Natural convection from outer surface of square ducts at arbitrary inclination

T. V. S. M. R. Bhushan, K. Vijaya Kumar Reddy

Abstract. Experiments have been conducted to investigate natural convection heat transfer from the outer surface of axially inclined square ducts. Steady state heat transfer characteristics are studied at an arbitrary inclination of 45° from vertical in laminar and transition regions in still air, with channel area ratio and orientation as study parameters. Wide range of heat inputs are considered to analyze natural convection under laminar and transition regions under constant heat flux conditions. Empirical correlations are derived for local and average Nusselt and modified Rayleigh numbers. Experimental results were compared with established correlations pertaining to vertical cylinders and enhancement of heat transfer at 45° from vertical orientation were observed.

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Heat transfer between porous rotating eccentric cylinders

Satish C. Rajvanshi, Sunita R. Jain,
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Abstract. Thermal field in a two-dimensional annulus between eccentric rotating cylinders with porous walls is analyzed. The space between two cylinders includes incompressible viscous fluid. The inner cylindrical surface is maintained at constant temperature and a specified constant heat flux is imposed on the outer surface. The energy equation is transformed into a modified bipolar coordinate system. The temperature is obtained as perturbation in terms of a measure of clearance ratio between the cylinders, and the modified Reynolds number. This study may be useful in determining the thermal performance of heat exchangers.

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Effect of magnetic field on thermosolutal Marangoni boundary layer flow

Kalidas Das, Nilangshu Acharya,
Prabir Kumar Kundu

Abstract. Thermosolutal Marangoni boundary layer flow which can be formed by an electrically conducting fluid along a flat surface taking into account the Soret and Dufour effects in the presence of magnetic field and thermophoresis is investigated. The bvp4c function from MATLAB is employed to yield the numerical solutions for the present model. The effects of various governing parameters are discussed and presented graphically. The analysis exposed that the thickness of thermal boundary layer reduces with increasing the value of thermosolutal tension ratio whereas reverse effect occurs for Dufour parameter. The concentration distribution across the boundary layer decreases as thermophoretic parameter decreases.

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Some sides of fatigue damage

Petr Brož , Daniel Dobiáš

Abstract. A nonlinear cumulative damage model is proposed and applied on the meso-scale of the primary ply and considering three damage failures. It also predicts fatigue life of composite unidirectional lamina, introducing the failure criterion as well.

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Dynamic simulation of a permanent magnet spherical motor based on cyclical trajectory planning

Yuansheng Li, Xiwen Guo, Qunjing Wang, Bao Zhang, Yuan Zhao, Qing Liu

Abstract. A cyclical trajectory planning method for a permanent magnet spherical motor (PMSM) with multiple degrees of freedom in three-dimensional space is proposed. First of all, its mechanical structure is introduced and dynamic model of the rotor is established. Then, a dynamic simulation involving load or not is carried out. The cyclical movement of the PMSM in no-load regime is supposed to be expressed by a Fourier series. The simulation results show the simplicity, effectiveness and concreteness of the proposed method, which lay a solid foundation for the future work on the dynamic control of the PMSM.

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Parallel edge finite element method to solve eddy current field problems

Dániel Marcsa, Miklós Kuczmann

Abstract. Two non-overlapping domain decomposition methods are presented and compared. They are used for parallelization of the finite element method with edge element approximation. In this case, the methods under investigation are the Schur complement method and the Lagrange multiplier based finite element tearing and interconnecting method, and their solvers. The performance of these methods and solvers is investigated in detail for two-dimensional eddy current field problems as case studies.

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Mitigation of magnetic fields produced by overhead sagging conductors of complex geometry using sagging passive loop conductor

Krzysztof Budnik, Wojciech Machczyński

Abstract. The magnetic flux densities above the earth surface produced by overhead sagging conductors of complex geometry are estimated. The power line is divided into a series of straight-line segments (spans). The analytical formulas for calculating the 3D magnetic field with respect to a convenient and unique reference system are derived. Moreover the mitigation effects due to the passive loop are also investigated, whereas the mitigation loop can be treated as a two-sagging-conductor closed loop located under the power line.

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Influence of pulse width modulated supply voltage waveform on energy efficiency and electromagnetic torque of induction motors

Yury B. Kazakov, Nikolai K. Shvetsov

Abstract. Calculation of losses increasing in adjustable frequency induction motor with different supply voltage waveforms is performed. Calculation is carried out using analytic method based upon harmonic analysis of supply voltage waveform, and also using numeric calculation of electromagnetic field based upon finite element method. Computation of change of electromagnetic torque is also performed using analytical method. All the calculations are carried out taking into account actual variation of resistances and inductive impedances with frequency.

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