitors and several MOS transistors. The circuit contains no inductance, which is particularly suitable for integration. The QVCRO can provide two explicit quadrature outputs at high impedance terminals that can be connected directly to the next stage of a communication system without any matching conditions while drawing 5.5 mA from a 1.2 V supply voltage. The oscillation frequency of the QVCRO can be tuned from 1.8 GHz to 2.4 GHz by changing the control voltage, and the phase noise of the QVCRO is −98.24 dBc/Hz at 1 MHz offset. Comparing with the previously reported works, the proposed QVCRO has the advantages of lower supply voltage, lower power consumption and smaller chip area than most of the other devices of this kind.

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Maxwell's vector potential method, transient currents and the skin effect

Malcolm S. Raven

Abstract. Maxwell's original vector potential analysis of time dependent current flow in a conducting wire is analyzed in detail and the results are compared with the better known analysis using Bessel functions. A normalized impedance is derived in terms of a dimensionless parameter proportional to the ratio of the conductor radius to skin depth. We also obtain general power series summations for the sinusoidal case obtaining equations for the coefficients in the infinite series, examine the stability of the series and find that if the skin depth decreases to less than 40 % of the wire radius, the series diverge sharply.

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