Sedimentation of dilute fine-grained suspension in intermediate region

Pavel Vlasák, Zdeněk Chára

Abstract. The results of experimental investigation of the continuous sedimentation of dilute model of fine-grained suspension in the intermediate region of settlement are analyzed. The effect of the particle size (glass beads of average diameter 150–850 μm, concentration and inclination of the vessel axis on particle fall velocity is evaluated. It is confirmed that the local relative particle-liquid velocity has a practically constant value across the vessel cross-section. The settling pattern is strongly affected even by a very gentle slope of the vessel axis, which causes an asymmetrical absolute velocity profile and significant increase of the local concentration and absolute fall velocity of particles near the upward-facing wall of the vessel.

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Simulation of flight control of a hummingbird like robot near hover

Matěj Karásek, André Preumont

Abstract. A hummingbird robot with a pair of flapping wings and a 12 cm wingspan is analysed. The analysis is based on quasi-steady aerodynamics. Constructed is a control derivatives matrix that estimates the effect of each wing kinematics parameter on the cycle averaged wing forces and forms the key stone of the flight controller. Implemented is the controller in a simulation model with rigid body dynamics and "continuous" (i.e., not averaged) aerodynamics. The simulation results show that the controller stabilizes the robot attitude and controls the flight in 4 DOFs (translation in any direction + yaw rotation) by modifying only two wing kinematic parameters per wing—the flapping amplitude and the mean wing position. Other control parameters are possible. Thus, various mechanical design solutions can be studied in the future.

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Identification and application of Gurson–Tvergaard–Needleman model for sub-sized three-point-bend geometry

Luděk Stratil, Hynek Hadraba,
Vladislav Kozák, Ivo Dlouhý

Abstract. The process identification and determination of micro-mechanical parameters of Gurson–Tvergaard–Needleman (GTN) model for Eurofer97 steel in ductile regime was carried out. The possibility to derive the GTN model parameters from smooth tensile specimens was verified. The process identification of the model parameters was done by combination of fractography and metallography examination of the broken tensile specimens and finite element analysis using Abaqus code. Crack resistance curve of the material was determined on sub-sized pre-cracked bend bars. The material's length scale as a characteristic element size was chosen based on sensitivity analysis. The agreement between experimentally determined and simulated crack resistance curves was not satisfactory. The possible reasons for different behaviour of the GTN model are discussed.

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Indirect determination of material model parameters for single trabecula based on nanoindentation and three-point bending test

Petr Zlámal, Ondřej Jiroušek,
Daniel Kytýř, Tomáš Doktor

Abstract. A procedure for determination of elasto-visco-plastic constitutive model with damage for human single trabecula is developed. The procedure is tested using experimental data from nanoindentation and three point bending test. Constants of the material model are identified by indirect finite element simulations and numerical results are fitted to measured data using a custom algorithm based on least squares method. In the case of nanoindentation, the penetration depth of tip during the finite element analyses is fitted to experimental nanoindentation curves. In the case of three-point bending, displacements of nodes are compared with displacements of markers observed during the experiment using digital image correlation.

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Slip effects on non-Newtonian fluid flow through porous medium in a channel of lower stretching wall: Homotopy analysis method

Dileep Singh Chauhan, Rashmi Agrawal, Amla Olkha

Abstract. The steady flow of viscoelastic fluid (Walters' liquid B') through a channel filled with a porous medium is analysed. The flow in the channel is induced by the lower stretching wall. The upper wall of the channel is porous and stationary. A constant suction velocity is applied at the upper channel wall. Partial slip boundary conditions for the velocity are assumed at both the walls. The non-linear partial differential equations governing the viscoelastic fluid flow through porous medium are converted into non-linear ordinary differential equation using similarity transformations. The problem is then solved using homotopy analysis method. The effects of the various pertinent parameters on the velocity profiles and skin friction are investigated, and discussed.

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Thermal analysis on frequencies of non-homogeneous trapezoidal plate of variable thickness and density

Arun Kumar Gupta, Pragati Sharma

Abstract. An analysis and numerical results are presented for frequencies for thermally induced vibration on non-homogeneous trapezoidal plate of variable thickness and density on the basis of classical plate theory. The influences of the degree of non-homogeneity, aspect ratios, thermal gradient and taper constant have been investigated on the frequencies of the trapezoidal plate for the first two modes of vibration. Rayleigh–Ritz method is used to find the frequency parameter for clamped–simply supported boundary condition. Results are shown graphically. The obtained results have been compared with the published papers of the authors. A comparison of the results obtained by the present problem with those previously published shows a very well agreement together.

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Entropy generation and heat transfer in MHD squeezing flow in porous medium bounded by two parallel rotating plates with heat flux

Satish Chandra Rajvanshi,
Sargam Wasu, Baljinder Singh Saini

Abstract. The squeezing flow of viscous incompressible fluid in a highly permeable medium between two parallel, permeable rotating plates is investigated. The plates are rotating in their own planes with varying angular velocities. The upper plate is maintained at a given temperature, while heat flux is prescribed on the lower plate. The effect of permeability and magnetic parameter on the temperature, heat transfer and entropy generation is reported.

Contents

Fast and accurate model to investigate the effect of composite and suspended substrate on the characteristics of circular patch antenna

Manotosh Biswas, Sourav Banik

Abstract. A simple, fast and accurate cavity model based on CAD design tool is presented. Its purpose is to investigate the effect of suspended and composite substrate on resonant frequency, input impedance, total quality factor, bandwidth and gain of a circular patch antenna (CPA) operates in dominant and higher order modes. The computed values employing the present model are compared with previously reported experimental values. The present model is also validated by commercial softwares HFSS and IE3D. The proposed model shows very close agreements with both experimental and simulated (HFSS and IE3D) values.

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